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EDITORIAL

Dilemma in Dengue fever and Chikungunya diagnosis and treatment - an editorial

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HN sarker[1]

Dengue fever and chikungunya are both mosquito-borne viral diseases. The earliest descriptions of a dengue outbreak date from 1779; its viral cause and spread were understood by the early 20th century [1]. Dengue fever is caused by the Dengue virus. Dengue has become a global concern since the commencement of the Second World War. In 2025, as per dashboard of WHO worldwide total dengue cases are 3661680, severe cases 12667, confirmed cases 1505828 and total deaths are 2244, and in Bangladesh, upto 4th August total cases are 22,065 and total death is 86.

Historically, Chikungunya was referred to as Dengue. It was only after an outbreak of Chikungunya in Makonde Plateau, somewhere near Tanzania, that it was identified as a separate disease. Chikungunya is caused by the Chikungunya virus (CHIKV) which was first isolated by RW Ross in 1953 [2] [3][4]. In June 2025, the Institute of Epidemiology, Disease Control and Research in Bangladesh reported an outbreak of chikungunya in Dhaka city, with 337 cases reported between January and May 28, 2025.

Both dengue fever and chikungunya are mosquito-borne viral diseases with similar symptoms and geographic distribution, but they differ in severity and potential complications. Both the viral infections are characterized by similar symptoms and signs such as:

- High Fever
- Headache
- Pain in the joints and eyes
- Rashes
- Lethargy

These similar symptoms and signs make the diagnosis challenging in the early stages. Due to sharing quite similar signs, it becomes difficult in identifying the exact problem.

Dengue can be severe, even life-threatening, with bleeding and may lead to DHF, DSS, organ failure, and death [5]. Chikungunya is rarely fatal and symptoms are generally self-limiting, typically resolving within a few days. However, chikungunya can cause long-lasting arthritis in some individuals; however, occasionally the joint pain may last for months or years [6][7].

Similarities:

- Mosquito bite is the main cause of Chikungunya and Dengue. Both the diseases are caused by a female mosquito, primarily Aedes aegypti and Aedes albopictus.
- Dengue and Chikungunya diseases are more common in the tropical and sub-tropical climates. India subcontinent faces the threat of these vector-borne diseases.
- Both the diseases share similar symptoms and signs.

The difference between Dengue and Chikungunya

Despite being quite similar, both the diseases are very much different. Some of the differences in both the viral infections are:

- Dengue and Chikungunya, though transmitted by the same mosquito type, but are caused by different viruses. While Dengue is caused by a Flavirideae flavivirus, Chikungunya is caused by a Togaviridae alphavirus.
- The incubation period for dengue is of 3-14 days while it stays for about 2–7 days. The incubation period of Chikungunya is of 1-12 days and the duration varies from one to two weeks. However, signs such as joint pain may stay for a long time.
- Swelling and pain is high in Chikungunya as compared to that in Dengue. Arthritis is mainly in arms and legs in Chikungunya.
- Dengue can cause bleeding in some cases, shock, etc. Whereas Chikungunya can cause tremendous joint pain.
- In Dengue, rashes are limited to limbs and face. Whereas in Chikungunya, rashes occur all across the face, palms, feet, and limbs.
- In severe cases of Dengue, complications like breathlessness, shock or organ failure can occur. Whereas complications such as chronic arthritis and rare neurological problems are possible in Chikungunya. Arthritis is absent in Dengue.
- Low platelet count occurs in Dengue, whereas lymphopenia occurs in Chikungunya.

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In spite of quite similarity, it is possible to differentiate these two viral infections clinically by different characters discussed above. Serological tests such as antigen like NS1 antigen and antibody test can help in diagnosis.

There is no specific antiviral therapy for both. Both diseases require supportive care, such as hydration and pain relief. For chikungunya, NSAIDs can be used for pain relief, but only after dengue has been ruled out.

Every year millions of people are affected by Dengue and Chikungunya all across the globe. Thousands in India subcontinent are also infected with these diseases every year. Deaths are also caused due to these diseases. Therefore, you should know that these diseases are killers and it is important to kill the cause of the diseases before it kills you i.e. by mosquito elimination and the prevention of bites [8].

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ORIGINAL ARTICLE

Correlation between 24-Hour Holter Monitoring and Clinical Presentation of Arrhythmia in Adults with Type 2 Diabetes Mellitus — A Cross-Sectional Study of 100 Cases

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ABSTRACT

Background: *Cardiac arrhythmias are common in patients with Type 2 Diabetes Mellitus and may present with symptoms like palpitations, dizziness, or syncope. Holter monitoring is a useful tool for detecting arrhythmias in this high-risk population.* ***Methods & Materials:*** *This study employed a cross-sectional design and was conducted at BIRDEM General Hospital, located in Shahbagh, Dhaka. The research was carried out over six months from March 2013 to August 2013. Patients of 18 years of age and above, of either gender, referred for Holter monitoring with symptoms of palpitations, dizziness and syncope were evaluated for types of arrhythmia.* ***Results:*** *The mean age of patients was 58.80±10.98 years. Maximum number of patients with arrhythmia were found in the age group of 60-69 years. Male to female ratio was 1.7:1. There were significant correlation between control in FBG values and arrhythmia in the study subjects (p= <0.001). Statistically significant difference in mean ventricular and supraventricular beats (in 24 hours) was observed between controlled diabetes and those with uncontrolled diabetes (P-value was 0.016 and 0.01 respectively). The complaints for which patients were referred included dizziness in 34%, palpitations in 55% and syncope in 11%. Eighty-eight percent (approx.) patients with dizziness, 72.7% patients with palpitations and 47.4% of patients who presented with syncope had documented arrhythmias (p=0.01).* ***Conclusion:*** *Twenty four hour Holter monitoring is an important investigation for evaluation of patients with palpitation, dizziness and syncope. Arrhythmias were detected frequently in diabetic population in both symptomatic and asymptomatic patients.*

Key words: *24-hour Holter monitoring, Type 2 Diabetes Mellitus, Cardiac arrhythmia, Palpitations, Dizziness, Syncope, Glycemic control*

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INTRODUCTION

Type 2 Diabetes Mellitus has long been recognized to be an independent risk factor for Cardiovascular disease (CVD). Prospective studies, such as the Framingham, Honolulu, and San Antonio Heart Studies, as well as numerous more recent population studies have documented the excess CVD risk in patients with diabetes from multiple racial and ethnic groups. The United Kingdom Prospective Diabetes Study (UKPDS) demonstrated benefits in decreasing microvascular disease by controlling hyperglycemia in patients with Type 2 Diabetes Mellitus and also reported that glycemic control also probably reduces macrovascular disease[1].

Cardiovascular disease is the leading cause of morbidity and mortality in patients with diabetes mellitus. Patients with diabetes mellitus have a 2 to 4 time's higher risk of cardiovascular disease and upto 3 times increase in mortality than non diabetics. The accelerated rate of atherosclerosis seen in diabetes mellitus predisposes patients to coronary

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artery disease and to higher rates of myocardial infarction and death[2] . Diabetes has long been recognized as a risk factor for arrhythmia which was subsequently reaffirmed in several studies It has been established that diabetes causes enhanced susceptibility to arrhythmias.This susceptibility may be based on a combination of nonhomogenous collagen accumulation affecting local conduction and increased electrophysiologic se nsitivity to catecholamines[3].

Cardiac Arrhythmia, or an irregular heartbeat, is a serious but treatable condition. Arrhythmias occur when the electrical impulses, in the heart, which coordinate the heartbeats do not function properly, causing the heart to beat too fast, too slow or irregularly. Various types of Arrhythmias include Paroxysmal Supra-Ventricular Tachycardia [PSVT], Atrial flutter, Atrial Fibrillation, Ventricular Tachycardia, Ventricular Fibrillation and various types of heart block. Main causes of arrhythmias are Hypertension, Ischemic heart disease, Valvular heart disease, Cardiomyopathies, Sinus node disease, Pericarditis, COPD (Chronic Obstructive Pulmonary Disease), Thyroid Disease, Alcohol abuse, Vagal stimulation, Smoking, etc.[4] Symptoms are usually palpitation, lightheadedness, history of syncope or near-syncope, vertigo, etc. Common Tests for Arrhythmia are Electrocardiography (ECG or EKG), Holter monitor (continuous ambulatory electrocardiographic monitor), Transtelephonic monitor, Treadmill testing, Head-Tilt Test, Electrophysiologic testing, Echocardiogram., Chest X-ray[5].

Traditionally, ambulatory monitoring has been used to determine the cause of palpitations and syncope and to a lesser degree, to identify ventricular ectopy or nonsustained ventricular tachycardia in patients at potential risk for sudden cardiac death[6]. Atrial fibrillation has become an increasingly important indication for ambulatory monitoring, predominantly as a tool to monitor the efficacy and safety of pharmacological and nonpharmacological therapies[7,8]. A substudy of the Valsartan Antihypertensive Long-term Use Evaluation (VALUE) trial showed patients with new-onset DM had a significantly higher event rate of new-onset Atrial fibrillation with a hazard ratio of 1.49 compared with patients without DM,and there was a trend toward more AF in patients with DM at baseline[9].

The duration of monitoring largely depends on symptom frequency. In the evaluation of palpitations, patients who experience daily symptoms can be evaluated with a Holter monitor. More often, palpitations are sporadic and require slightly longer monitoring[10]. The value of arrhythmia monitoring for syncope is both to identify an arrhythmia as a cause for syncope and to document a syncopal event without a corresponding arrhythmia, thus suggesting a nonarrhythmic cause[11].

In the vast majority of circumstances, ambulatory monitors are used to identify a direct correlation between symptoms and the presence or absence of an arrhythmia. Prolonged asymptomatic pauses can be a clue to the cause of syncope but caution must be used in the interpretation of the significance of these rhythms[7,12,13].

The objective of this study was to determine association between patient's symptoms and incidence of arrhythmia by 24-hour electrocardiographic Holter monitoring in Diabetic population.

METHODS & MATERIALS

This study employed a cross-sectional design and was conducted at BIRDEM General Hospital, located in Shahbagh, Dhaka. The research was carried out over six months from March 2013 to August 2013. Departments involved in the study included Internal Medicine, Cardiology, and Neurology. The study involved a total of 100 adult patients with Type 2 Diabetes Mellitus (T2DM) who were referred for 24-hour Holter ECG monitoring due to symptoms suggestive of arrhythmia. Patients were selected from the inpatient departments of the aforementioned units.

Sample Selection

Inclusion Criteria

- Age 18 years or older.
- Both male and female patients.
- Diagnosed with Type 2 Diabetes Mellitus.
- Referred for Holter monitoring due to symptoms suggestive of arrhythmia.

Exclusion Criteria

- Patients with Type 1 Diabetes Mellitus.
- Non-diabetic patients.
- Patients with permanent pacemaker implantation.

Data Collection and Study Procedure: Participants were enrolled based on inclusion and exclusion criteria. Clinical evaluations, laboratory investigations, and 24-hour Holter ECG monitoring were conducted. During Holter monitoring, patients were instructed to log any episodes of palpitations, dizziness, or syncope. Demographic and clinical data—including age, gender, medical history, comorbidities, and glycemic control—were collected using a structured data collection sheet and validated against patient medical records. Arrhythmia types were documented and classified per standard diagnostic criteria. Lown classification was used for ectopic beats (Grades 2, 3, and 4 included). Additional arrhythmias identified included sinus bradycardia, sinus arrest, AV blocks, supraventricular tachycardia (SVT), ventricular tachycardia (VT), and atrial fibrillation. Comorbidities such as hypertension, dyslipidemia, ischemic heart disease (IHD), stroke, thyroid disorders, etc., were also evaluated based on clinical and diagnostic parameters.

Ethical Considerations: The study was approved by the Ethical Review Board of BIRDEM Academy and the Bangladesh College of Physicians and Surgeons (BCPS). The objectives, benefits, and risks of participation were clearly explained in the local language. Written informed consent was obtained from all participants. Confidentiality was maintained throughout the study.

Statistical Analysis: Data were analyzed using SPSS for Windows, version 10. Descriptive statistics such as frequencies and percentages were used to describe baseline characteristics. Inferential statistics, including chi-square tests, were employed to evaluate relationships between variables. A p-value of <0.05 was considered statistically

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significant. Data visualization was done using Microsoft Office Chart tools.

RESULTS

Table – I: Relation between Age distribution of the study subjects and arrhythmia

Age (years)	With arrhythmia (n=75)	Without arrhythmia (n=25)
40-49 (n=18)	16	2
50-59 (n=30)	22	8
60-69 (n=31)	25	6
≥ 70 (n=21)	12	9
Total	75	25

Maximum number of patients with arrhythmia were found in the age group of 60-69 years. (Table I)

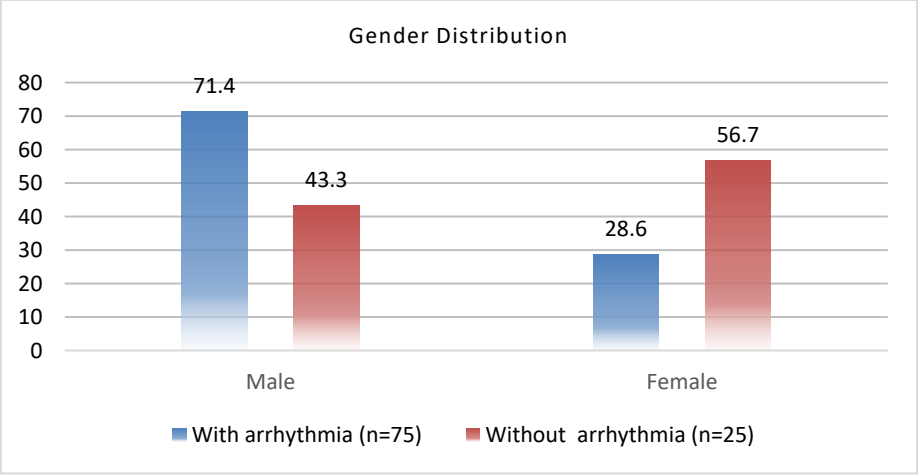

Figure – 1: Bar diagram showing relation between gender distribution of the study subjects and arrhythmia.

Among the study subjects, 71.4% males and 28.6% females had documented arrhythmia (p=0.01) (Figure 1).

Table – II: Relation between clinical presentation and documented arrhythmia

Presentation	Arrhythmia		P value
	Present No. (%)	Absent No. (%)	
Palpitation (n=55)	40 (72.7%)	15 (27.3%)	0.01[s]
Dizziness (n=34)	30 (88.2%)	04 (11.8%)	
Syncope (n=11)	05 (47.4%)	06 (52.6%)	

p value measured by Chi-square test; s= Significant

Among the study subjects, 55% presented with palpitation, 34% had dizziness and 11% had history of syncope. Their Holter monitoring revealed arrhythmia in 72.7%, 88.2% and 47.4% respectively(p=0.01) (Table II).

Table – III: Types of Arrhythmia detected in the study subjects

Type of arrhythmia	Number	Percentage
Atrial fibrillation	14	14.00
Atrial flutter	01	01.00
Atrial extrasystoles	47	47.00
Ventricular extrasystoles	52	52.00
SVT	30	30.00
VT	02	02.00
AV block	07	07.00
Sinus bradycardia	11	11.00

**Multiple responses were elicited.*

On Holter monitoring, arrhythmia was found in the form of atrial fibrillation in 14%, atrial flutter in 1% , ventricular ectopy in 52%, and supraventricular ectopy in 47%, ventricular tachycardia (VT) in 2%, supraventricular tachycardia (SVT) in 30%, atrioventricular block (AV block) in 7%, sinus bradycardia in 11% (Table III).

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Table – IV: Correlation between glycaemic control and arrhythmia in the study subjects

Glycaemic control	Controlled	Uncontrolled	P value
FBG	35	65	
Arrhythmia	15	55	<0.001[s]
No arrhythmia	20	10	
2ABF	23	77	
Arrhythmia	13	53	0.27[ns]
No arrhythmia	10	24	
Hb A_1C%	28	72	
Arrhythmia	11	22	0.11[ns]
No arrhythmia	17	15	

P value measured by Chi-square test; S= significant; ns = Not significant

There were significant correlation between control in FBG values and arrhythmia in the study subjects (p= <0.001). However, control in HbA_1C and ABF values did not show any significance to incidence of arrhythmia (Table IV).

Table – V: 24 hours holter ECG monitoring findings of ventricular ectopy

Events	Number	Percentage
Single PVC's	41	41.00
Triplets	17	17.00
Couplets	12	12
Ventricular run	08	08.00
Late VE's	02	02.00
Bigeminy	11	11.00
Trigeminy	07	7.00
Mean ± SD total ventricular ectopic beats in 24 hours (Maximum-Minimum)	7315.98±5289.33 (18334-17)	

**Multiple responses were elicited.*

24 hours Holter ECG monitoring findings of ventricular ectopy (n=52)

Regarding ventricular ectopic, it was seen that 8% subjects had ventricular run, 41% had single PVC's. Beside these findings, triplets (17%), couplets (12%), bigeminy (11%) and trigeminy (7%) were observed (Table V).

Table VI: 24 hours holter ECG monitoring findings of supraventricular ectopy

Events	Number	Percentage
Single PAC's	55	55.00
Atrial pairs	22	22.00
Drop	14	14.00
Late	09	09.00
Atrial run	25	25.00
Bigeminy	12	12.00
Trigeminy	10	10.00
Mean ± SD total supraventricular ectopic beats in 24 hours (Maximum -Minimum)	6632.23 ±5484.73 (19340-15)	

**Multiple responses were elicited.*

24 hours holter ECG monitoring findings of supraventricular ectopy (n=47)

In case of supraventricular ectopy, it was seen that 25% subjects had atrial run, 22% had single atrial pairs and 14% had drop. Beside these findings, single PAC's (55%), late (09%), bigeminy (12%) and trigeminy (10%) were observed (Table VI).

Table VII: Relation of incidence of supraventricular ectopy with glycaemic control

2ABF level (mmol/l)	Mean ± SD total supraventricular ectopic beats in 24 hours (maximum-minimun)	P-value
Below 10 (n=23)	4876.60±5612.26 (14300-15)	0.01
10 and more (n=77)	8265.88±7011.76 (19340-40)	

**P-value was achieved by t-test.*

Significant difference in mean supraventricular ectopic beats (in 24 hours) between subjects with controlled blood sugar and those with uncontrolled one (P-value was 0.01) (Table VII) was seen in the study.

DISCUSSION

Cardiac arrhythmia is a heterogeneous group of conditions in which there is abnormal electrical activity in the heart. The heartbeat may be too fast or too slow, and may be regular or irregular. Some arrhythmias are life-threatening medical emergencies that can result in cardiac arrest. In fact, cardiac arrythmias are one of the most common causes of death when travelling to a hospital. Symptoms of arrythmia include palpitation, dizziness, black out, presyncope, syncope. Still others may not be associated with any symptoms at all, but may predispose the patient to potentially life threatening stroke or embolism[14].

Diabetes and cardiovascular disease often appear together. Diabetes mellitus has been said to be equivalent to coronary heart disease, while conversely many patients with established coronary heart disease suffer from diabetes or its pre-states. 20-30% of the patients with an acute coronary syndrome have diabetes and as many as 40% have impaired glucose tolerance. There is evidence that both in-hospital and long-term mortality rates after an acute myocardial infarction are twice as high for patients with diabetes as for those without[14]. Hyperglycaemia, insulin resistance and the consequent cellular shift to increased oxidative stress carry a high risk for the development of co morbidities and cardiovascular risk factors, mainly hypertension, lipid disorders, pro-inflammatory state, and activation of coagulation and thrombosis. As a consequence, the mortality and the incidence of all forms of cardiovascular disease are two- to eightfold higher in persons with diabetes, and coronary artery disease accounts for 75% of all deaths in such individuals[15]. This present cross-sectional study was carried out enrolling 100 subjects aged 18 years and above in the Department of Internal medicine, Cardiology and Neurology, BIRDEM General Hospital, Dhaka. The study subjects were enrolled in this study after fulfillment of the inclusion criteria who were collected from the patients in-patient department of the respective disciplines who were admitted for evaluation of arrhythmia.

The mean age of the study population was 58.80±10.98 years. No patients were found below the age of 40 years. Majority (31%) of the respondents were found in the age group of 60-69 years. About 30% subjects were found within 50-59 years, 18% in 40-49 years age groups and 21% within 70 years and above. Minimum age and maximum age of the patients were 40 years and 84 years respectively. The mean age of the subjects with arrhythmia was 59.30±10.01 years. Maximum number of patients with arrhythmia were found in the age group of 60-69 years.

It was observed that 63 (63%) were male and rests 37 (37%) were female. Male to female ratio was 1.7:1. Among male and female subjects, 71.4% males and 28.6% females had documented arrhythmia (p=0.01) (Figure II). These were common epidemiological background of diabetic arrhythmic subjects. Vinik et al., found that 64% were male and 36% were female with mean age of 64.4 ± 7.6 years in a similar previous study[16]. Nichols et al., reported mean age of the study subject was 58.4 ± 11.5 years[17].

Mean Fasting blood glucose (FBG) and Hb A_1C% level were 15.06±6.40 mmol/l and 10.13±2.59 respectively. There were significant correlation between control in FBG values and arrhythmia in the study subjects (p= <0.001).

On ECG recordings, atrial fibrillation was found in 16 subjects, atrial flutter in 1, atrial ectopics in 50, ventricular ectopics in 54, features of hypokalaemia in 11, features of hyperkalaemia in 3, sinus bradycardia in 14, atrioventricular block in 9, features of ischaemia in 13, and normal findings in 11subjects.

Among the study subjects, 55% presented with palpitation, 34% had dizziness and 11% had history of syncope. Eighty-eight percent of the patients with dizziness, 72.7% patients with palpitations and 47.4% of patients who presented with syncope had documented arrhythmias (p=0.01). Irfan et al., showed twenty percent of patients with dizziness had documented arrhythmias, 50% of patients with palpitations had documented arrhythmias and 12% of patients who presented with syncope had documented arrhythmias (p=0.07)[18]. Irfan et al., showed in 100 symptomatic patients who underwent 24-hour Holter monitoring, 82% had documented arrhythmias[18]. No specific symptom was more likely than any others to predict the occurrence of significant arrhythmia and no arrhythmia was closely associated with any specific symptom. Zeldis et al., showed that no specific complaint or combination of complaints was more likely to predict a disturbance in rhythm[19]. In their study, the overall incidence of arrhythmias was 53% and of major significant arrhythmias were 39%. Sarsin et al., conducted a study on 140 consecutive patients with unexplained syncope who underwent 24-hour Holter monitoring. Nine of the 140 patients had serious arrhythmia during Holter monitoring[20].

On Holter monitoring, arrhythmia was found in the form of atrial fibrillation in 14%, atrial flutter in 1% , ventricular ectopy in 52%, and supraventricular ectopy in 47%, ventricular tachycardia (VT) in 2%, supraventricular tachycardia (SVT) in 30% of which 3% had sustained SVT of 2-3 minutes duration, atrioventricular block (AV block) in 7%, sinus bradycardia in 11%. Irfan et al., noted arrhythmias on 24-hour Holter monitoring reports included atrial ectopy in 60%, ventricular ectopy in 54%, ventricular tachycardia in 7% and supraventricular tachycardia (SVT) in 38%, of which 2% had sustained SVT of 2-3 minutes duration[18]. Two percent had paroxysmal atrial fibrillation, 15% had sinus bradycardia, 6% had sinus arrest, 10% had sinus exit block and 5% had varying degrees of AV block. Some patients reported more than one arrhythmia. Nichols et al., revealed Diabetes was significantly correlated with atrial fibrillation[17]. Previous study by Binici et al., revealed that atrial fibrillation was seen in 7.22% study subjects which was comparable with the findings of the present study[21].

It was seen statistically significant difference in mean ventricular ectopic beats (in 24 hours) between subjects with controlled blood sugar and those with uncontrolled one (P-value was 0.016).

Regarding supraventricular events, study by Binici et al., revealed that mean total supraventricular beats in 24 hours was 3929, PAC's was observed in 70% subjects and atrial run was observed in 42% patients[21]. Regarding ventricular events Adabaq et al., conducted a study where it was seen that mean total ventricular beats in 24 hours was 3256[22]. Single premature ventricular contractions were noted in 42% subjects. Statistically significant difference in mean supraventricular beats (in 24 hours) was observed between controlled diabetes and those with uncontrolled diabetes (P-value was 0.01).

Limitations of the study

The patient population observed was relatively small. The major limiting factor was the spontaneous frequency of symptom itself, which may not occur during that particular period. If the typical symptom occurs at some time during the study, with or without a concurrent electrocardiographic abnormality, the 24-hour study is still diagnostic and useful. However, this may be complicated by the fact that the same arrhythmia may occur at one time concurrently with symptoms and at other times, asymptomatically. Similarly, the presenting complaint may occur at multiple times during the 24-hour Holter monitoring period and in association with varying electrocardiographic findings. In every case, a cause and effect relationship needs to be established.

Conclusion

This cross-sectional study demonstrates that 24-hour Holter ECG monitoring is an effective tool for detecting arrhythmias in adults with Type 2 Diabetes Mellitus presenting with symptoms like palpitations, dizziness, and syncope. A significant correlation was found between poor glycemic control and the incidence of both ventricular and supraventricular ectopics. Potassium imbalance also contributed to arrhythmogenesis. Most symptomatic diabetic patients had documented arrhythmias, indicating that hyperglycemia and associated autonomic dysfunction may play a key role in arrhythmia development. Holter monitoring should be considered an essential part of cardiac evaluation in this high-risk group.

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Conflicts of interest

There are no conflicts of interest.

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ORIGINAL ARTICLE

Aesthetic & Functional Outcome following Ventral Hernioplasty & Lipo-abdominoplasty in Bangladesh

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ABSTRACT

Background: *Ventral hernias, often associated with abdominal wall weakness and previous surgeries, pose both functional and aesthetic challenges. Lipo-abdominoplasty has emerged as a complementary approach that addresses contour deformities while reinforcing the abdominal wall. Aim of this this study was to assess the aesthetic and functional outcome following Ventral Hernioplasty & Lipo-abdominoplasty in Bangladesh.* ***Methods & Materials:*** *This prospective observational study was conducted at Department of Plastic Surgery, Shaheed Ziaur Rahman Medical College Hospital, Bogura, Cosmetic Surgery Centre and Eden MultiCare Hospital, Dhaka, Bangladesh, from January 2021 to December 2021. Total 30 patients who underwent combined ventral hernioplasty and lipo-abdominoplasty during the study period were included in this study.* ***Result:*** *The majority of patients (90%) were female, with a mean age of 35.5 years (SD±9.5 years) and a mean BMI of 24.7 ± 2.9 kg/m^2. Most procedures were completed in under three hours with minimal intraoperative blood loss in 73.3% of cases. Hospital stay was ≤3 days in 83.3% of patients. Incisional hernias were most common (53.3%), and the onlay mesh technique was used in all patients. Functionally, 80% resumed daily activities by day 7, and 70% returned to work within two weeks. Early complications were observed in 30% of cases, with seroma being the most common (16.7%).* ***Conclusion:*** *Combined ventral hernioplasty and lipo-abdominoplasty offers a safe and effective solution with favorable functional recovery, minimal complications, and enhanced abdominal aesthetics. This integrated surgical approach is particularly relevant for middle-aged, comorbid female patients and shows promising potential in resource-constrained surgical settings like Bangladesh.*

Keywords: *Aesthetic Outcome, Functional Outcome, Ventral Hernioplasty, and Lipo-abdominoplasty.*

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INTRODUCTION

Ventral hernias impose a considerable global surgical load, particularly following twin pregnancy and laparotomies, with rates of up to 20% in some postoperative groups[1]. They develop under the impact of a multifactorial risk factor profile that includes obesity, prior abdominal surgery, wound dehiscence, smoking, and impaired nutritional or tissue healing status[2,3]. The incidence is particularly high in the South Asian countries, with increasing cesarean section rates and increasingly open abdominal surgeries being some of the factors in the rising incidence of hernias[4]. Despite these rising figures, there is a dearth of large-scale epidemiological and surgical outcome studies from South Asia, particularly Bangladesh. Reports of patient-centered outcomes like postoperative function and aesthetic satisfaction are even scarcer, demonstrating a significant gap in both surgical literature and health policy relevant to this region of the world[1].

The surgical management of ventral hernias has undergone a dramatic transformation over the last several decades. Having previously been managed with primary suture repair, these methods have been found to carry high recurrence rates greater than 40% in some series especially in patients with larger defects or risk-filled profiles[5]. This has led to the universal application of mesh-based methods, which reduce recurrence and improve abdominal wall integrity significantly. There occurred along with this progression the development of anatomical placement methods like onlay mesh placement, which intended to eliminate complications such as seromas, infection, and mesh migration[6]. Component

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separation techniques, such as posterior and endoscopic, facilitated tension-free closure in large or complex hernias, with the possibility of improved long-term durability[7]. These developments not only enhance structural repair but have also paved the way for the integration of reconstructive and aesthetic procedures in abdominal wall surgery.

One such development is lipo-abdominoplasty, a refinement of the traditional abdominoplasty. Designed to preserve neurovascular structures and reduce flap necrosis, it combines deep-plane liposuction with skin resection and myofascial plication to provide both cosmetic enhancement and core stabilization[8]. Over the past decade, the combined ventral hernia repair and lipo-abdominoplasty has become increasingly popular. This combination provides the unique benefits of a single anesthetic exposure, a consolidated recovery, and the twofold advantage of functional reconstruction and aesthetic contouring[9]. This synergy is particularly applicable in women who have postnatal or post-weight loss abdominal wall deformity, where both functional disability and psychosocial distress are present. While Western literature has demonstrated low complication rates and high patient satisfaction with said combined procedures, there remains an acute lack of data replicating their performance in South Asia or low-resource settings.

Bangladesh, with its rapidly urbanizing healthcare system, provides a compelling background for considering this surgical symbiosis. Nonetheless, there is a significant gap in outcome-based surgical studies in recording the unique regional idiosyncrasies. These include heterogeneous surgeon experience in aesthetic and reconstructive surgeries, delayed presentations due to sociocultural stigma, and underreporting of body image concerns, especially in postnatal women where abdominal deformity is normalized or tacitly accepted[2]. Also, societal expectations often prompt women to prioritize family duties over personal reconstruction, once more resulting in further care delay or compromise.

In view of this imbalance, the present study was designed as a prospective observational study to assess both aesthetic and functional outcomes following concomitant ventral hernioplasty and lipo-abdominoplasty in a Bangladeshi tertiary care setting

OBJECTIVES

To assess the aesthetic and functional outcome following Ventral Hernioplasty & Lipo-abdominoplasty in Bangladesh.

METHODS & MATERIALS

This prospective observational study was conducted at Department of Plastic Surgery, Shaheed Ziaur Rahman Medical College Hospital, Bogura, Cosmetic Surgery Centre and Eden MultiCare Hospital, Dhaka, Bangladesh, from January 2021 to December 2021. Total 30 patients who underwent combined ventral hernioplasty and lipo-abdominoplasty during the study period were included in this study. Patients were selected based on pre-defined inclusion criteria, which required candidates to be adult individuals (aged 30–50 years) presenting with a diagnosed ventral hernia and an indication for abdominoplasty, either due to excess abdominal skin, muscular laxity, or post-weight loss body contour deformity. Patients with recurrent hernias, major comorbidities contraindicating elective surgery, or those unwilling to participate in follow-up evaluations were excluded. Preoperative assessments included detailed medical history, physical examination, and imaging studies where necessary. Surgical planning involved a multidisciplinary approach with preoperative counseling covering both the functional and aesthetic goals of the procedure. All operations were performed under spinal anesthesia by a dedicated plastic surgical team trained in abdominal wall reconstruction and aesthetic body contouring techniques. Standardized protocols were followed for mesh selection, mesh placement, and flap design for abdominoplasty. Postoperative care protocols were unified across both centers and included analgesia, early ambulation, and use of compression garments. Patients were monitored for complications such as wound dehiscence, seroma, infection, and hernia recurrence. Functional outcomes were evaluated based on pain resolution, core stability, and physical activity tolerance, while aesthetic outcomes were assessed through clinical scoring and patient-reported satisfaction. Follow-up assessments were carried out at 1, 3, and 6 months postoperatively. Ethical approval for the study was obtained from the institutional ethical review board prior to commencement. Written informed consent was taken from all of the participants. All collected data were recorded systematically and analysed using SPSS software version 26.

RESULT

Table – I: Baseline characteristics of the study patients (*n*=30)

Characteristics	Number of Patients	Percentage (%)
Age Group (Years)		
18-24	8	26.7
25-34	9	30
35-44	8	26.7
≥45	5	16.6
Mean ± SD	35.5 ± 9.5	
Range	30-50	
Sex		
Male	3	10
Female	27	90
BMI (kg/m^2)		
Mean ± SD	24.7 ± 2.9	
Comorbidities		
None	14	46.7
Diabetes	9	30.0
Hypertension	7	23.3

Table I presents the baseline characteristics of the 30 patients enrolled in this study. The majority of patients (30%) were in the 25–34-year age group, followed by 26.7% each in the 18–24 and 35–44 age groups, and 16.6% were aged ≥45 years. The mean age of the study population was 35.5 years (SD± 9.5 years). Regarding sex distribution, female patients dominated the sample, comprising 90% (n=27), while males represented

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10% (n=3). The mean body mass index (BMI) was 24.7 ± 2.9 kg/m^2. With regard to comorbidities, nearly half the patients (46.7%) reported no comorbid conditions, while 30% had diabetes and 23.3% had hypertension, reflecting common metabolic risk factors that may influence surgical outcomes.

Table – II: Surgical outcome of the study patients (*n*=30)

Surgical Outcome Variable		Frequency (n)	Percentage (%)
Duration of Surgery	< 3 hours	19	63.3
	≥ 3 hours	11	36.7
Intraoperative Blood Loss	Minimal (<250 ml)	22	73.3
	Moderate (250–500 ml)	8	26.7
Surgical Site Drain Placement	Required	26	86.7
	Not required	4	13.3
Hospital Stay	≤ 3 days	25	83.3
	> 3 days	5	16.7

Table II outlines the surgical outcomes among the study population. In terms of operative duration, 63.3% of the procedures were completed in under 3 hours, while 36.7% lasted 3 hours or more, depending on complexity and the extent of combined procedures. Intraoperative blood loss was minimal (<250 ml) in 73.3% of cases, and moderate in 26.7%, indicating a largely controlled surgical field. A surgical drain was placed in 86.7% of patients, while 13.3% did not require it. Regarding hospital stay, the majority of patients (83.3%) were discharged within three days, while only 16.7% required prolonged admission, highlighting favorable early postoperative recovery in most cases.

Table – III: Type of hernia and position of mesh among the study patients (*n*=30)

Category	Number of Patients	Percentage (%)
Hernia Type		
Umbilical	14	46.7
Incisional	16	53.3
Mesh Position		
Onlay	30	100

Table III categorizes patients by hernia type and mesh placement technique. Among the types of ventral hernias encountered, incisional hernias were the most common (53.3%), followed by umbilical (46.7%). Regarding mesh positioning, onlay method was used in all patients.

Table – IV: Functional outcome of the study patients (*n*=30)

Functional outcome	Number of Patients	Percentage (%)
Able to resume daily activity by Day 7	24	80
No core pain during basic activities	26	86.7
Improved posture/core stability reported	23	76.7
Returned to work within 2 weeks	21	70

Table IV details the functional outcomes observed in the early postoperative period. Notably, 80% of patients resumed their daily activities by postoperative day 7, suggesting a rapid recovery trajectory. In terms of discomfort, 86.7% reported no core pain during basic activities, indicating effective structural reinforcement. Furthermore, 76.7% of patients reported improved posture and core stability, aligning with the goals of combining ventral hernia repair with rectus-muscle plication during lipo-abdominoplasty. Additionally, 70% of patients returned to work within two weeks, affirming the functional success and quality-of-life impact of the procedure.

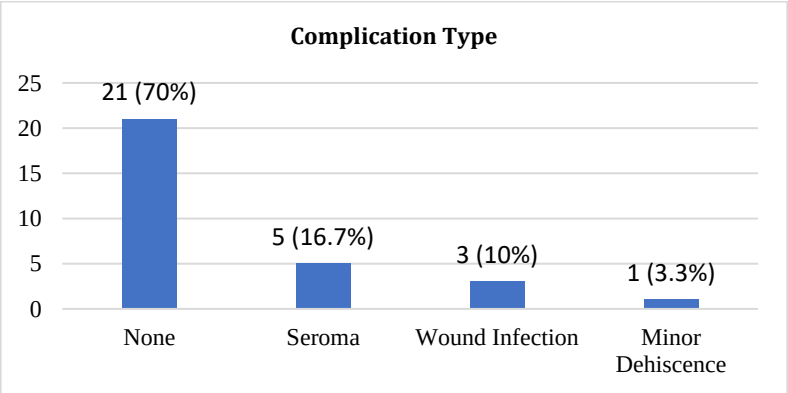

Figure – 1: Distribution of complications among the study patients (*n*=30)

Figure 1 presents the distribution of early postoperative complications observed in the study population. Of the 30 patients assessed, the majority (70%) experienced no complications, underscoring the relative safety and tolerability of the combined ventral hernioplasty and lipo-abdominoplasty procedure. Among those who did develop complications, seroma formation was the

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most common, occurring in 5 patients (16.7%), which is consistent with expected outcomes in abdominoplasty-based surgeries involving large tissue planes. Wound infection was noted in 3 patients (10%), all of which were managed conservatively without requiring reoperation. A single case (3.3%) of minor wound dehiscence was reported, also resolving with routine wound care.

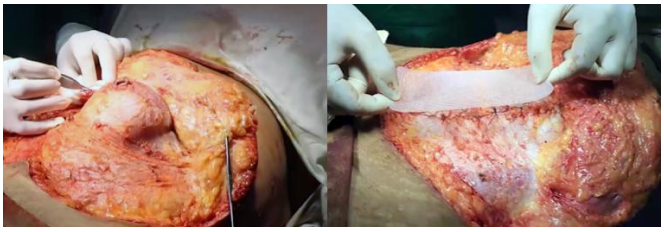

Figure – 2: Dissection and exposure of hernial sac and intraoperative placement of polypropylene mesh over the abdominal wall during hernioplasty

Figure – 3: Preoperative and postoperative comparison following ventral hernioplasty with lipo-abdominoplasty on a female patient

Figure – 4: Dramatic contour improvement and umbilical realignment post lipo-abdominoplasty with ventral hernia repair

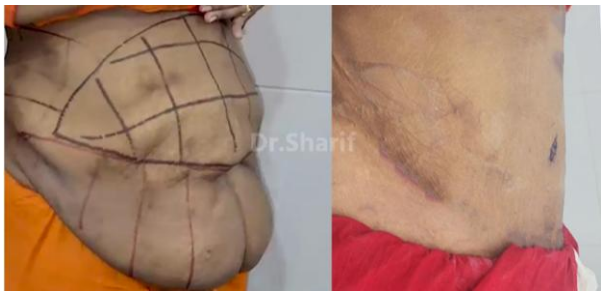

Figure – 5: Preoperative marking and final result after 360° lipo-abdominoplasty with ventral hernia repair

DISCUSSION

The present study aimed to assess the aesthetic and functional outcomes of combined ventral hernioplasty and lipo-abdominoplasty, with a particular focus on patient recovery, complication rates, and quality-of-life improvements. The demographic profile of the cohort demonstrated that the majority of patients were middle-aged females, with a mean age of 35.5 years. This aligns with earlier studies reporting

similar trends, where female individuals represent a large proportion of those seeking abdominal wall reconstruction, often due to post-pregnancy laxity or prior surgeries[10,11]. Interestingly, the majority of patients in this study presented with a normal BMI (mean 24.7 kg/m^2), challenging the prevailing assumption that body contouring and hernia repairs are exclusive to obese or overweight individuals. Previous studies corroborate this finding, illustrating that normal-weight patients often pursue abdominoplasty for functional or aesthetic reasons unrelated to obesity[12,13]. Additionally, Plehutsa et al.[14] identified a subgroup of abdominoplasty patients with normal BMIs undergoing surgery for abdominal wall defects, further validating our patient profile. The prevalence of comorbidities, particularly diabetes (30%) and hypertension (23.3%), also mirrors global findings, confirming the metabolic overlap that contributes to increased surgical candidacy and potential risks[15]. Operative data revealed that most procedures were completed in under three hours, with intraoperative blood loss remaining minimal in 73.3% of cases, which is consistent with findings from Eltantawy et al.[16], who observed similar trends in hernio-abdominoplasty with Scarpa's fascia preservation. The high rate of drain placement observed (86.7%) is consistent with standard practices in abdominoplasty procedures where seroma prevention is critical. In high-volume centers with access to progressive tension sutures, the use of drains remains prevalent in many surgical settings, particularly where resource constraints or patient risk profiles justify it.[9,17] These practices also align with the reported use of multiple suprafascial drains in complex abdominal wall reconstructions.[18] The majority of patients (83.3%) were discharged within three days, a favorable early postoperative course that compares well with previous large-scale studies on combined procedures reporting mean hospital stays of 2-4 days[19,20].

Regarding hernia types, incisional hernias were the most common (53.3%), followed by umbilical (46.7%), aligning closely with global epidemiological data[21]. Regarding mesh positioning, onlay method was used in all patients.

Functionally, outcomes were encouraging. A large majority (80%) resumed daily activities by Day 7, and 86.7% reported no core pain during basic movements, indicating robust early recovery. These findings are comparable to those by Licari et al.[22], who demonstrated measurable improvement in core stability and quality-of-life parameters following incisional hernia repair. Notably, 76.7% of our patients reported postural and core stability improvement, consistent with Mazzocchi et al.[18], who documented postural enhancements following rectus plication. Additionally, 70% returned to work within two weeks, paralleling the return-to-function timeline described by Adams et al.[23] and Swedenhammar[24].

The overall complication rate was 30%, with seroma being the most frequent (16.7%), followed by wound infection (10%) and minor dehiscence (3.3%). These figures fall within the range reported in previous literature. Jabaiti[25] and Vidal et al.[26] both reported seroma rates of approximately 15–20% following abdominoplasty-based procedures, particularly when combined with liposuction or extensive undermining. Wound infections in our cohort were conservatively managed and align with Massey et al.[27], who emphasized that most seromas and superficial infections resolve without surgical reintervention. The isolated case of minor wound dehiscence (3.3%) also supports findings by Denys et al.[28], suggesting that such complications, while notable, do not significantly compromise outcomes when managed appropriately.

The outcomes of this study affirm the growing international consensus that combining ventral hernioplasty with lipo-abdominoplasty offers both functional reinforcement and aesthetic improvement with a favorable safety profile. The demographic similarities, operative feasibility, complication rates, and functional recovery observed in this cohort resonate with global literature, supporting its relevance and reproducibility in low-resource, high-volume surgical environments like Bangladesh.

Limitations of the study

In our study, there was small sample size and absence of control for comparison. The study was conducted at a short period of time.

CONCLUSION AND RECOMMENDATIONS

This study demonstrates that combined ventral hernioplasty and lipo-abdominoplasty is a safe and effective surgical approach, offering both functional and aesthetic benefits. With minimal complications, early recovery, and high patient satisfaction, it presents a viable solution for abdominal wall reconstruction in resource-limited settings like Bangladesh. The predominance of favorable outcomes underscores the value of integrated surgical planning. Further multicentric, long-term studies are warranted to validate these findings and guide standardized protocols for combined reconstructive procedures.

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ORIGINAL ARTICLE

Association of Glycemic Status, Serum Potassium and Serum Magnesium Levels with Arrhythmia in Type 2 Diabetes Mellitus at a Tertiary Care Setting

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ABSTRACT

Background: *Type 2 Diabetes Mellitus is a chronic metabolic disorder associated with significant cardiovascular complications, including arrhythmias. This study aimed to assess the association of glycemic control, serum potassium, and serum magnesium levels with the occurrence of arrhythmia in patients with Type 2 Diabetes Mellitus at a tertiary care center.* ***Aim of the study:*** *The aim of the study was to evaluate the association of glycemic control, serum potassium, and serum magnesium levels with the occurrence of arrhythmia in patients with Type 2 Diabetes Mellitus at a tertiary care center.* ***Methods & Materials:*** *This cross-sectional study was conducted from March to August 2013 at the Departments of Internal Medicine, Cardiology, and Neurology, BIRDEM General Hospital, Dhaka. One hundred adults with type 2 diabetes and arrhythmia symptoms underwent 24-hour Holter monitoring. Data included clinical history, ECG, and lab tests (glucose, HbA1c, electrolytes, thyroid). Arrhythmias were classified; analysis used SPSS v10 with significance at $p < 0.05$.* ***Results:*** *Poor glycemic control (mean 2ABF 14.15 mmol/L, HbA1c 8.61%) was linked to higher ectopy. Patients with 2ABF ≥10 mmol/L had more ventricular (5596 vs. 3601; $p = 0.016$) and supraventricular ectopics (8266 vs. 4877; $p = 0.010$), showing a clear association between postprandial hyperglycemia and arrhythmia burden.* ***Conclusion:*** *Poor glycemic control and electrolyte imbalance, particularly low potassium, are significantly associated with increased arrhythmic burden in Type 2 Diabetes Mellitus.*

Key words: *Glycemic Status, Electrolyte Imbalance, Arrhythmia.*

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INTRODUCTION

Over the past few decades, Type 2 Diabetes Mellitus (T2DM) has become a major public health issue[1]. Worldwide, approximately 422 million adults are affected by diabetes mellitus (DM), according to the World Health Organization's 2016 report. T2DM is marked by both reduced insulin secretion and resistance to insulin, leading to persistent hyperglycemia[2]. This chronic elevation in blood glucose contributes to long-term cardiovascular complications, including coronary artery disease (CAD), myocardial infarction (MI), congestive heart failure (CHF), and sudden cardiac death due to arrhythmias[3,4]. Research has indicated a high prevalence of ventricular arrhythmias among individuals with T2DM[5].

Intensive glycemic control in diabetes, particularly when it leads to hypoglycemia, along with cardiac autonomic neuropathy (CAN), has been linked to altered heart rate variability and disturbances in ventricular repolarization[6]. Prolongation of the corrected QT interval (QTc), greater QT dispersion (QTd), and elevated HbA1c levels have all been associated with higher mortality rates, especially among elderly patients with type 2 diabetes[6]. Insulin resistance in these individuals may stem from a reduced number of insulin receptors on the cell membrane, diminished receptor affinity

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for insulin, or post-receptor signaling defects impairing insulin's cellular action[7].

Serum magnesium plays a critical role in maintaining various physiological functions[8]. As a key intracellular cation, magnesium serves as a cofactor in glucose phosphorylation and thus contributes significantly to glycemic control[9]. It supports essential cellular processes by participating in enzymatic reactions, nucleic acid stability, and energy metabolism[10]. Despite its importance, hypomagnesemia often goes undetected in individuals with diabetes[11]. Low magnesium levels have been linked to impaired glucose transport across cell membranes, decreased insulin secretion from the pancreas, disrupted post-receptor insulin signaling, and impaired insulin-receptor binding[12]. Furthermore, magnesium deficiency has been associated with several clinical conditions, including hypocalcemia, tetany, hypokalemia, cardiac arrhythmias, stroke, ischemic heart disease, electrolyte imbalances, and bronchial asthma[13].

Despite increasing awareness of cardiovascular risks in T2DM, limited research has concurrently examined the combined influence of glycemic status, serum potassium, and serum magnesium levels on arrhythmia risk in this population. Most studies have focused on isolated risk factors or specific arrhythmia types, leaving a gap in understanding their interrelationship in routine clinical settings. The purpose of the study was to assess the association of glycemic control, serum potassium, and serum magnesium levels with the occurrence of arrhythmia in patients with Type 2 Diabetes Mellitus at a tertiary care center.

OBJECTIVE

- To evaluate the association of glycemic control, serum potassium, and serum magnesium levels with the occurrence of arrhythmia in patients with Type 2 Diabetes Mellitus at a tertiary care center.

METHODS & MATERIALS

This cross-sectional study was conducted at the Departments of Internal Medicine, Cardiology, and Neurology of BIRDEM General Hospital, Shahbagh, Dhaka, Bangladesh, over a period of six months, from March to August 2013. A total of 100 adult patients were included to evaluate the association of glycemic control, serum potassium, and serum magnesium levels with the occurrence of arrhythmia in patients with Type 2 Diabetes Mellitus.

Inclusion criteria:

- Patients aged ≥18 years of either gender, referred for 24-hour Holter monitoring with symptoms suggestive of arrhythmia
- Diagnosed cases of Type 2 Diabetes Mellitus

Exclusion criteria:

- Patients with type 1 diabetes mellitus
- Non-diabetic individuals
- Patients with permanent pacemaker implants

Eligible patients were enrolled consecutively after obtaining informed consent. All participants underwent a 24-hour Holter ECG, during which they were instructed to note any symptoms such as palpitations, dizziness, or syncope. Data collection included clinical history, physical examination, and laboratory investigations such as fasting blood glucose (FBS), 2-hour postprandial glucose (2ABF), HbA1c, serum electrolytes (potassium, magnesium), and thyroid function tests. Glycemic control was assessed according to ADA 2013 guidelines.

Holter recordings were analyzed for arrhythmias, including ventricular ectopics (graded using Lown classification, grades 2–4), supraventricular ectopics, bradyarrhythmias, AV blocks, atrial fibrillation, and tachyarrhythmias. Data were analyzed using SPSS version 10, and a p-value of <0.05 was considered statistically significant.

RESULTS

Table – I: Glycaemic Profile of the Study Population (*n*=100)

Investigations	Mean ± SD	Minimum – Maximum
FBG (mmol/L)	15.06 ± 6.40	4.2 – 25.3
2ABF (mmol/L)	16.28 ± 7.60	6.5 – 29.6
HbA1c (%)	10.13 ± 2.59	6.3 – 14.4

Table I presents the glycaemic parameters of the 100 enrolled patients. The mean fasting blood glucose (FBG) was 15.06 ± 6.40 mmol/L, ranging between 4.2 and 25.3 mmol/L. The mean 2-hour after-breakfast (2ABF) glucose level was 16.28 ± 7.60 mmol/L, with a range from 6.5 to 29.6 mmol/L. The mean HbA1c was 10.13 ± 2.59%, with values spanning 6.3% to 14.4%, indicating overall poor long-term glycaemic control in the study population.

Table – II: Correlation Between Glycemic Control and Arrhythmia in the Study Population

Glycaemic Control	Controlled	Uncontrolled	P value
FBG	35	65	<0.001
Arrhythmia	15	55	
No arrhythmia	20	10	
2ABF	23	77	0.270
Arrhythmia	13	53	
No arrhythmia	10	24	
HbA1c (%)	28	72	0.110
Arrhythmia	11	22	
No arrhythmia	17	15	

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Table II illustrates the relationship between glycemic control and the presence of arrhythmia among the study population with Type 2 Diabetes Mellitus. Among those with uncontrolled fasting blood glucose (FBG), 55 out of 65 patients (84.6%) developed arrhythmia, compared to 15 out of 35 (42.9%) in the controlled FBG group—a statistically significant difference ($p < 0.001$). Although arrhythmia was also more frequent in patients with uncontrolled 2-hour after-breakfast blood glucose (2ABF) and elevated HbA1c, the differences were not statistically significant ($p = 0.270$ and $p = 0.110$, respectively).

Table – III: Correlation Between Serum Potassium Levels and Arrhythmia in the Study Population

Potassium Level	Number	Arrhythmia		P value
		Present	Absent	
Normal	79	68	11	0.030
Hypokalaemia	13	7	6	
Hyperkalaemia	8	0	8	

Table III illustrates the distribution of arrhythmia across different serum potassium levels in the study population. Among patients with normal potassium levels (n=79), 86.1% had arrhythmia. Notably, all patients with hyperkalaemia (n=8) had no arrhythmia, while nearly half of those with hypokalaemia (n=13) exhibited arrhythmic events (53.8%). The association between potassium status and arrhythmia was statistically significant ($p = 0.030$).

Table – IV: Correlation Between Serum Magnesium Levels and Arrhythmia in the Study Population

Magnesium Level	Number	Arrhythmia		P value
		Present	Absent	
Normal	92	73	19	0.120
Reduced level	6	2	4	
Raised level	2	0	2	

Table IV presents the distribution of arrhythmia in relation to serum magnesium levels among patients with Type 2 Diabetes Mellitus. Although the majority of patients had normal magnesium levels (92 cases), arrhythmia was present in 73 of them. Among those with reduced magnesium levels (n=6), arrhythmia occurred in 2 cases, while none of the 2 patients with elevated magnesium levels experienced arrhythmia. However, the association between magnesium status and arrhythmia did not reach statistical significance ($p = 0.120$).

Table – V: Relation of Incidence of Ventricular Ectopy with Glycemic Control (2ABF Level)

2ABF Level (mmol/l)	Mean ± SD Total Ventricular Ectopic Beats (Maximum–Minimum)	P value
Below 10 (n = 23)	3601.12 ± 4179.83(13870–17)	0.016
10 and more (n = 77)	5595.97 ± 3782.29(18334–60)	

Table V shows the association between glycemic control, as measured by 2-hour post-breakfast blood glucose (2ABF), and the incidence of ventricular ectopic beats in Type 2 Diabetes Mellitus patients. Those with poor glycemic control (2ABF ≥10 mmol/L, n = 77) had a significantly higher mean number of ventricular ectopic beats (5595.97 ± 3782.29; range 18334–60) compared to those with better glycemic control (2ABF <10 mmol/L, n = 23), who had a lower mean ectopic count (3601.12 ± 4179.83; range 13870–17). The difference was statistically significant ($p = 0.016$).

Table – VI: Relation of Incidence of Supraventricular Ectopy with Glycemic Control

2ABF Level (mmol/l)	Mean ± SD Total Supraventricular Ectopic Beats(Maximum–Minimum)	P value
Below 10 (n = 23)	4876.60 ± 5612.26(14300–15)	0.010
10 and more (n = 77)	8265.88 ± 7011.76(19340–40)	

Table VI presents the relationship between glycemic control, as measured by 2-hour post-breakfast blood glucose (2ABF) levels, and the incidence of supraventricular ectopic beats in patients with Type 2 Diabetes Mellitus. Patients with uncontrolled glycemic status (2ABF ≥10 mmol/L, n = 77) showed a significantly higher mean number of supraventricular ectopic beats (8265.88 ± 7011.76; range 19340–40) compared to those with better glycemic control (2ABF <10 mmol/L, n = 23), who had a mean of 4876.60 ± 5612.26 (range 14300–15). This difference was statistically significant ($p = 0.010$).

DISCUSSION

Type 2 Diabetes Mellitus is increasingly recognized not only for its metabolic implications but also for its association with cardiovascular complications such as arrhythmias. In diabetic

individuals, symptoms like palpitations, dizziness, and syncope often point toward underlying rhythm disturbances that may go undiagnosed without continuous monitoring. This study examined the occurrence and patterns of arrhythmias in adults with T2DM using 24-hour Holter monitoring, aiming to uncover potential links with glycemic control and electrolyte levels. The findings highlight a notable prevalence of both ventricular and supraventricular arrhythmias, particularly in patients with poor glycemic control and altered serum potassium and magnesium levels, reinforcing the importance of comprehensive cardiac evaluation in this population.

In the present study, the mean fasting blood glucose (FBG), 2-hour after breakfast glucose (2ABF), and HbA1c levels were 15.06 ± 6.40 mmol/L, 16.28 ± 7.60 mmol/L, and 10.13 ± 2.59%, respectively, reflecting poor glycemic control and substantial variability in glucose levels. These findings resonate with those of Gu et al.[14], who reported that patients with new-onset atrial fibrillation exhibited significantly greater HbA1c variability, suggesting that fluctuating glycemic states increase the risk of arrhythmias in T2DM. Andersen et al.[15] similarly demonstrated that both hypoglycemia and increased glycemic variability were associated with a higher frequency of arrhythmic events in diabetic patients. The elevated glycemic indices in our study, particularly the high HbA1c levels, indicate chronic hyperglycemia and potential glycemic swings, which may predispose patients to arrhythmogenesis through autonomic imbalance, electrolyte disturbance, and structural cardiac changes, supporting the hypothesis that dysregulated glycemic status is a key contributor to arrhythmia risk in T2DM.

In the present study, a significant association was observed between uncontrolled fasting blood glucose (FBG) and arrhythmia ($p < 0.001$), with 84.6% of arrhythmic patients belonging to the uncontrolled FBG group, highlighting FBG as a strong predictor of cardiac electrical disturbances in diabetic patients. This finding closely aligns with the Mendelian randomization analysis by Harati et al.[16], which demonstrated a 16% increased risk of atrial fibrillation (AF) in individuals with FBG between 5.5–6.9 mmol/L and a 13% risk increase for every 1% rise in HbA_1c. Similarly, Sun et al.[17] reported that a 1 mmol/L increase in baseline FBG raised AF risk by 33%, reinforcing the role of hyperglycemia in arrhythmogenesis. While our study also noted higher rates of arrhythmia in patients with uncontrolled postprandial glucose (2ABF) and HbA_1c, these associations did not reach statistical significance ($p = 0.270$ and $p = 0.110$, respectively), a trend consistent with Sun et al.'s review, which recognized a link between elevated HbA_1c and ventricular arrhythmias despite less robust predictive power than FBG. Together, these comparisons underscore the critical importance of fasting glycemic control in mitigating arrhythmic risk in type 2 diabetes.

In the present study, a significant association was observed between serum potassium levels and arrhythmia occurrence ($p = 0.030$), with the highest burden of arrhythmia seen in the hypokalemic group (7 out of 13 cases). This finding is consistent with the results of Pitt et al.[18], who reported that patients with type 2 diabetes and low potassium levels (<4.0 mmol/L) had a 67% higher risk of arrhythmic events compared to those within the normal potassium range. While arrhythmia was most prevalent in hypokalemia, it was notably absent among patients with hyperkalemia (0 of 8), potentially reflecting the complex and often nonlinear impact of potassium extremes on cardiac electrophysiology. These findings underscore the critical role of maintaining normal potassium homeostasis in mitigating arrhythmic risk among diabetic patients.

In our study examining the association between serum magnesium levels and arrhythmia in patients with Type 2 Diabetes Mellitus, the majority (92%) had normal magnesium levels, with 73 remaining arrhythmia-free. Among the small subset of patients with reduced magnesium (6%), arrhythmia was observed in 2 individuals, while 4 did not experience arrhythmic events. Notably, none of the two patients with elevated magnesium levels developed arrhythmia. Although the association was not statistically significant ($p = 0.120$), the observed pattern aligns with broader epidemiological evidence suggesting a potential arrhythmogenic role of hypomagnesemia. Oost et al.[19] similarly reported an inverse relationship between serum magnesium levels and the incidence of atrial fibrillation, heart failure, and microvascular complications in individuals with T2DM, highlighting the importance of electrolyte monitoring in this population.

In our study examining the association between 2-hour post-breakfast blood glucose (2ABF) levels and ventricular ectopic beats in patients with Type 2 Diabetes Mellitus, we found that those with elevated 2ABF (≥10 mmol/L) exhibited a significantly higher mean number of ventricular ectopic beats (5595.97 ± 3782.29) compared to patients with lower 2ABF levels (<10 mmol/L), who had a mean of 3601.12 ± 4179.83 ectopic beats ($p = 0.016$). These findings align with Andersen et al.[15], who reported that increased glycemic variability—though not specifically 2ABF—was associated with a higher incidence of cardiac arrhythmias, emphasizing the broader impact of glycemic fluctuations on arrhythmic risk. Our data reinforce the notion that postprandial hyperglycemia may play a critical role in triggering ventricular arrhythmias, highlighting the importance of tight glycemic control to potentially mitigate cardiac electrical instability in this population.

In our study, we observed that patients with higher 2-hour post-breakfast blood glucose (2ABF) levels (≥10 mmol/L) had a significantly greater mean number of supraventricular ectopic beats (8265.88 ± 7011.76) compared to those with lower 2ABF levels (<10 mmol/L), who had a mean of 4876.60 ± 5612.26 ($p = 0.010$). This finding aligns with the work of Ceriello et al.[20], who demonstrated that postprandial hyperglycemia serves as an independent risk factor for cardiovascular disease in Type 2 Diabetes Mellitus (T2DM) patients. Their study underscores the broader cardiovascular risks associated with elevated postprandial glucose levels, supporting the notion that postprandial hyperglycemia contributes not only to vascular complications but also to increased arrhythmic burden, as reflected in our results on supraventricular ectopy. These findings highlight

the importance of controlling postprandial glucose spikes to reduce cardiac arrhythmia risk in T2DM populations.

Limitations of the study

The study had several limitations:

- The study population was relatively small, limiting generalizability.
- Symptom frequency was spontaneous and unpredictable, potentially missing during the 24-hour monitoring period.
- Arrhythmias may occur both with and without symptoms, complicating interpretation.
- Symptoms could recur multiple times during monitoring with varying ECG findings.
- Establishing a definitive cause-effect relationship between symptoms and ECG findings remains challenging.

Conclusion

Our study demonstrates that poor glycemic control is strongly associated with the occurrence of arrhythmia in patients with Type 2 Diabetes Mellitus. Patients with elevated fasting and post-breakfast glucose levels not only developed arrhythmias more frequently but also exhibited a higher burden of both ventricular and supraventricular ectopic beats. Additionally, abnormal serum potassium levels, particularly hypokalemia, were significantly linked to arrhythmic events. Although a trend was observed with low magnesium levels, this association did not reach statistical significance. Overall, these findings underscore the critical importance of maintaining optimal glycemic control and electrolyte balance to reduce cardiac arrhythmic risk in this patient population.

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ORIGINAL ARTICLE

Evaluation of Complex Tibial Plateau Fracture Treated with Ilizavor External Fixator

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ABSTRACT

Background: *Complex tibial plateau fractures provide a significant challenge in orthopaedic surgery. The Ilizarov technique addresses common issues in fracture therapy and allows for closed reduction and fixation without significant soft tissue stripping.* ***Aim of the study:*** *The purpose of this study was to evaluate the outcomes of treating complicated tibial plateau fractures with the Ilizarov technique in conjunction with minimal internal fixation.* ***Methods & Materials:*** *This retrospective study was conducted in the Department of Orthopedic Surgery, Barind Medical College, Rajshahi, TMSS Medical College, Bogura, Cumilla Medical College, Cumilla and East West Medical College, Dhaka, Bangladesh. The study included 30 Schatzker type VI tibial plateau fractures in 29 individuals, whose mean age ranged from 20 to 76 years. Nine fractures were open and twenty-one were closed. Tscherne and Gotzen's classification of soft tissue injury was used for closed fractures, while Gustilo and Anderson's classification was used for open fractures. Rasmussen's method and the Knee Society clinical assessment score were used for radiographic, clinical, and functional evaluations.* ***Results:*** *Except for one with varus malunion, all fractures healed. The frame was removed after an average of 16.3 weeks (range 14-24). Only 28 patients (29 fractures) were available for follow-up. The average follow-up period was 27 months (range 16–36). The radiographic reduction of fractures was excellent in 18 cases and good in 12. Using the Knee Society clinical assessment method, 18 knees were classified as exceptional, seven as good, one as fair, and two as poor. Five patients demonstrated clinically significant grade 2+ medial-lateral instability. Only two were symptomatic, although they had no functional limitations. Eleven individuals reported no pain, while the rest 18 experienced mild or intermittent pain. Eight individuals had difficulty walking, and six need walking assistance. There was a strong association (P<0.005) between the existence of accompanying injuries and the final outcome, with the most significant being a concurrent distal femoral fracture.* ***Conclusion:*** *This study emphasizes the Ilizarov method's therapeutic success and minimal morbidity rate. The technique is ideally suited to the treatment of difficult tibial plateau fractures in which comminution would necessitate extensive dissection and internal fixation with plates and screws, further compromising the soft tissue.*

Keywords: *Tibial plateau, Ilizarov technique, Radiographic, Internal fixation*

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INTRODUCTION

Complex tibial plateau fractures are a tough surgical issue[1]. Challenges include fracture patterns (articular depression, condylar comminution, diaphyseal involvement), soft tissue and ligament injuries, neurovascular injury, and compartment syndrome[2]. Failure to reestablish articular congruity and the existence of ligamentous instability are the most important variables contributing to poor long-term outcomes[3]. Success requires restoring articular cartilage, preserving biology, aligning the mechanical axis, restoring joint stability, and maintaining functional motion[4]. Nonoperative therapy is ineffective, and internal fixation can lead to problems such as wound breakdown, skin necrosis, deep infections, stiffness, and ankylosis. Surgery may need several debridements,

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arthrodesis, or even amputation[5,6]. Even with minimally invasive internal fixing procedures, the challenge remains[7] Ilizarov external fixation is a promising therapy method for achieving all treatment objectives. Ilizarov offers advantages such as closed or mini-open fracture reduction with less wound complications, early joint motion, functional loading, and weight bearing, as well as the ability to increase reduction and alignment while on a fixator, resulting in a speedier recovery. Knee replacement surgery is less invasive than internal fixation, eliminating the need for major incisions, soft tissue damage, and considerable hardware. For complex tibial plateau fractures, a multi-center prospective randomised trial comparing Ilizarov external fixation and internal fixation found that the latter has a slightly quicker return to function and a shorter hospital stay, while open reduction and internal fixation lead to more complications[8]. To assess the results of using the Ilizarov procedure in combination with minimum internal fixation to treat complex tibial plateau fractures, we carried out a retrospective analysis.

METHODS & MATERIALS

Thirty tibial plateau fractures (Schatzker type VI[9]) in 30 patients (27 men and three women) with a mean age of 41.4 (20–76) years were included in the study. There were 21 closed and nine open fractures. Soft tissue injury for the closed fractures was classified according to Tscherne and Gotzen[10], and open fractures were classified according to Gustilo and Anderson[11] (Table I). All fractures were the result of high-energy trauma. Twenty patients had associated injuries. The method used was a combination of previously published protocols[12,13]. The goal was to correctly decrease the condyles and stabilize the tibial shaft beneath them. Anatomical reduction of the joint surface was a secondary goal, generally achieved using percutaneous or restricted techniques. Longitudinal traction on the fracture table, combined with varus or valgus stresses, helped reduce condylar size. Accurate condylar reduction and compression were made possible by the percutaneous application of large, pointed reduction forceps. Large-caliber K wires were sometimes used to handle bone fragments for reduction. In five cases, bone grafting was performed. After reducing the condyles, counter-opposed Olive. Wires were employed between fragments to compress them. Three to four wires should be at least 14 mm away from the junction line and diverge at least once. Stabilizing the condylar and metaphyseal pieces typically needed a 60° angle. Minimal internal fixing was utilized in 18 fractures (Figure-1). In six cases, a modest incision was made over the primary fracture line or area of comminution to reduce the articular surface. The preassembled frame, consisting of three rings joined by threaded rods, was fastened to the previously inserted olive wires. The distal ring was fastened to a transfixion reference wire that ran parallel to the ankle joint in order to reestablish the tibia's mechanical axis. The intermediate ring was put just distal to any shaft fracture components. A femoral frame was used in five cases to treat a femoral fracture (Figure-2) and two other cases for fracture comminution that required distraction above the knee. Patients began mild activities on the second post-operative day. Weight-bearing was increased as tolerated. For six weeks, patients with severe articular comminution were kept off their feet. Radiographic, clinical, and functional evaluations were conducted using Rasmussen's technique[14] and the Knee Society clinical assessment score[15].

RESULT

Except for one with varus malunion, all fractures healed. The frame was removed after an average of 16.3 weeks (range 14-24). Only 28 patients (29 fractures) were available for follow-up. The average follow-up period was 27 months (range 16–36). According to Rasmussen's criterion[14], the radiographic reduction of fractures was excellent in 18 cases and good in 12. Using the Knee Society clinical assessment method, 18 knees were classified as exceptional, seven as good, one as fair, and two as poor. The average total range of knee flexion was 112.5° (range: 0-170°), while three individuals had a total arc of motion of less than 60°. In cases treated with knee distraction, the average knee flexion was 83° (range 0-145°), while those with ipsilateral femoral fractures had an average knee flexion of 55°. Five patients demonstrated clinically significant grade 2+ medial-lateral instability. Only two were symptomatic, although they had no functional limitations. Eleven individuals reported no pain, while the rest 18 experienced mild or intermittent pain. Eight individuals had difficulty walking, and six need walking assistance. There was a strong association ($P<0.005$) between the existence of accompanying injuries and the final outcome, with the most significant being a concurrent distal femoral fracture. However, the magnitude of soft-tissue injury also influenced the outcome. Of the 18 instances treated with extra minimal internal fixation, 12 were graded outstanding, five acceptable, and one fair. Five of ten instances treated without minimal internal fixation were graded outstanding, four good, and one fair. The quality of reduction improved the functional score, as demonstrated in [Table II]. Pin-tract infection was slight and common, but it was treated with local dressings and antibiotics.

Table – I: Grading of soft-tissue injuries for closed and open fractures

	Closed fractures (Tscherne–Gotzen)				Open fractures (Gustilo–Anderson)					Total
	0	1	2	3	I	II	IIIA	IIIB	IIIC	
Cases	3	6	9	3	3	2	2	2		30

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Table – II: Relationship between the quality of reduction and the functional outcome

Functional outcome	Quality of reduction				
	Anatomical	Good	Fair	Poor	Total
Excellent	9	9	-	-	18
Good	7	2	-	-	9
Fair	1	1	-	-	2
Poor	-	-	-	-	-
Total	17	12	-	-	29

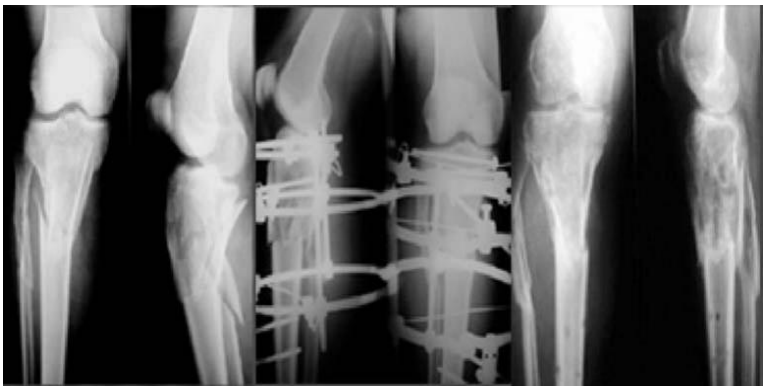

Figure – 1: Closed right tibial fracture in a 41-year-old man treated with closed reduction, minimal internal fixation, and fixation with Ilizarov's apparatus.

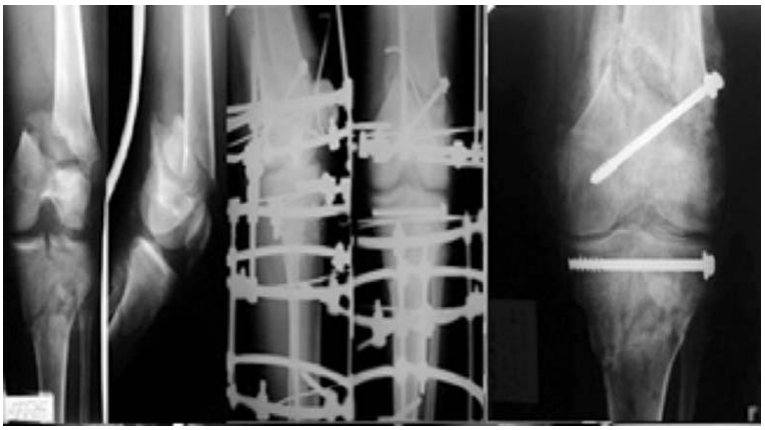

Figure – 2: Left distal femoral fracture and ipsilateral tibial plateau fracture in a 20-year-old man treated with minimal internal fixation and cross-knee Ilizarov fixator.

DISCUSSION

The treatment of intraarticular fractures in the tibial plateau is fundamentally complicated[16,17]. Articular congruity must be restored, and soft tissues must be treated with care, just as bone[18,12]. Not all fractures can be reduced with ligamentotaxis alone, and a limited open reduction with minor periosteal stripping is sometimes required[19]. Because internal fixation will not be used, the Ilizarov fixation provides for a more flexible choice of incisionIn 26 percent of 50 complex plateau fractures treated with Ilizarov fixation, Morandi and Pearse[20] observed elevation and bone grafting. Marsh et al.[21] were able to decrease 16 of 21 plateau fractures treated with halfpin fixation, whether closed, percutaneously, or through open wounds. In this study, closed reduction was successfully accomplished in 24 cases. In our investigation, six instances required minimal open reduction by a 5- to 6-cm incision, whereas five needed bone grafting to sustain the raised articular surface. This ratio was much lower than those reported by Watson and Coufal[11] (79% open reduction and 57% grafting), Weiner et al.[22] (60% open reduction), and Dendrinos et al.[23] (50% open reduction). In 18 plateau fractures (60%), little internal fixation was performed using percutaneously inserted lag screws. This differs from Weiner et al.[22], who employed screw fixation in all of their intraarticular fractures, and Dendrinos et al.[4], who only used external fixation wires and no screws. Our group's average fixation length was only slightly longer than that reported by Kumar and Whittle[12] (24.7 weeks), which included four cases of delayed/non-union. With their elimination, this period was reduced to 16 weeks, which is consistent with the mean time to union reported in previous samples[13,22]. Using Rasmussen criteria for radiographic

assessment, we achieved excellent to good decrease in all of our cases, which outperformed all comparable series[13,22]. While Morandi and Pearse[20] noted 113°, Guadinez et al.[24] recorded a mean range of movement (ROM) of 85°. According to Zecher et al.[25], every patient they treated achieved at least 90°. Despite the inclusion of three cases of knee stiffness, our study had a higher average knee range of motion than comparable studies. Using the Knee Society assessment method, our study's average knee score was 87.7, functional score was 87.2, and knee rating was 87.4. Mikulak et al.[26] found a mean knee score of 78.5, a mean functional score of 81.9, and an average knee rating of 80.2 in 24 patients. Kumar and Whittle[12] found a mean knee score of 83 and a mean functional score of 69 in 45 individuals (79%) with anatomical decrease. In nine patients (21%) with nonanatomical reduction, the average knee score was 52, although the average functional score was just 19. Several publications have found characteristics that increase the likelihood of a successful outcome[20,22]. The majority of the reports contain only low- or very few high-energy fractures. There is limited published information on the outcomes of treating high-energy fractures. The differences in osseous and soft-tissue injury patterns between these two categories indicate that the result and treatment required may differ. In the current investigation, two variables had a direct relationship with the final ROM: knee distraction and the concomitant distal femoral fracture. Polytrauma patients had only fair and poor outcomes, primarily those with concurrent ipsilateral femoral fractures. This was also the case in Mikulak et al.[26], and it is consistent with the findings of Lobenhoffer et al.[27]. The severity of soft-tissue injury was also a strong predictor of functional outcome. In our study, open injuries accounted for 45% of poor results. Mallik et al.[28] discovered infection worsening four of five bicondylar fractures treated with plates, whereas Young and Barrack[29] identified deep infection in seven of eight fractures treated with double plates. Given its deadly nature, one of the management goals must be to keep infection to an absolute minimum. In the current study, pin-tract infection had no effect on the end outcome[28,22]. Some writers have indicated that anatomical restoration of the plateau surfaces is critical for preventing subsequent osteoarthrosis[9,29]. Others have reported good functional outcomes after conservative treatment or surgical treatment that did not completely restore the anatomy[16,17,13,22]. One cause for these divergent viewpoints is a lack of a consistent classification and evaluation procedure. Furthermore, the criteria for an acceptable result may not have been severe enough to detect differences between the fracture and therapy groups. It is unclear if the inferior results were due to the degree of the initial articular damage or the quality of articular reduction.

Limitation of the study: The study has small sample sizes and a single focus area. The study's findings might therefore not accurately represent the whole picture.

CONCLUSION & RECOMMENDATION

With just a slight difference in knee ratings between patients with anatomical and nonanatomical results, the clinical-radiological association in our study showed that the quality of articular reduction had less of an impact on the final result. Significant early comminution seemed to produce the worst results. Overall, this study emphasizes the Ilizarov method's therapeutic success and minimal morbidity rate. The technique is ideally suited to the treatment of difficult tibial plateau fractures in which comminution would necessitate extensive dissection and internal fixation with plates and screws, further compromising the soft tissue. The findings of this investigation support those of several predecessors. The reduced incidence of soft tissue problems, early range of motion, early weight bearing, and strong functional recovery all compare favorably with other reported results, supporting the notion that external fixation should be the preferred therapy for such injuries.

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ORIGINAL ARTICLE

Frequency of Polycystic Ovary Syndrome in Female Patients with Acne Vulgaris — A Cross-Sectional Study

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ABSTRACT

Background: *Acne vulgaris is a common dermatological condition frequently encountered in women of reproductive age. Emerging evidence suggests a significant association between persistent acne and polycystic ovary syndrome (PCOS), a complex endocrine disorder characterized by hyperandrogenism, menstrual irregularities, and metabolic disturbances. Early identification of PCOS among acne patients is critical for timely management and prevention of long-term complications.* ***Aim of the study:*** *To determine the frequency of PCOS among women presenting with acne vulgaris and to evaluate the associated clinical and anthropometric characteristics.* ***Methods & Materials:*** *This hospital-based, cross-sectional study included 136 women diagnosed with acne vulgaris attending the outpatient Dermatology and Venereology department of Combined Military Hospital, Dhaka, between December 2022 and May 2023. Socio-demographic data, clinical presentations, menstrual history, and anthropometric measurements were recorded. PCOS diagnosis was based on clinical criteria including hyperandrogenic features and menstrual disturbances. Statistical analyses compared clinical parameters between acne patients with and without PCOS.* ***Result:*** *The prevalence of PCOS among acne patients was 36.8%. Women with PCOS showed significantly higher frequencies of hirsutism (88.0% vs. 3.49%, $p < 0.001$), alopecia (38.0% vs. 8.14%, $p < 0.001$), obesity (42.0% vs. 10.47%, $p < 0.001$), acanthosis nigricans (66.0% vs. 9.30%, $p < 0.001$), and menstrual disturbances (62.0% vs. 11.63%, $p < 0.001$) compared to non-PCOS acne patients. Seborrhea was more common in PCOS patients but did not reach statistical significance (58.0% vs. 41.86%, $p = 0.069$). The mean BMI was significantly higher in the PCOS group.* ***Conclusion:*** *The present study demonstrates a high prevalence of PCOS among women with acne vulgaris, particularly in those exhibiting hyperandrogenic and metabolic features. These findings emphasize the importance of routine PCOS screening in dermatological practice to enable early diagnosis and multidisciplinary care.*

Keywords: *Polycystic ovary syndrome, acne vulgaris, hyperandrogenism, hirsutism, menstrual irregularities, obesity*

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INTRODUCTION

Acne vulgaris is a common, chronic, and multifactorial inflammatory skin disorder that affects approximately 9.8% of women globally[1]. Its prevalence is particularly high during adolescence, typically diminishing in adulthood and becoming uncommon after menopause[2]. The development and persistence of acne are influenced by various intrinsic and extrinsic factors, including age, ethnicity, dietary habits, emotional stress, smoking, and hormonal fluctuations[3]. The pathophysiology of acne involves five core mechanisms: follicular hyperkeratinization, increased sebum production, inflammation, colonization of the pilosebaceous unit by Cutibacterium acnes (formerly Propionibacterium acnes), and hormonal influences most notably the action of androgens on

sebaceous glands[4]. Polycystic ovary syndrome (PCOS), one of the most common endocrine disorders in women of reproductive age, affects an estimated 6–10% of this population[5]. It is defined by the presence of oligo- or anovulation, clinical or biochemical signs of hyperandrogenism, and polycystic ovarian morphology on ultrasound, as outlined in the Rotterdam criteria[6]. Clinically, PCOS presents with a wide spectrum of symptoms including menstrual irregularities, infertility, and metabolic abnormalities[7]. Cutaneous manifestations are also prevalent and may include acne, seborrhea, hirsutism, and androgenetic alopecia, with hirsutism being the most frequently observed, occurring in approximately 65–75% of cases[8]. Acne, while less common, is present in about 15–25% of PCOS patients[9]. Although hyperandrogenism is a recognized pathogenic factor in acne development due to its stimulatory effect on sebaceous gland activity and follicular keratinization, a significant proportion of women with acne do not display measurable biochemical hyperandrogenism[10]. Nevertheless, acne may serve as an early dermatological indicator of underlying endocrine dysfunction, particularly in women with additional signs such as hirsutism, obesity, or menstrual irregularities. Studies suggest that hirsutism is found in 20–30% of women with acne[11], while the prevalence of PCOS among acne patients ranges from 20–40%, suggesting a notable overlap between the two conditions[9]. It is important to note, however, that acne may not always be the direct result of PCOS but could arise due to secondary factors commonly associated with the syndrome, such as insulin resistance, poor dietary patterns, psychosocial stress, or the use of comedogenic skincare products[12]. Given these associations, it is recommended that women presenting with persistent, treatment-resistant acne particularly when accompanied by signs of androgen excess—undergo screening for PCOS[13]. Early recognition and diagnosis of PCOS are essential due to its long-term implications, including increased risk of infertility, metabolic syndrome, type 2 diabetes, cardiovascular disease, and endometrial cancer[14]. Despite increasing awareness, the exact prevalence of PCOS in women presenting with acne vulgaris remains underexplored in many populations. Therefore, the aim of this study is to determine the frequency of polycystic ovary syndrome in women presenting with acne vulgaris, thereby contributing to improved diagnostic insight and management strategies for both conditions.

METHODS & MATERIALS

This hospital-based, cross-sectional study was conducted in the Outpatient Department of Dermatology and Venereology at Combined Military Hospital (CMH), Dhaka. The study was carried out over a six-month period, from December 2022 to May 2023.

Study Population

A total of 136 female patients presenting with acne vulgaris were recruited consecutively during the study period using a non-probability consecutive sampling technique. All participants attended the dermatology outpatient clinic of CMH, Dhaka.

Inclusion Criteria

- Women diagnosed with acne vulgaris.
- Women of reproductive (childbearing) age.
- Patients who provided written informed consent for pelvic ultrasonography.
- Patients who consented to undergo relevant blood investigations.

Exclusion Criteria

- Patients with known systemic comorbidities including diabetes mellitus, hypertension, ischemic heart disease, thyroid disorders, or systemic autoimmune diseases.
- Patients currently or recently (within 3 months) using hormonal therapy, corticosteroids, or oral contraceptive pills.
- Patients unwilling to provide informed consent.

Study Variables and Data Collection

Data were collected using a structured format encompassing demographic, clinical, hormonal, and radiological variables. Demographic and clinical parameters included age, menstrual history (cycle length, regularity, duration of bleeding), body weight, height, body mass index (BMI), duration and type of acne, distribution of lesions, and signs of hyperandrogenism such as hirsutism. Acne severity was graded clinically as mild, moderate, or severe. BMI was calculated using the standard formula: weight in kilograms divided by height in meters squared (kg/m^2). Menstrual irregularity was defined as having fewer than nine periods per year or menstrual cycles exceeding 40 days, in the absence of pregnancy.Pelvic ultrasonography (USG) was performed in all participants to assess ovarian morphology. A 3.5 MHz transabdominal probe was used for unmarried women employing the full bladder technique, while a 5 MHz transvaginal probe was used for married participants. The diagnosis of polycystic ovary (PCO) was established based on the presence of multiple small (2–8 mm) subcapsular cysts with dense echogenic stroma. PCO was not diagnosed in cases with randomly distributed cysts lacking stromal echogenicity.Hormonal evaluation included serum concentrations of total testosterone, luteinizing hormone (LH), and follicle-stimulating hormone (FSH). Blood samples were collected in a fasting state and analyzed using radioimmunoassay methods. The diagnosis of polycystic ovary syndrome (PCOS) was based on the presence of acne with menstrual irregularities and either clinical signs of hyperandrogenism or a serum LH/FSH ratio ≥2 and/or ultrasonographic findings consistent with PCO morphology.

Statistical Analysis

All data were checked for completeness, consistency, and accuracy. Data entry and analysis were performed using IBM SPSS Statistics version 23.0 (IBM Corp., Armonk, NY). Descriptive statistics were used to summarize the data. Continuous variables were expressed as mean ± standard

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deviation (SD), and categorical variables were presented as frequencies and percentages. Group comparisons were conducted using the Chi-square test for categorical variables and unpaired Student's t-test for continuous variables. A p-value <0.05 was considered statistically significant with a 95% confidence interval.

Ethical Considerations

The study protocol received approval from the Institutional Ethics Committee of Combined Military Hospital, Dhaka. Informed written consent was obtained from all participants prior to enrollment. Participant confidentiality and anonymity were maintained throughout the study in accordance with the ethical principles of the Declaration of Helsinki.

RESULT

A cross-sectional study was conducted among a total of 136 childbearing women presenting with acne vulgaris in the Department of Dermatology and Venereology of Combined Military Hospital (CMH), Dhaka. The primary objective was to determine the frequency of polycystic ovarian syndrome (PCOS) in this population. The findings revealed that 50 participants out of 136 were diagnosed with PCOS, indicating a frequency of 36.8% (Figure 1). The mean age of the participants was 27.9±5.6 years, ranging from 18 to 39 years. A majority of the participants were aged 25 years or older. Most of the patients were married and had attained higher education. A large proportion were students, with a monthly income of over 10,000 and residing in urban areas, as demonstrated in (Table I). Clinical presentation analysis revealed that papular acne was the most frequent manifestation, followed by pustule, comedone, and nodule. Regarding the duration of acne, two-thirds of the patients had a disease history of 1 to 3 months. Cheeks were the most commonly involved sites, followed by different regions of the face and forehead (Table II). The mean age at first appearance of acne was 17.8±0.7 years. The mean menstrual cycle length was 32.8±6.2 days. The minimum and maximum durations of menstrual bleeding were 4.1±1.3 days and 6.5±1.5 days, respectively. The mean body mass index (BMI) of the respondents was 24.13±4.2 kg/m^2 (Table III). Clinical features such as hirsutism were present in 44 out of 50 women with PCOS but only 3 out of 86 women without PCOS. Alopecia was observed in 19 PCOS patients and 7 without PCOS. Obesity was present in 21 PCOS cases and 9 without. Acanthosis nigricans was seen in 33 PCOS patients but only 8 of the non-PCOS group. Menstrual disturbance was reported by 31 PCOS women and only 10 without PCOS. Seborrhoea was more common among PCOS patients (29 out of 50), although the difference was not statistically significant. These differences in clinical features are presented in Table IV.

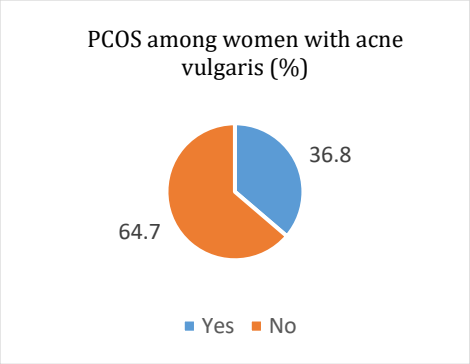

Figure – 1: Prevalence of Polycystic Ovary Syndrome (PCOS) among women presenting with acne vulgaris

Table – I: Socio-demographic profile of the study population (*n*=136)

Variable	Frequency (n)	Percentage (%)
Age (years)		
<25	48	35.29
≥25	88	64.71
Mean ± SD	27.9 ± 5.6	18 - 39
Marital Status		
Married	95	69.85
Unmarried	41	30.15
Education		
Illiterate	9	6.62
Primary	4	2.94
Secondary	27	19.85
Higher	96	70.59
Occupation		
Housewife	43	31.62
Service	34	25.00
Student	59	43.38
Income		
≤10,000	37	27.21
>10,000	99	72.79
Residence		
Rural	53	38.97
Urban	83	61.03

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Table – II: Clinical presentation profile of women with acne vulgaris.

Clinical presentation	Frequency (n)	Percentage (%)
Clinical Manifestations		
Acne Comedone	41	30.15
Acne papule	98	72.06
Acne nodule	33	24.26
Acne pustule	53	38.97
Duration of disease (month)		
1 – 3	91	66.91
4 - 6	45	33.09
Site of Involvement		
Right side of cheek	73	53.68
Left side of cheek	69	50.74
Right side of forehead	18	13.24
Left side of forehead	20	14.71
Right side of face	22	16.18
Left site of face	21	15.44

Table – III: Menstrual and anthropometric characteristics of the Study Population

Variable	Mean ± SD
Age of respondents (years)	27.9 ± 5.8
Age at first acne (years)	17.8 ± 0.7
Length of menstrual cycle (days)	32.8 ± 6.2
Minimum duration of menstrual bleeding (days)	4.1 ± 1.3
Maximum duration of menstrual bleeding (days)	6.5 ± 1.5
Body Mass Index (BMI, kg/m^2)	24.13 ± 4.2

Table – IV: Clinical findings of the study population

Clinical Finding	Acne patients with PCOS	Acne patients without PCOS	p-value
Hirsutism			
Present	44 (88.00)	3 (3.49)	<0.001
Absent	6 (12.00)	83 (96.51)	
Seborrhoea			
Present	29 (58.00)	36 (41.86)	0.069
Absent	21 (42.00)	50 (58.14)	
Alopecia			
Present	19 (38.00)	7 (8.14)	<0.001
Absent	31 (62.00)	79 (91.86)	
Obesity			
Present	21 (42.00)	9 (10.47)	<0.001
Absent	29 (58.00)	77 (89.5)	
Acanthosis Nigricans			
Present	33 (66.00)	8 (9.30)	<0.001
Absent	17 (34.00)	78 (90.70)	
Menstrual disturbance			
Present	31 (62.00)	10 (11.63)	<0.001
Absent	19 (38.00)	76 (88.37)	

DISCUSSION

Polycystic ovary syndrome (PCOS) has emerged as one of the most common endocrine disorders affecting women of reproductive age, often manifesting through a constellation of dermatological, metabolic, and reproductive symptoms[15,16]. Among these, acne vulgaris frequently serves as an early clinical indicator, particularly when persistent, treatment-resistant, or occurring beyond adolescence[16]. Recent insights into the pathophysiology of PCOS have highlighted the role of hyperandrogenism, insulin resistance, and inflammatory mediators—mechanisms that also contribute to acne development[17]. Consequently, acne is increasingly recognized not merely as a cosmetic concern but as a potential dermatologic marker of systemic hormonal imbalance[18]. In this context, identifying the prevalence of PCOS among acne patients is critical for timely diagnosis and intervention. In the present study, the prevalence of polycystic ovary syndrome (PCOS) among women with acne vulgaris was found to be

36.8%, which is consistent with findings from previous studies indicating a strong association between acne and PCOS. A hospital-based observational study conducted by Shareef et al. in India reported a similar prevalence rate of 30% among women presenting with acne, highlighting the relevance of dermatological symptoms as early indicators of reproductive endocrinopathies[19]. Similarly, a cross-sectional study by Bliede et al. at Tishreen University Hospital in Syria identified PCOS in 34% of women with acne, further supporting the dermatological–endocrine link[20]. Our study population primarily consisted of women aged 18 to 39 years, with a mean age of 27.9 ± 5.6 years, aligning with the typical age range of PCOS onset reported in the literature[19,20]. Furthermore, the majority of participants (64.71%) were aged ≥25 years. Comparable results were reported by Maluki (2010), who documented a mean age of 25.02 ± 6.04 years, with participants ranging from 17 to 40 years[21]. Similarly, Schmidt et al. conducted a retrospective cross-sectional study at the University of California, San Francisco, including 401 women with suspected PCOS, where the median age was 28 years[22]. Our analysis of clinical features showed that acne papules (72.06%) and pustules (38.97%) were predominant. Notably, PCOS was significantly associated with other androgenic manifestations. Hirsutism, a hallmark of hyperandrogenemia, was present in 88% of acne patients with PCOS, compared to only 3.49% in those without PCOS ($p < 0.001$). Consistent with the findings reported by Maluki (2010), the prevalence of hirsutism was markedly elevated in acne patients diagnosed with PCOS (88.0%) compared to those without PCOS (3.5%)[21]. Hirsutism serves as a critical clinical marker of hyperandrogenemia and constitutes a key diagnostic criterion for PCOS, as demonstrated in the study by Sharquie et al. (2007) and corroborated by subsequent research[23]. Alopecia (38% vs 8.14%, $p < 0.001$), acanthosis nigricans (66% vs 9.3%, $p < 0.001$), and obesity (42% vs 10.47%, $p < 0.001$) were also significantly more common among PCOS cases. Keen et al. (2017) reported a comparable frequency of alopecia (31%) and acanthosis nigricans (30%) among Indian women with PCOS[24]. Similarly, a Jordanian study observed alopecia in 42.5% of PCOS patients, with acanthosis nigricans and other cutaneous signs being significantly more common in overweight and obese individuals[25]. Avila et al. (2014) noted that 53% of PCOS patients had acanthosis nigricans, strongly associated with obesity and insulin resistance[26]. A multicenter study from southern India also demonstrated a high prevalence of acanthosis nigricans (56%) among PCOS women, particularly those with elevated BMI[27]. Acanthosis nigricans, in particular, serves as a visible marker of insulin resistance—a central feature of PCOS. Taieb et al. emphasized that insulin resistance not only contributes to metabolic risk but also amplifies androgen production, exacerbating both acne and other cutaneous symptoms[28]. Additionally, menstrual irregularity was reported by 62% of PCOS patients compared to just 11.63% of non-PCOS individuals ($p < 0.001$). The mean menstrual cycle length in the overall population was 32.8 ± 6.2 days, suggestive of oligo-ovulation or anovulation in many cases. This is very similar to a study performed by Sharquie et al.[23]. This finding also consisted with the study of Norman et al. (2007), Ehrmann, 2005 and Chang and Katz (1999)[29-31]. Although seborrhea was observed more frequently among PCOS patients (58%) compared to non-PCOS patients (41.86%), this difference was not statistically significant ($p = 0.069$). Gowri et al. reported that 52.5% of women with PCOS exhibited seborrhea, making it one of the most common dermatological manifestations after acne and hirsutism[32]. In a study conducted by Artar et al., an even higher prevalence of seborrhea (89.4%) was observed among PCOS subjects, indicating a strong dermatological association with hyperandrogenism[33]. Similarly, an Egyptian study by Abdelazim et al. identified seborrhea in 27.6% of PCOS patients, with no statistically significant correlation found between seborrhea and hormonal parameters such as LH/FSH ratio or serum testosterone ($p > 0.5$)[34].

Limitations of the study:

Every hospital-based study has some limitations and the present study undertaken is no exception to this fact. The present study's cross-sectional design restricts causal inferences regarding the relationship between acne vulgaris and PCOS. Additionally, diagnosis of PCOS was primarily clinical without confirmatory hormonal assays or ultrasonographic evaluation, potentially affecting diagnostic accuracy. The single-center, hospital-based setting may limit the generalizability of findings to the wider population, especially in rural or underserved areas. Furthermore, selection bias may exist due to the consecutive sampling method. Future studies with larger, multicenter cohorts and comprehensive biochemical and imaging assessments are warranted to validate and extend these findings.

CONCLUSION AND RECOMMENDATIONS

The present study demonstrates a high frequency of polycystic ovary syndrome (PCOS) among women with acne vulgaris, with 36.8% affected. Clinical features such as hirsutism, alopecia, acanthosis nigricans, obesity, and menstrual irregularities were significantly associated with PCOS, underscoring the multifaceted nature of this endocrine disorder. These findings highlight the importance of routine screening for PCOS in women presenting with acne, especially those exhibiting hyperandrogenic or metabolic signs. Early identification and integrated management can improve dermatologic and systemic outcomes, emphasizing the critical role of multidisciplinary approaches in optimizing patient care.

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ORIGINAL ARTICLE

Estimating Acute Cholecystitis Severity Using C-Reactive Protein and ESR Levels

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ABSTRACT

Background: *Acute cholecystitis (AC) is a common inflammatory condition of the gallbladder, and timely severity assessment is crucial for appropriate management. While the Tokyo Guidelines (TG18) provide a framework for diagnosis and grading, they lack specific biomarker thresholds for severity estimation. This study explores the role of C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR) as potential predictors of disease severity.* ***Aim of the study:*** *To evaluate the association of CRP and ESR levels with the severity of acute cholecystitis and propose potential cut-off values for clinical application.* ***Methods & Materials:*** *A descriptive cross-sectional study was conducted on 130 patients diagnosed with acute cholecystitis between June 2023 and June 2025. Patients were classified into mild, moderate, or severe categories based on clinical, laboratory, and imaging findings. CRP and ESR levels were analyzed in relation to disease severity.* ***Result:*** *CRP and ESR levels were significantly associated with disease severity ($p<0.001$). All mild cases had CRP <1 mg/L, while all severe cases had CRP >6 mg/L. Mean CRP values were 0.646±0.231 mg/L (mild), 5.30±1.76 mg/L (moderate), and 13.78±4.48 mg/L (severe). ESR followed a similar trend: 14.76±3.54 mm/hr (mild), 36.78±2.35 mm/hr (moderate), and 47.45±2.97 mm/hr (severe). Ultrasound findings such as gallbladder wall thickening, common bile duct dilation, and bile spillage were also significantly associated with severity.* ***Conclusion:*** *CRP and ESR levels correlate strongly with the severity of acute cholecystitis and may serve as practical biomarkers for early risk stratification. These findings support their integration into routine diagnostic and prognostic evaluation, particularly in resource-limited settings.*

Keywords: *Acute cholecystitis, C-reactive protein, Erythrocyte sedimentation rate,*

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INTRODUCTION

Acute cholecystitis (AC) is one of the most common complications of gallstone disease and a leading cause of emergency hospital admissions for abdominal pain requiring surgical intervention[1]. Globally, gallstone disease affects approximately 10–20% of the adult population, with acute cholecystitis developing in up to 20% of symptomatic patients[2]. In Bangladesh, gallbladder disease has shown a rising trend, with hospital-based studies reporting a prevalence of 6–8% among adults, and acute cholecystitis accounting for a significant portion of gallstone-related admissions, especially among women aged 30–60 years[3]. Despite advances in diagnostic modalities and surgical techniques, early and accurate severity assessment of acute cholecystitis remains a key challenge for optimizing treatment decisions and improving patient outcomes[4]. The diagnosis and grading of acute cholecystitis were largely subjective and varied across institutions. The Tokyo Guidelines (TG), first proposed in 2007 and subsequently updated in 2013 and 2018, established internationally recognized diagnostic and severity grading criteria for acute cholecystitis to unify clinical practice and improve patient care[5]. These guidelines integrate clinical, laboratory, and radiological findings to improve diagnostic accuracy and guide therapeutic strategies[6]. According to the Tokyo Guidelines 2018 (TG18), the diagnosis of acute cholecystitis is based on a combination of local signs of inflammation e.g., Murphy's sign, right upper quadrant tenderness, systemic signs of inflammation e.g., fever, elevated white blood cell count, or elevated C-reactive protein [CRP], and imaging findings characteristic of

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gallbladder inflammation[7]. Following diagnosis, the clinical severity is stratified into three grades: mild, moderate, and severe, based on clinical, laboratory, and organ dysfunction parameters[8]. While CRP is listed in the TG18 as part of the diagnostic workup, it is not formally included in the severity grading criteria. However, emerging evidence suggests that CRP, as a sensitive and dynamic acute-phase reactant, correlates well with the severity of inflammation in acute cholecystitis and can serve as a useful prognostic indicator[9]. Numerous studies have demonstrated that higher CRP levels are associated with complicated or severe cases, such as gangrenous cholecystitis, empyema, or perforation[10]. Despite this, the guidelines do not propose specific CRP cut-off values for grading severity, leaving clinicians without a standardized threshold to differentiate mild from moderate or severe disease[11]. Similarly, erythrocyte sedimentation rate (ESR), although less frequently used in acute settings due to its slower kinetics, may complement CRP in identifying prolonged or subacute inflammation[12]. Given the wide availability, low cost, and clinical utility of CRP and ESR, establishing their predictive value for assessing the severity of acute cholecystitis may enhance early risk stratification, particularly in low-resource settings[13]. This study aims to evaluate the role of CRP and ESR in estimating disease severity among patients with acute cholecystitis, with the goal of determining potential cut-off values that can support clinical decision-making alongside the Tokyo Guidelines criteria.

METHODS & MATERIALS

This descriptive cross-sectional study was conducted at the Department of Surgery, Khulna Medical College Hospital, Khulna, Bangladesh. The study was carried out over a period of two year, from June 2023 to June 2025. This study was designed as a diagnostic, observational cohort study aimed at evaluating the association between the severity of acute cholecystitis and levels of inflammatory markers, specifically CRP and ESR. The study was conducted in a clinical setting where all relevant laboratory and imaging assessments were performed as part of routine care. The study included total 130 patients with acute cholecystitis.

Inclusion Criteria

- Aged 18 years or older.
- Underwent serum CRP and ESR testing at the time of hospital admission.
- Diagnosed with acute cholecystitis based on clinical, laboratory, and ultrasonographic findings.

Exclusion Criteria

- Individuals with coexisting conditions known to influence inflammatory markers, such as diabetes mellitus, HIV, hepatitis, intestinal tuberculosis, or other immunocompromised states.
- Patients with histopathological findings suggestive of malignancy.
- Pregnant individuals.
- Patients with conditions that could confound CRP levels, such as acute pancreatitis or systemic infections.

Ethical Consideration

Approval was obtained from the Institutional Ethics Committee before the commencement of data collection. All participants were fully informed about the study's purpose, procedures, and any potential risks. Informed consent was obtained in written form. Confidentiality of patient information was maintained. As no experimental interventions were involved and only routine laboratory investigations were analyzed, the study posed minimal risk to participants.

Surgical Technique

Most patients underwent laparoscopic cholecystectomy under general anesthesia. The standard technique included the use of four ports (two 5 mm and two 10 mm) with visualization of Rouviere's sulcus and critical view of safety for identifying Calot's triangle. Cystic duct and artery were clipped, and the gallbladder was removed from the liver bed. In cases requiring open cholecystectomy, a right subcostal incision was made to facilitate gallbladder removal using electrocautery or harmonic scalpel. When indicated, cholangiography or common bile duct exploration was also performed.

Data collection

Medical records were reviewed to collect demographic data, including age, sex, and body mass index (BMI), as well as comorbidities. Laboratory investigations performed at initial presentation included complete blood count (hemoglobin and WBC), liver enzymes (ALT, AST), amylase, total bilirubin, CRP, and ESR levels. Radiological findings, including gallbladder wall thickness, common bile duct (CBD) diameter, number and size of gallstones, presence of impacted stones at the gallbladder neck, and bile spillage, were retrieved from ultrasound reports. The severity of acute cholecystitis was classified into mild (n=80), moderate (n=30), and severe (n=20) categories based on clinical, radiological, and surgical criteria.

Statistical Analysis

Data were entered and analyzed using SPSS version 26. Descriptive statistics were used to summarize the data. Categorical variables were presented as frequencies and percentages, while continuous variables were reported as mean ± standard deviation (SD). Associations between AC severity and categorical variables were analyzed using the Fisher's exact test or Chi-square test, as appropriate. A p-value less than 0.05 was considered statistically significant.

RESULT

The mean BMI was 25.7 ± 5.1 kg/m^2. Comorbidities were present in 24 patients (18.46%). The mean hemoglobin level was 12.5 ± 2.6 g/dL, and the average white blood cell count was $11.8 \pm 3.7 \times 10^3$/mL. Liver function parameters showed a mean total bilirubin of 1.56 ± 1.28 mg/dL, ALT of 50.6 ± 51.4 IU/L, and AST of 55.3 ± 61.7 IU/L (Table 1). Female (55.38%)

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participants were more common than male (44.62%) participants (Figure 1). Mild cholecystitis was more common in younger age groups, particularly 31–40 years (37.5%) and 41–50 years (30%). Moderate and severe cases were more frequent in older patients, with 26.67% and 40% of moderate and severe cases, respectively, occurring in the 51–60 age group (Table 2). Table 3 shows that ultrasound findings showed significant associations with cholecystitis severity. Gallbladder wall thickening (>4 mm) was more prevalent in moderate (20%) and severe cases (30%) compared to none in mild cases (p=0.02). A dilated common bile duct (>6 mm) was observed in 26.67% of moderate and 40% of severe cases versus only 5% of mild cases (p=0.005). Multiple stones were more common in severe cholecystitis (50%) compared to mild (10%) (p=0.014). Larger stones (>1 cm) predominated in mild and moderate cases but were less frequent in severe cases (p=0.052). Impacted stones at the gallbladder neck were significantly associated with increasing severity (p=0.001), present in 50% of severe cases. Bile spillage was also strongly correlated with severity, occurring in 90% of severe and 33.33% of moderate cases but absent in all mild cases (p=0.001) (Table 3). All patients with mild cholecystitis had CRP levels below 1 mg/L. In moderate cases, 66.67% had CRP levels between 1–6 mg/L, while 33.33% had levels above 6 mg/L. All patients with severe cholecystitis had CRP levels greater than 6 mg/L. The mean CRP levels increased with severity: 0.646±0.231 mg/L in mild, 5.30±1.76 mg/L in moderate, and 13.78±4.48 mg/L in severe cases (Table 4). Among patients with mild cholecystitis, 87.5% had ESR levels between 14–18 mm/hour, and 12.5% had levels between 19–38 mm/hour. In moderate cases, 93.33% had ESR levels of 19–38 mm/hour, whereas 6.67% had levels of 39–50 mm/hour. All severe cases had ESR levels between 39–50 mm/hour. The mean ESR values increased with disease severity: 14.76±3.54 mm/hour in mild, 36.78±2.35 mm/hour in moderate, and 47.45±2.97 mm/hour in severe cholecystitis (Table 5).

Table – I: Baseline characteristics of study population (*n*=130)

Variables	Mean±SD
Comorbidity, n(%)	24 (18.46)
BMI (kg/m2)	25.7 ± 5.1
Hemoglobin (gr/dl)	12.5 ± 2.6
WBC x 103 mL	11.8 ± 3.7
Total bilirubin (mg/dl)	1.56 ± 1.28
ALT (IU/L)	50.6 ± 51.4
AST (IU/L)	55.3 ± 61.7

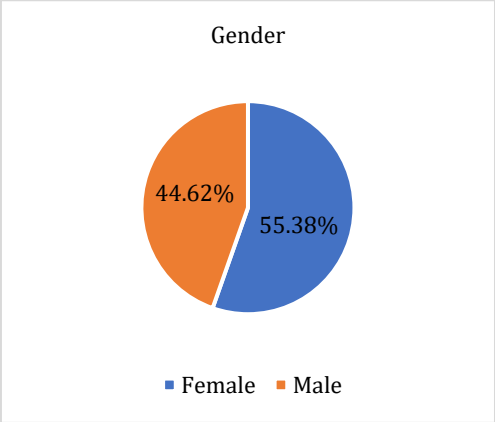

Figure – 1: Distribution of patients by gender (*n*=130)

Table – II: Age distribution of participants (*n*=130)

Age (years)	Mild cholecystitis (n=80)		Moderate cholecystitis (n=30)		Severe cholecystitis (n=20)		P-value
	n	%	n	%	n	%	
<30	16	20.00	2	6.67	4	20.00	0.027
31-40	30	37.50	2	6.67	2	10.00	
41-50	24	30.00	12	40.00	4	20.00	
51-60	6	7.50	8	26.67	8	40.00	
>60	4	5.00	6	20.00	2	10.00	

Table – III: Association of grade of acute cholecystitis with USG findings (*n*=130)

USG	Mild cholecystitis (n=80)		Moderate cholecystitis (n=30)		Severe cholecystitis (n=20)		Total		P-value
	n	%	n	%	n	%	n	%	
Gall bladder wall thickness									
<4 mm	80	100	24	80	14	70	118	90.77	0.02
>4 mm	0	0	6	20	6	30	12	9.23	
CBD diameter									
<6 mm	76	95	22	73.33	12	60	110	84.62	0.005
>6 mm	4	5	8	26.67	8	40	20	15.38	
Number of stone									
Single	72	90	26	86.67	10	50	108	83.08	0.014
Multiple	8	10	4	13.33	10	50	22	16.92	
Size of stone									
<1 cm	8	10	2	6.67	8	40	18	13.85	0.052
>1 cm	72	90	28	93.33	12	60	112	86.15	
Impacted stone at neck of GB									

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Absent	80	100	26	86.67	10	50	116	89.23	0.001
Present	0	0	4	13.33	10	50	14	10.77	
Bile spillage									
Absent	80	100	20	66.67	2	10	102	78.46	0.001
Present	0	0	10	33.33	18	90	28	21.54	

Table – IV: Association of grade of acute cholecystitis with CRP (*n*=130)

CRP (mg/l)	Mild cholecystitis (n=80)		Moderate cholecystitis (n=30)		Severe cholecystitis (n=20)		P-value
	n	%	n	%	n	%	
<1	80	100.00	0	0.00	0	0.00	0.001
1-6	0	0.00	20	66.67	0	0.00	
>6	0	0.00	10	33.33	20	100.00	
Mean±SD	0.646±0.231		5.300±1.76		13.78±4.48		

Table – V: Association of grade of acute cholecystitis with ESR (*n*=130)

Serum ESR (mm/hour)	Mild cholecystitis (n=80)		Moderate cholecystitis (n=30)		Severe cholecystitis (n=20)		P-value
	n	%	n	%	n	%	
14-18	70	87.50	0	0.00	0	0.00	0.001
19-38	10	12.50	28	93.33	0	0.00	
39-50	0	0.00	2	6.67	20	100.00	
Mean±SD	14.76±3.54		36.78±2.35		47.45±2.97		

DISCUSSION

Acute cholecystitis is a common inflammatory condition of the gallbladder, often requiring timely diagnosis and severity assessment to guide treatment. Biomarkers like CRP and ESR have emerged as valuable tools for evaluating inflammation. This study aims to estimate the severity of acute cholecystitis using CRP and ESR levels, aiding in early risk stratification and management. The mean body mass index (BMI) was 25.7 ± 5.1 kg/m^2, which indicates that a significant portion of patients were overweight, a known risk factor for gallstone formation and subsequent cholecystitis. This aligns with findings from the CHOLECOVID study, which reported a mean BMI of 27.1 ± 5.3 kg/m^2 among AC patients, underscoring the association between higher BMI and gallbladder disease[14]. In this study, the mean hemoglobin level was 12.5 ± 2.6 g/dL, The white blood cell (WBC) count averaged 11.8 ± 3.7 × 10^3/mL, indicative of a mild leukocytosis commonly observed in inflammatory conditions like AC. This is consistent with the study by Zgheib et al., which found that WBC counts were significantly higher in patients with moderate or gangrenous cholecystitis compared to those with milder forms[15]. Liver function tests revealed elevated levels of total bilirubin (1.56 ± 1.28 mg/dL), alanine aminotransferase (ALT) (50.6 ± 51.4 IU/L), and aspartate aminotransferase (AST) (55.3 ± 61.7 IU/L). These elevations may reflect biliary obstruction or hepatic inflammation associated with AC. Zgheib et al. reported similar findings, with mean total bilirubin levels of 1.82 mg/dL, ALT of 110.9 IU/L, and AST of 164.4 IU/L in patients with AC and concomitant common bile duct stones (CBDS), that highlights the impact of biliary obstruction on liver enzymes[15]. In our study of acute cholecystitis patients, most participants were middle-aged with the 41–50 age. Females slightly outnumbered males (55.38%). Although no significant association was found between gender and disease severity, older age was linked to more severe cholecystitis (p=0.02). These findings align with those of Gurbulak et al., who reported a female predominance and increasing severity with age (p<0.05)[16]. Similar age trends were noted by Muhammad et al. (mean age 40.32 years, 75% female) [17], Sakalar et al. (mean age 59.87 years, severity correlated with age but not gender)[18], and Park et al., who observed that patients with more severe disease were significantly older (p<0.05)[19]. The Tokyo Guidelines highlight key USG indicators of acute cholecystitis (AC), including probe tenderness in the area of gall bladder, GB wall thickness >4 mm, enlarged gall bladder, impacted gall stones, presence of debris or pericholecystic fluid collection and sonolucent layer in GB wall[20]. In our study, USG was performed in all cases. We observed GB wall thickening (>4 mm) in 9.23%, CBD dilation (>6 mm) in 15.38%, multiple stones in 16.92%, impacted stones at the GB neck in 10.77%, and bile spillage in 21.54%. Most stones (86.15%) were >1 cm. Significant associations were found between AC severity and GB wall thickening, CBD dilation, multiple and impacted stones, and bile spillage (p<0.05), though stone size was not significantly associated (p>0.05). Supporting studies reported GB wall thickening in 47.3%, multiple stones in 81.1%, and CBD dilation in 20.3% of cases[21]. Indar et al. also found USG findings correlated with moderate AC severity (p<0.05)[22]. Another study noted increasing abnormal USG features with severity but without statistical significance[23]. According to the Tokyo Guidelines, CRP is used for diagnosing AC, but not for grading its severity. In our study, all severe cases had CRP >6 mg/L, while mild cases had CRP <1 mg/L. The mean CRP levels were 0.646 mg/L (mild), 5.30 mg/L (moderate), and 13.78 mg/L (severe), showing a significant correlation with disease severity (p<0.05). ESR, an acute-phase reactant, has limited clarity in diagnosing and grading AC. According to our study, higher ESR levels significantly associated with increased disease severity (p<0.05). ESR ranged from 14–18 mm/hr in 53.85% of cases, 19–38 mm/hr in 29.23%, and 39–50 mm/hr

in 16.92%. Our results from CRP and ESR are comparable with the findings of Gurbulak et al.[24]. Despite these findings, ESR is a non-specific marker influenced by many conditions, such as infections, autoimmune diseases, and pregnancy. Our results suggests that ESR increases with inflammatory burden, although its diagnostic accuracy is limited.

Limitations of the study:

- The cross-sectional design did not allow for evaluation of long-term outcomes such as complications, recurrence, or mortality.
- Although exclusion criteria were applied, other unmeasured comorbid conditions might have influenced CRP and ESR levels, potentially introducing bias.
- Severity classification relied on clinical and imaging findings without histopathological confirmation, which may lead to interobserver variability.

CONCLUSION

CRP and ESR levels show a clear and statistically significant correlation with the clinical severity of acute cholecystitis. CRP levels below 1 mg/L were consistently associated with mild disease, while values exceeding 6 mg/L strongly predicted severe inflammation. Similarly, higher ESR levels aligned with increasing severity grades. These markers, due to their accessibility and cost-effectiveness, can be valuable adjuncts to clinical and radiological assessment, especially in resource-limited settings. Future studies with larger sample sizes and multicenter participation are recommended to validate these cut-off values and further refine severity prediction tools for acute cholecystitis.

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ORIGINAL ARTICLE

Characterization of Cervical Lymph Node Metastasis in Oropharyngeal Squamous Cell Carcinoma — Patterns and Implications for Treatment Planning

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ABSTRACT

Background: *Oropharyngeal squamous cell carcinoma (OPSCC) is a common malignancy in the head and neck region, with cervical lymph node metastasis being a critical factor influencing prognosis and treatment planning. The aim of this study was to characterize the patterns of cervical lymph node metastasis in OPSCC patients and to evaluate its impact on management strategies.* ***Methods & Materials:*** *A cross-sectional study was conducted at the Department of Otolaryngology & Head-Neck Surgery, Sylhet M.A.G Osmani Medical College Hospital, from September 2018 to August 2020. A total of 100 patients with OPSCC and metastatic cervical lymphadenopathy were selected based on predefined inclusion and exclusion criteria. Data were collected using a structured questionnaire and clinical examination, including fibre-optic laryngoscopy (FOL), imaging (CT/MRI), punch biopsy of oropharyngeal lesions, and fine-needle aspiration cytology (FNAC) of enlarged lymph nodes. Histopathological analysis was performed by the same pathologist. Statistical analysis was carried out using SPSS version 26.* ***Results:*** *The study found that the palatine tonsil was the most common primary site of lymph node metastasis, with 75% of patients presenting with ipsilateral lymph node involvement. The most common carcinoma stage was T2, while the predominant lymph node stage was N3. Level II and Level III lymph nodes were most commonly involved. The findings suggested that the patterns of lymph node metastasis are crucial for treatment decisions, including the choice between primary surgery, chemoradiation, or surgery after chemoradiation.* ***Conclusion:*** *This study emphasizes the importance of cervical lymph node involvement in managing OPSCC. The findings offer valuable insights for treatment planning, especially regarding neck dissection and chemoradiation. Larger studies with extended follow-up are needed to confirm these patterns and refine treatment strategies for OPSCC patients with lymph node metastasis*

Keywords: *Oropharyngeal squamous cell carcinoma, cervical lymph node metastasis, treatment planning, neck dissection, chemoradiation.*

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INTRODUCTION

Oropharyngeal squamous cell carcinoma (OPSCC) is a subset of head and neck squamous cell carcinoma (HNSCC), affecting regions such as the base of the tongue, soft palate, palatine tonsil, and posterior pharyngeal wall.[1] OPSCC accounted for 0.5% of global cancer incidence in 2018, with 92,887 new cases.[2] While its incidence has decreased in developed countries, OPSCC remains highly prevalent in South-Central Asia and Central and Eastern Europe. In Bangladesh, OPSCC is one of the top five most common cancers, contributing to 2.4% of cancer incidence and 3% of cancer-related deaths in 2018.[3] Risk factors for Oropharyngeal squamous cell carcinoma (OPSCC) include smoking, alcohol consumption, and human papillomavirus (HPV) infection, with advanced

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stage and lymphadenopathy further worsening prognosis.[1,4] Cervical lymph node metastasis is a major prognostic factor, influencing treatment and survival outcomes.[5] The oropharynx's nonkeratinized stratified squamous epithelium is prone to lymphovascular invasion, contributing to early lymph node metastasis.[6] Lymphatic drainage in the head and neck follows a superficial to deep sequence, with various cervical lymph node levels involved in Oropharyngeal squamous cell carcinoma (OPSCC) metastasis. Notably, 10-20% of metastatic cervical lymph nodes have an unknown primary, often originating in the nasopharynx or oropharynx.[7] Fine needle aspiration cytology remains the gold standard for diagnosing metastatic lymph nodes.[8] This study aims to characterize the pattern of cervical lymph node metastasis in Oropharyngeal squamous cell carcinoma (OPSCC) to improve understanding of its metastatic behavior and inform better treatment strategies for affected patients.

METHODS & MATERIALS

This cross-sectional study was conducted at the Department of Otolaryngology & Head-Neck Surgery, Sylhet M.A.G Osmani Medical College Hospital, from 1st September 2018 to 31st August 2020. The study population consisted of adult patients diagnosed with metastatic cervical lymphadenopathy from oropharyngeal squamous cell carcinoma, who met the inclusion criteria. Purposive sampling was employed to select participants, and the sample size was calculated using Guilford's and Frucher's formula. Based on a 95% confidence interval and an allowable error of 10%, the calculated sample size was 96.04, and 100 patients were ultimately included in the study. Inclusion criteria were: patients aged over 18 years with confirmed primary oropharyngeal squamous cell carcinoma and neck node metastasis by FNAC and histopathology. Exclusion criteria included patients with a history of chemoradiation or neck surgery, as well as those with advanced-stage disease.

Study Procedure

This study was conducted at the Department of Otolaryngology & Head-Neck Surgery, Sylhet M.A.G Osmani Medical College Hospital, with ethical approval. A total of 100 patients who met the inclusion and exclusion criteria were selected during the study period. Data were collected using a pre-tested, structured questionnaire. Each patient underwent a comprehensive history and clinical examination, focusing on the ear, nose, throat, and neck. Fibre-optic laryngoscopy (FOL) was performed, and general investigations, including CT and MRI of the neck, were conducted. Punch biopsy of oropharyngeal lesions and FNAC from enlarged lymph nodes were performed, with histopathological analysis conducted by the same pathologist. Peroperative findings were recorded for patients who underwent surgery, and post-operative follow-up was provided. All data were documented in case record forms and analyzed using SPSS version 26.

Data Processing and Analysis

Data were processed and analyzed manually and using SPSS version 26. Quantitative data were expressed as means and standard deviations, while qualitative data were presented as frequencies and percentages. A p-value of <0.05 was considered statistically significant, while a p-value >0.05 was considered insignificant.

Ethical Considerations

Ethical clearance for the study was obtained from the Ethical Review Committee of Sylhet M.A.G Osmani Medical College. Permission to conduct the study was granted by the concerned department. All participants were assured of appropriate treatment for any complications arising from the study. Confidentiality was guaranteed, and participants were informed that they could withdraw from the study at any time without consequence.

RESULT

The study found that the palatine tonsil was the most common primary site of lymph node metastasis, with 75% of patients presenting with ipsilateral lymph node involvement. The most common carcinoma stage was T2, while the predominant lymph node stage was N3. Level II and Level III lymph nodes were most commonly involved. The findings suggested that the patterns of lymph node metastasis are crucial for treatment decisions, including the choice between primary surgery, chemoradiation, or surgery after chemoradiation.

Table – I: Demographic Distribution of Patients by Age Group and Sex (*n*=100)

Age group in year	No. of patient	Percentage
mean±SD (yrs)	53.09±9.35	
20 to 30 years	1	1
31 to 40 years	14	14
41 to 50 years	20	20
51 to 60 years	40	40
> 60 years	25	25
Sex		
Male	65	65
Female	35	35
Total	100	100

1 shows that 40% of the patients were aged between 51 and 60 years, and Table 25% were older than 60 years. Additionally, 20% of the patients were aged between 41 and 50 years, 14% were between 31 and 40 years, and only 1% were aged between 20 and 30 years. The mean age of the patients was 53.09±9.35 years. In our study, the majority of squamous cell carcinoma (SCC) cases occurred in individuals over 50 years of age. Regarding gender distribution, 65% of the patients were male, and 35% were female, with males being predominant in this study.

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Table – II: Distribution and Status of Cervical Lymph Nodes in Oropharyngeal Squamous

Carcinoma Patients (*n*=100)

	Number of Patients (n)	Percentage (%)
Distribution of nodes		
Ipsilateral	75	75
Contralateral	20	20
Bilateral	5	5
Nodal involvement		
Single	30	30
Multiple	70	70
Consistency		
Hard	52	52
Firm to hard	35	35
Firm	11	11
cystic	2	2
Mobility		
Mobile	70	70
Fixed	30	30
Size		
<3 cm	20	20
3 to 6 cm	35	35
>6 cm	45	45

Table II presents that lymph node involvement was ipsilateral in 75% of cases, contralateral in 20%, and bilateral in 5%. Multiple nodal involvement was observed in 70% of cases, while 30% had single nodal involvement. Regarding nodal consistency, 52% of cases showed hard consistency, 35% were firm to hard, 11% were firm, and 2% were cystic. In terms of nodal mobility, 70% of the nodes were mobile, and 30% were fixed. The size of the nodes was more than 6 cm in 45% of cases, between 3 to 6 cm in 35%, and less than 3 cm in 20%. The majority of patients had ipsilateral nodal involvement, with multiple nodal involvement being more common and hard consistency being the predominant finding.

Table – III: Distribution of Patients by Site of Involvement in Oropharyngeal Squamous Cell Carcinoma (*n*=100)

Site	Number of Patients (n)	Percentage (%)
Tonsil	55	55
Base of tongue	25	25
Soft palate	15	15
Posterior pharyngeal wall	5	5
Total	100	100

Table III demonstrated that 55% cases involved site was Tonsil, base of tongue was in 25% cases, 15% cases were soft palate and only 5% cases was posterior pharyngeal involvement. Tonsil is the most common site of involvement than another site of oropharynx.Table 3 demonstrated that 55% cases involved site was Tonsil, base of tongue was in 25% cases, 15% cases were soft palate and only 5% cases was posterior pharyngeal involvement. Tonsil is the most common site of involvement than another site of oropharynx.

Table – IV: Distribution of Patients by T Staging in Oropharyngeal Squamous Cell Carcinoma (*n*=100)

Staging of disease	Number of Patients (n)	Percentage (%)
T_1	24	24
T_2	54	54
T_3	13	13
T_4	9	9
Total	100	100

Table IV illustrates that 54% patients had Stage T2, 24% patients had Stage T1, 13% patients had Stage T3 and 9% patients had Stage T4. Most common patients had T2 stage.

Table – V: Staging of Cervical Lymph Node Metastasis in Oropharyngeal Squamous Cell Carcinoma (*n*=100)

Staging of lymph node	Number of Patients (n)	Percentage (%)
Stage N_1	20	20
Stage N_2	35	35
Stage N_3	45	45
Total	100	100

Table V shows that 45% of the patients were diagnosed with Stage N3 lymph node metastasis, 35% with Stage N2, and 20% with Stage N1. The most common lymph node stage observed in the study was N3.

Table – VI: Distribution of Nodal Metastasis in Cervical Lymph Node Levels in Oropharyngeal Squamous Cell Carcinoma (*n*=100)

	Cervical lymph node level	Number of Patients (n)	Percentage (%)
Ipsilateral	Level I	8	10.7
	Level II	39	52.0
	Level III	18	24.0
	Level IV	10	13.3
	Level V	-	-
Contralateral	Level I	5	25.0
	Level II	10	50.0
	Level III	5	25.0
Bilateral	Level I	2	40
	Level II	1	20
	Level III	2	40

Table VI indicates that in cases of ipsilateral nodal involvement, 39 patients had involvement at Level II, 18 at Level III, 8 at Level I, and 10 at Level IV. For contralateral nodal involvement, 10 patients had involvement at Level II, 5 at Level I, and 5 at Level III. In bilateral nodal involvement, 2 patients had involvement at Level I, 2 at Level III, and 1 at Level II. The most common level of involvement was Level II.

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Table – VII: Primary Tumor Site Distribution According to Lymph Node Staging in Oropharyngeal Squamous Cell Carcinoma (n=100)

		Lymph node stage			Total
		N_1	N_2	N_3	
Site	Palatine tonsil	5	25	25	55
	Base of the tongue	5	5	15	25
	Soft palate	10	5	0	15
	Post-pharyngeal wall	0	0	5	5
Total		**20**	**35**	**45**	**100**

Table VII presents the lymph node staging in head and neck cancer across different sites. In the palatine tonsil group, both N2 and N3 stages were observed in 25 patients from each group. In contrast, all 5 patients with post- involvement. The differences observed between these groups are statistically significant ($\chi^2 = 37.05$; $P < 0.005$).

Table – VIII: Primary Tumor Site Distribution According to Consistency of Metastatic Lymph Nodes in Oropharyngeal Squamous Cell Carcinoma (*n*=100)

		Consistency				Total
		Hard	Firm to hard	Firm	cystic	
Site	Palatine tonsil	30	15	8	2	55
	Base of the tongue	12	10	3	0	25
	Soft palate	10	5	0	0	15
	Post-pharyngeal wall	0	5	0	0	5
Total		**52**	**35**	**11**	**2**	**100**

Table VIII illustrates the consistency of metastatic lymph nodes based on the site of the primary oropharyngeal squamous cell carcinoma (OPSCC). A total of 52 patients showed hard lymph nodes, with 30 of these cases originating from the palatine tonsil group. Only 2 lymph nodes in the palatine tonsil group were soft in consistency. No cystic consistency lymph nodes were found in other sites. However, the differences observed between the sites were not statistically significant ($\chi^2 = 15.08$; $P < 0.09$).

Table IX: Tumor Site Distribution According to Staging in Oropharyngeal Squamous Cell Carcinoma (*n*=100)

		Stage of tumor				Total
		T_1	T_2	T_3	T_4	
Site	Palatine tonsil	5	38	6	6	55
	Base of the tongue	10	10	3	2	25
	Soft palate	9	1	4	1	15
	Post-pharyngeal wall	0	5	0	0	5
Total		**24**	**54**	**13**	**9**	**100**

Table IX shows the staging of the primary head and neck tumor based on the site of the tumor. A total of 54 patients were classified as Stage T2, with the highest frequency (38 patients) observed in the palatine tonsil group. Only 9 patients were categorized as Stage T4, with 6 of these patients coming from the palatine tonsil group. The differences between the groups were statistically significant ($\chi^2 = 32.27$; $P < 0.001$).

DISCUSSION

The present study aimed to characterize cervical lymph node metastasis in patients with oropharyngeal squamous cell carcinoma (OPSCC). Our findings align with previous studies on the clinical presentation, patterns of metastasis, and the impact of lymph node involvement on patient outcomes in OPSCC. Our study demonstrated that the majority of patients (40%) were aged between 51 and 60 years, with 65% of the sample being male. These findings are consistent with previous research indicating that OPSCC predominantly affects older individuals, particularly those over 50, with a clear male predominance.[1,2] The increasing prevalence of OPSCC in this age group is particularly relevant, as it may reflect the long-term effects of smoking and alcohol consumption, both of which are well-established risk factors for the disease.[9,10] The distribution of cervical lymph node metastasis in our cohort showed that 75% of patients had ipsilateral lymph node involvement, 20% contralateral, and 5% bilateral, with 70% of patients presenting with multiple node involvement. These findings are in line with studies by Patel et al. (2013) and Vartanian et al. (2003), who reported that ipsilateral nodal metastasis was most common in OPSCC, particularly in cases with multiple nodes affected[5,7]. Furthermore, we observed a predominance of hard

consistency in the affected nodes (52%), which is consistent with findings from previous studies[11]. This finding highlights the aggressive nature of the disease, as hard nodal consistency is often associated with advanced disease and poorer prognosis[8]. The mobility of the lymph nodes was also assessed, with 30% of nodes being fixed, which can serve as an indicator of extracapsular spread, a well-known poor prognostic factor in OPSCC.[5,12] In terms of primary tumor site distribution, our results showed that the palatine tonsil was the most common site of involvement (55%), followed by the base of the tongue (25%) and the soft palate (15%). This distribution aligns with the findings of Shah et al. (1986),[13] who also reported the palatine tonsil as the most common site of OPSCC, a trend which has been observed globally due to its lymphatic drainage patterns that predispose the tonsils to metastasis[14]. Moreover, our study identified that the majority of patients (54%) presented with T2 stage tumors, followed by T1 (24%), T3 (13%), and T4 (9%). This stage distribution is comparable to the findings of Kato et al. (2020), who found T2 to be the most common stage in OPSCC.[15] The early detection of tumors in lower stages, such as T1 and T2, has been associated with better survival outcomes, which emphasizes the importance of early diagnosis and appropriate management strategies[5]. The lymph node staging in our study revealed that 45% of patients had N3 stage metastasis, followed by N2 (35%) and N1 (20%), indicating that the majority of patients had advanced nodal disease. This finding is consistent with the study by Bluemel et al. (2015), who reported a similar distribution of nodal stages in OPSCC, with N3 being the most prevalent in cases with advanced disease.[11] The involvement of multiple cervical lymph node levels, particularly Level II, was the most common in our study, which is consistent with findings from Dogan et al. (2014), who also reported Level II as the most frequently affected in OPSCC.[16] Furthermore, Vartanian et al. (2003) and Kato et al. (2018) have emphasized that understanding the pattern of lymph node involvement at different cervical levels is crucial for determining the appropriate treatment plan, including neck dissection and radiotherapy.[7,15] Regarding the consistency of metastatic lymph nodes, our study found that 52% of patients exhibited hard lymph nodes, with the majority of these originating from the palatine tonsil group. This finding is supported by the work of Fossum et al. (2017), who noted that hard consistency is often associated with more advanced metastatic disease.[17] Additionally, the lack of cystic nodes in other sites, as seen in our study, has been previously reported in similar studies, where cystic consistency is relatively rare in metastatic nodes.[11] The staging of the primary tumor according to its site revealed that the palatine tonsil group had the highest frequency of Stage T2 tumors, with 38 patients. This is consistent with the findings of Vartanian et al. (2003), who observed that the palatine tonsil is the most common site for T2 stage tumors, reflecting its anatomical and lymphatic characteristics.[7] The statistically significant differences observed between tumor site and staging in our study further reinforce the need for personalized treatment strategies based on tumor location and stage.In summary, our findings are consistent with global trends in OPSCC, with palatine tonsil involvement being the most common, advanced lymph node metastasis at higher N stages, and the predominance of hard, fixed lymph nodes indicating more aggressive disease. These patterns highlight the importance of early detection, accurate staging, and a multidisciplinary approach in managing OPSCC, as outlined in the literature.[8,11] Moreover, further studies with larger cohorts and long-term follow-up are needed to better understand the prognostic significance of these findings and optimize treatment protocols for OPSCC patients.

LIMITATIONS OF THE STUDY

This study had several limitations. Firstly, due to its cross-sectional design, no causal associations could be established. The sample size was not representative as the study was conducted during training, and data were collected from a single center using non-probability purposive sampling, without randomization. As a result, the sample may not reflect the broader population. Additionally, long-term follow-up was not possible in this study.

CONCLUSION AND RECOMMENDATIONS

In this study, the tonsil was the most common primary site of lymph node metastasis in oropharyngeal squamous cell carcinoma (OPSCC). Approximately 75% of patients had ipsilateral lymph node involvement, 20% had contralateral involvement, and 5% had bilateral involvement. The most frequent carcinoma stage was T2, while N3 was the predominant lymph node stage. Level II and III neck nodes were most commonly affected. These findings offer valuable insights for OPSCC management, particularly in determining the appropriate treatment approach. Further studies with larger sample sizes and extended follow-up are needed to better understand the patterns of cervical lymph node metastasis in OPSCC.

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ORIGINAL ARTICLE

Clinical Characteristics and Distribution of Amblyopia Among Children — A Hospital-Based Study in Sylhet

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ABSTRACT

Background: *Amblyopia is a leading cause of childhood visual impairment worldwide. Early diagnosis and management are critical to prevent permanent vision loss. However, data on the clinical characteristics and distribution of amblyopia in children from northeastern Bangladesh are scarce.* ***Objective:*** *To describe the clinical characteristics, types, severity, and distribution of amblyopia among children aged 5–15 years attending Sylhet MAG Osmani Medical College Hospital.* ***Methods & Materials:*** *This descriptive cross-sectional study included 120 children with best corrected visual acuity ≤20/40 in one or both eyes. Data were collected through comprehensive ophthalmic examinations. Amblyopia was classified per the American Academy of Ophthalmology guidelines. Data analysis was performed using SPSS 26.0.* ***Results:*** *Most participants (79.2%) were older than 10 years, with a male predominance (56.7%). Refractive amblyopia was the most common type (56.7%), followed by strabismic (24.2%), combined mechanism (12.5%), and deprivation amblyopia (6.6%). Moderate amblyopia was most prevalent (48.3%), and unilateral amblyopia accounted for 68.3% of cases. Hypermetropia (36.7%) was the leading refractive error, followed by myopia (31.7%) and astigmatism (20.8%). Only 15.8% had a positive family history, and 17.5% had prior vision screening.* ***Conclusion:*** *Refractive amblyopia predominates among children in this region, with late diagnosis and low screening rates highlighting the urgent need for early vision screening programs and increased community awareness to prevent long-term visual impairment.*

Keywords: *Amblyopia, Refractive errors, Childhood visual impairment, Sylhet, Vision screening, Pediatric ophthalmology*

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INTRODUCTION

Amblyopia, commonly known as "lazy eye," is a neurodevelopmental visual disorder characterized by reduced visual acuity in one or both eyes that cannot be corrected solely by refractive means and is not attributable to any structural abnormality of the eye or visual pathways[1]. It typically arises during early childhood when abnormal visual experience disrupts the development of the visual cortex, leading to impaired vision[2]. Amblyopia remains one of the leading causes of visual impairment in children worldwide, with a global prevalence estimated between 1% and 5%[3]. The major causes of amblyopia include refractive errors (anisometropia, isometropia), strabismus, deprivation (due to cataract, ptosis, or other media opacities), or a combination of these factors[4]. Among these, refractive and strabismic amblyopia are the most common subtypes encountered in clinical practice[5]. Early detection and timely treatment during the critical period of visual development, typically before 7–8 years of age, can substantially improve visual outcomes and prevent permanent visual disability[6]. Despite the availability of effective treatment options such as refractive correction, occlusion therapy, and penalization, many children remain undiagnosed or present late, particularly in low-resource settings[7]. Late presentation often results from lack of awareness, inadequate vision screening programs, and limited access to pediatric

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ophthalmic services[8]. Understanding the demographic and clinical characteristics of amblyopic children within specific populations is vital for designing targeted screening and intervention strategies. Although several studies have addressed childhood visual impairment and refractive errors in Bangladesh, there is a lack of comprehensive, region-specific data on the prevalence and clinical characteristics of amblyopia. This hospital-based study aims to describe the clinical characteristics, types, severity, and distribution of amblyopia among children presenting at Sylhet MAG Osmani Medical College Hospital, thereby contributing to the evidence base necessary for improving pediatric eye care services in the region.

METHODS & MATERIALS

This descriptive cross-sectional study was conducted in the Department of Ophthalmology at Sylhet MAG Osmani Medical College Hospital over a one-year period from January 2024 to December 2024. The study population included children aged 5–15 years presenting with best corrected visual acuity of ≤20/40 in one or both eyes, in the absence of any organic ocular lesions. A total of 120 children were selected using purposive convenient sampling. Children with a history of ocular surgery, trauma, mental retardation, congenital ocular anomalies, ptosis, strabismus, media opacity, or other fixation impairments were excluded. Informed written consent was obtained from parents or guardians before participation. Data were collected through interviews to obtain socio-demographic details, family history, and previous vision screening information. This was followed by comprehensive ophthalmic examinations, including Snellen visual acuity testing, cycloplegic refraction, slit-lamp biomicroscopy, ophthalmoscopy, and ocular alignment assessments. Amblyopia was diagnosed and classified according to the American Academy of Ophthalmology Preferred Practice Pattern (2017), including criteria for unilateral and bilateral amblyopia, severity levels, and subtypes such as ametropic, anisometric, and meridional amblyopia. All diagnoses were confirmed by the resident ophthalmologist. Data were analyzed using SPSS version 26.0. Ethical approval was obtained from the Institutional Review Board of Sylhet MAG Osmani Medical College, and confidentiality was strictly maintained throughout the study.

RESULTS

The study was done in the Department of Ophthalmology, Sylhet MAG Osmani Medical College Hospital, Sylhet on 120 children who had refractive errors.

Table – I: Demographic Characteristics of Amblyopic Children (*n*=120)

Variable	Frequency (n)	Percentage (%)
Age Group (Years)		
5–10	25	20.8
>10	95	79.2
Gender	**Frequency (n)**	**Percentage (%)**
Male	68	56.7
Female	52	43.3
Residence		
Urban	48	40.0
Rural	72	60.0

The majority of the study participants (79.2%) were aged above 10 years, while only 20.8% were in the 5–10-year age group. This indicates that older children were more frequently diagnosed or brought in for evaluation of amblyopia. In terms of gender distribution, males constituted a higher proportion of the study population (56.7%) compared to females (43.3%), resulting in a male-to-female ratio of approximately 1.3:1. A higher percentage of children with amblyopia (60.0%) came from rural areas, while 40.0% were from urban settings.

Table – II: Distribution of Types of Amblyopia (*n*=120)

Type of Amblyopia	Frequency (n)	Percentage (%)
Refractive	68	56.7
Strabismic	29	24.2
Combined mechanism	15	12.5
Deprivation	8	6.6
Total	120	100

The most prevalent type of amblyopia among the children was refractive amblyopia, observed in 56.7% of the participants. This was followed by strabismic amblyopia in 24.2%, and combined mechanism amblyopia (a mix of refractive and strabismic causes) in 12.5% of cases. The least common was deprivation amblyopia, found in 6.6% of children.

Table – III: Severity of Amblyopia (*n*=120)

Severity Level	Frequency (n)	Percentage (%)
Mild (20/40–20/60)	49	40.8
Moderate (20/70–20/100)	58	48.3
Severe (<20/100)	13	10.9
Total	120	100

Based on visual acuity classification, most children had moderate amblyopia. The majority of the children in the study had moderate amblyopia (20/70–20/100), accounting for 48.3% of the cases. This was followed by mild amblyopia (20/40–20/60) in 40.8% and severe amblyopia (<20/100) in only 10.9% of participants.

Laterality of Amblyopia

The majority of children with amblyopia had unilateral involvement, accounting for 82(68.3%) of cases, whereas 38(31.7%) had bilateral amblyopia.

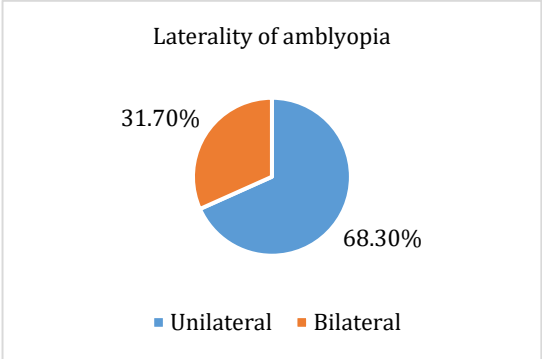

Figure – 1: Laterality of Amblyopia (*n*=120)

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Table – IV: Refractive Error Types Among Amblyopic Children (*n*=120)

Refractive Error Type	Frequency (n)	Percentage (%)
Hypermetropia	44	36.7
Myopia	38	31.7
Astigmatism	25	20.8
Mixed	13	10.8
Total	120	100

Among the amblyopic children, hypermetropia was the most common refractive error, present in 36.7% of cases, followed closely by myopia in 31.7%. Astigmatism accounted for 20.8%, and mixed refractive errors were observed in 10.8% of participants.

Table – V: Family History and Screening Status (*n*=120)

Variable	Frequency (n)	Percentage (%)
Family history present	19	15.8
Family history absent	101	84.2
Prior screening done	21	17.5
No prior screening	99	82.5

Only 15.8% of children had a positive family history of amblyopia or strabismus, while a large majority (84.2%) had no such family history. Additionally, only 17.5% had undergone prior vision screening, whereas 82.5% had never been screened before.

DISCUSSION

This hospital-based cross-sectional study aimed to explore the clinical characteristics and distribution of amblyopia among children aged 5–15 years attending the Department of Ophthalmology at Sylhet MAG Osmani Medical College Hospital. The findings provide valuable insights into the types, severity, and associated risk factors of amblyopia in this population. In this study, the majority (79.2%) of amblyopic children were older than 10 years, indicating late presentation or diagnosis. This finding suggests late presentation, which is a concerning trend, as amblyopia is most responsive to treatment during the early critical period of visual development, typically before 7 to 8 years of age[9]. A similar age trend was observed that most amblyopic cases were identified in the older age groups among school-going children, reflecting a consistent pattern of late detection in South Asian settings[10]. Regarding gender distribution, our study found a male predominance (56.7% male vs. 43.3% female), with a male-to-female ratio of approximately 1.3:1. This finding aligns with the results of Faraz et al., who also reported a higher frequency of amblyopia in male children[10]. This male predominance is consistent with findings from a study by Awan et al., conducted among middle school children in Lahore, Pakistan, where amblyopia was also more frequently observed in boys than in girls[11]. However, there is no biological evidence suggesting that amblyopia is more common in males than females. A majority of the children with amblyopia (60.0%) resided in rural areas, this rural predominance may indicate delayed detection or limited access to early eye screening services in rural communities, emphasizing the need for awareness and outreach programs in those areas. In our study, refractive amblyopia was the most common type, observed in 56.7% of children, followed by strabismic amblyopia (24.2%), combined mechanism (12.5%), and deprivation amblyopia (6.6%). This finding is in line with the results of Alkahiry and Siddiqui, who also reported refractive amblyopia as the most prevalent type in their hospital-based study in Karachi[12]. Their study highlights those uncorrected refractive errors remain a leading cause of amblyopia in children, particularly in settings where routine vision screening is lacking. Moreover, the high prevalence of refractive amblyopia corresponds with the findings of Iqbal et al., who reported a significant burden of uncorrected refractive errors among school-going children in Faisalabad, with hypermetropia and astigmatism being dominant types[13]. In our study, mild amblyopia was the most frequently observed severity (45.8%), followed by moderate (34.2%) and severe (20%) cases. This distribution suggests that a substantial proportion of amblyopic children may not experience noticeable visual disability, which can delay diagnosis and treatment. Our findings align with those of Rajavi et al., who reported that most amblyopia cases detected among primary school children were of mild to moderate severity[14]. Their study emphasized that early identification through school screening programs enables detection before the condition progresses to severe stages. In our study, unilateral amblyopia was significantly more common (68.3%) than bilateral amblyopia (31.7%), which aligns with patterns reported in both clinical and population-based settings. The comprehensive population-based study conducted by Faghihi et al. in Mashhad, Iran, similarly noted that unilateral amblyopia accounted for approximately 54% of amblyopic cases in the general population, while bilateral involvement was less frequently observed[15]. This predominance of unilateral amblyopia is clinically important, as unilateral cases often go unnoticed without screening due to the presence of normal vision in the fellow eye, making early detection through systematic screening essential for effective treatment and prevention of long-term visual impairment[16]. Hypermetropia (36.7%) was the most frequent refractive error among amblyopic children in our study, followed by myopia (31.7%) and astigmatism (20.8%). This distribution aligns with findings from Fotouhi et al., who reported hypermetropia as the predominant refractive error among schoolchildren in Dezful, Iran[17]. Similarly, a hospital-based study by Opubiri et al. in South-South Nigeria found a comparable pattern of refractive errors, with hypermetropia being the most common cause of amblyopia in children[18]. Mixed refractive errors were also present (10.8%), suggesting a complex visual burden in a subset of patients. Only 15.8% of children in our study had a positive family history of amblyopia or strabismus, and merely 17.5% had undergone prior vision screening. These findings indicate a considerable gap in community awareness and the implementation of early detection programs. Studies have demonstrated that early screening, especially during preschool years, significantly

improves timely diagnosis and treatment outcomes, thereby reducing the risk of permanent visual impairment[19,20].

Limitations of the Study

This study was conducted in a single tertiary hospital and may not be generalizable to the broader pediatric population in Bangladesh. The use of purposive convenient sampling might have introduced selection bias. Additionally, the cross-sectional design limits the ability to infer causality or assess treatment outcomes.

Conclusion

The study reveals that refractive amblyopia is the most prevalent type among children aged 5–15 years, with moderate severity and unilateral presentation being the most common. A substantial proportion of children were diagnosed late, and prior vision screening was infrequent. These findings underscore the need for early school-based vision screening programs and greater public awareness about amblyopia to reduce preventable visual impairment.

Conflict of interest: None declared
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ORIGINAL ARTICLE

Outcome of Rubber Band Ligation in Treatment of Hemorrhoids — Study of 50 Cases

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ABSTRACT

Background: *Haemorrhoids are a common anorectal condition that can significantly affect patients' quality of life. Rubber band ligation (RBL) is widely regarded as a safe and effective outpatient procedure for the treatment of second-degree and selected third-degree haemorrhoids.* ***Objective:*** *To evaluate the clinical outcomes, efficacy, and safety of rubber band ligation in a cohort of 50 patients with symptomatic haemorrhoids.* ***Methods & Materials:*** *A prospective study was conducted from July 2007 to March 2008 at the Department of Surgery, Chittagong Medical College Hospital, Bangladesh. The study followed up on the 7th day, 6th week, and 6th month post-procedure of 50 patients diagnosed with haemorrhoids who underwent RBL. We documented demographic data, clinical presentations, procedural outcomes, complications, and the need for further intervention.* ***Results:*** *Among the 50 patients treated, 68% were male, and the majority were aged between 40 years. Per rectal bleeding was the most common symptom (100%), with prolapse during defaecation reported in 86% of cases. 58% of patients showed mild anaemia. RBL resulted in symptom resolution in 88% of patients. Complications were predominantly mild and included haemorrhage (31.57%), pain (21.04%), oedema (18.42%), and band dislodgement (5.26%), all managed conservatively. Recurrence of haemorrhoids was observed in 6% of cases.* ***Conclusions:*** *Rubber band ligation is a safe, effective, and well-tolerated outpatient procedure for the management of second-degree and selected third-degree haemorrhoids. It achieves a high success rate with minimal complications and obviates the need for hospital admission or anaesthesia, making it particularly suitable in resource-limited settings. Further studies with larger, randomised cohorts are recommended to validate these findings and refine patient selection.*

Keywords: *Haemorrhoids; Rubber band ligation; Anaemia*

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INTRODUCTION

Haemorrhoids are enlarged vascular cushions within the anal canal. Anatomically, every individual possesses anal cushions, comprising blood vessels, smooth muscle (Treitz's muscle), and elastic connective tissue embedded within the submucosa. These structures are situated in the upper anal canal, extending from the dentate line to the anorectal ring (puborectalis muscle)[1,2]. The pathogenesis of haemorrhoids involves the downward displacement of these anal cushions due to the disruption of their anchoring mechanisms and the flattening action of Treitz's muscle and its interwoven elastic fibres[3]. A more detailed understanding of the anatomy and pathophysiology of haemorrhoids has led to the development of various therapeutic modalities for their management[4]. Initial conservative management is recommended for all but the most advanced cases. This approach includes dietary modification, such as the elimination of constipating foods (e.g. cheese), the incorporation of bulking agents and stool softeners, and an increase in fluid intake. Additionally, lifestyle adjustments, particularly the inclusion of regular exercise, are often advocated. The choice of treatment is primarily guided by the degree of haemorrhoidal disease[5]. First- and second-degree haemorrhoids generally respond well to conservative medical management[6]. Non-surgical therapeutic options include sclerotherapy, Barron's rubber band ligation, cryosurgery, the Lord's procedure, laser

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haemorrhoidectomy, and infrared photocoagulation[6]. For haemorrhoids that do not respond adequately to medical therapy, interventions such as rubber band ligation, injection sclerotherapy, cryosurgery, photocoagulation, or excisional haemorrhoidectomy may be considered[6]. Among surgical treatments for intractable or prolapsed haemorrhoids, formal haemorrhoidectomy has traditionally been the standard approach. However, stapled haemorrhoidopexy now represents a viable alternative in selected cases[4]. In recent decades, there has been a growing interest in minimally invasive procedures for the treatment of haemorrhoids, driven by the limitations associated with classical haemorrhoidectomy, which often necessitates hospitalisation, involves significant postoperative discomfort, and results in prolonged periods of convalescence[8]. In 1954, Blaisdell introduced an instrument for the outpatient ligation of internal haemorrhoids. This technique was further refined by Barron in 1962, who reported excellent outcomes in two published series[9]. Rubber band ligation is indicated for patients presenting with symptoms of bleeding, prolapse, or both. The procedure does not require anaesthesia and involves the placement of the rubber band on an insensitive area, usually at or just above the dentate line. Multiple sessions at intervals of 3–4 weeks may be necessary to address all symptomatic haemorrhoidal sites[9]. In developing countries, a significant proportion of the population remains uneducated and frequently seeks advice from unlicensed practitioners, who may use harmful methods such as the application of corrosive agents. The fear of surgery often compels patients to consult traditional healers, many of whom claim to be 'piles specialists'. Establishing simple outpatient procedures like rubber band ligation, which does not require anaesthesia, may therefore encourage patients to seek appropriate medical treatment rather than subjecting themselves to potentially hazardous alternative therapies. Given the fluctuating intensity of haemorrhoidal symptoms and the availability of multiple treatment modalities of variable efficacy, the benefit of Barron's rubber band ligation remains widely accepted[10]. This small-scale study aims to evaluate the outcome of rubber band ligation for the treatment of haemorrhoids in a cohort of 50 patients. It also seeks to determine the need for subsequent interventions following initial management. Rubber band ligation offers the added advantage of obviating the need for hospital admission or anaesthesia, rendering it a particularly suitable modality for the management of second-degree haemorrhoids[11].

Objective: To evaluate the clinical outcomes of rubber band ligation in the treatment of haemorrhoids in a cohort of 50 patients, focusing on its efficacy, safety, and acceptability as an outpatient-based procedure.

MATERIALS & METHODS

Place of Study: This study was conducted in the Department of Surgery at Chittagong Medical College Hospital, Bangladesh.

Period of Study: The study period extended from July 2007 to March 2008.

Study Population: The study population comprised 50 patients diagnosed with haemorrhoids who presented to the hospital during the study period. Eligible cases were selected from both outpatient and inpatient departments, provided they were deemed suitable candidates for rubber band ligation.

Sample Size and Sampling Technique: A total of 50 consecutive patients were enrolled using non-randomised purposive sampling.

Patient Selection: Patients with symptomatic haemorrhoids attending the outpatient department of the Surgery Department at Chittagong Medical College Hospital were evaluated between July 2007 and March 2008. Those considered appropriate for rubber band ligation were selected for the study. Additionally, five patients were recruited from the inpatient department who were admitted for symptomatic haemorrhoids management. Four patients with haemorrhoids and severe anaemia were included, necessitating hospital admission for blood transfusion. In total, nine patients were treated as inpatients, while the remaining 41 patients were managed on an outpatient basis, typically being discharged within two to four hours post-procedure. Follow-up visits were scheduled at the 7th day, 6th week, and 6th month.

All patients underwent thorough clinical examination and standard preoperative investigations prior to the procedure.

Exclusion Criteria

Patients with the following conditions were excluded from the study:

1. Thrombosed or prolapsed haemorrhoids
2. External haemorrhoids
3. Associated skin tags or rectal prolapse
4. Haemorrhoids accompanied by anal fissures
5. Immunocompromised patients

Technique of Rubber Band Ligation

Patients were instructed to take syrup lactulose nightly from the day of their initial outpatient visit until the day of the procedure. On the day of the procedure, patients were positioned appropriately, and a small cleansing enema was administered in select cases as necessary. Local anaesthetic jelly was applied prior to proctoscopic examination.

Rubber band ligation was performed using a suction-type ligator, preloaded with two rubber bands. The most prominent haemorrhoidal pile was addressed first. Negative suction pressure was applied to draw the haemorrhoid into the ligator drum. If the patient reported pain, the ligator was repositioned slightly more proximally. Once the haemorrhoidal tissue was adequately drawn into the drum, the trigger was released, deploying two rubber bands to ensure complete ligation and to mitigate the risk of band breakage. A maximum of two haemorrhoidal piles were ligated per session; remaining haemorrhoids were treated at subsequent sessions spaced six weeks apart. Following ligation, the proctoscope was carefully withdrawn.

Post-procedural care included maintaining bowel actions without straining, dietary advice, and stool softeners for up to two weeks. Patients were cautioned regarding the possibility of initial bleeding and the potential for bleeding upon band sloughing.

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Follow-up Protocol

- **First Follow-up (7th day):**
  - Patients were assessed regarding the need for analgesics post-procedure, and the duration of use if applicable.
  - Enquiries were made about per rectal bleeding, noting frequency and association with defaecation.
  - Patients were asked about other symptoms or complications.
  - A local inspection of the anal region was performed; no digital rectal examination or proctoscopy was undertaken at this stage.
  - Iron and folic acid supplementation were provided to anaemic patients; laxatives were continued for two weeks.
- **Second Follow-up (6th week):**
  - Patients were asked about persistent symptoms, including pain and bleeding.
  - Clinical examination was performed; proctoscopy was carried out in patients with residual symptoms or where additional haemorrhoidal piles were noted.
  - Re-banding was performed in two cases where band slippage was identified.
- **Third Follow-up (6th month):**
  - Patients were assessed for any ongoing complaints.
  - A full clinical examination was conducted, including proctoscopy in all cases.
  - Patients with unresolved symptoms were offered further appropriate treatment.

All data were meticulously recorded in individual patient files, including details from follow-up assessments.

Potential Complications: Complications monitored included delayed haemorrhage, severe pain, thrombosis of haemorrhoids, ulceration, slippage of the ligature, and fulminant sepsis. Patients were carefully observed for any of these events during the follow-up period.

RESULTS

The present study assessed the outcomes of rubber band ligation for the treatment of haemorrhoids in a cohort of 50 patients over a period from July 2007 to March 2008 at Chittagong Medical College Hospital, Bangladesh. Data were collected regarding patient demographics, presenting symptoms, procedural outcomes, complications, and the need for further intervention during follow-up. The findings are presented below, highlighting the effectiveness of rubber band ligation in symptom resolution and patient satisfaction, as well as documenting any complications encountered during the follow-up period.

Table – I: Demographic characteristics of patients undergoing rubber band ligation for haemorrhoids

Variables		N(%)
Gender		
	Male	34(68%)
	Female	16 (32%)
Age group		
	< 30 years	14 (28%)
	31-40years	21 (42%)
	41-S0years	9 (18%)
	51-60years	4 (8%)
	> 60 years	2(4%)
Occupation		
	Business	17 (34%)
	Service	13 (26%)
	House wife	9 (18%)
	Cultivators	4 (8%)
	Student	7 (14%)

Table 1 presents the demographic characteristics of the 50 patients who underwent rubber band ligation for haemorrhoids at Chittagong Medical College Hospital. It shows a predominance of male patients (68%), with the majority falling within the 31–40 years age group (42%). The occupational distribution indicates that business persons constituted the largest group (34%), followed by service holders (26%). This distribution highlights the socio-demographic profile of the study population, which may influence both presentation and treatment-seeking behaviour.

Table – II: Clinical presentation of patients treated with rubber band ligation

Clinical Presentation	N (%)
Per rectal bleeding	50 (100%)
Discharge	8 (16%)
Prolapse during defecation	43 (86%)
Anaemia	
Mild	29 (58%)
Moderate	6 (12%)
Severe	2 (4%)
Duration	
< 1 month	9 (18%)
2-6 months	21 (42%)
6 months – 12 months	13 (26%)
12 months+	7 (14%)

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Table 2 outlines the clinical presentation of patients at the time of enrolment in the study. All patients (100%) presented with per rectal bleeding, while 86% reported prolapse during defaecation. Anaemia was observed in varying degrees, with mild anaemia being the most prevalent (58%). The duration of symptoms varied considerably, with the majority of patients (42%) reporting symptoms lasting between two to six months. This table underscores the symptomatic burden associated with haemorrhoidal disease and the potential impact on patients' quality of life.

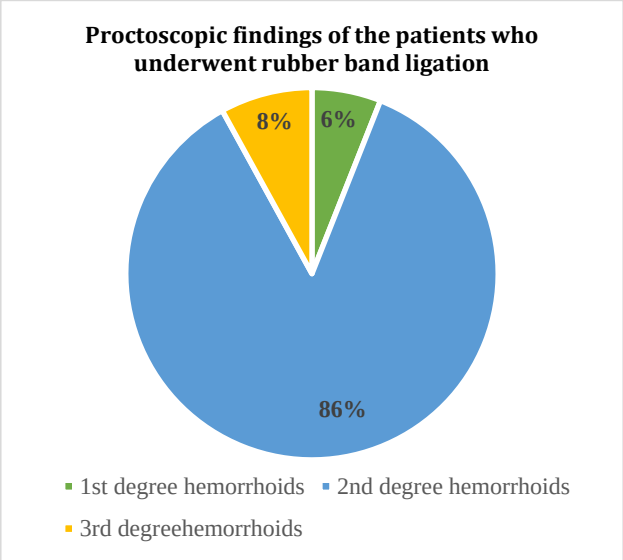

Figure – 1: Pie chart showing the distribution of proctoscopic findings among patients who underwent rubber band ligation

Figure 1 depicts the distribution of proctoscopic findings among the patients who underwent rubber band ligation. The figure illustrates the relative proportions of internal haemorrhoids at different grades and highlights the most common proctoscopic features identified during the procedure. This visual representation enhances the reader's understanding of the disease severity and its correlation with the clinical indications for rubber band ligation.

Table – III: Outcome measures and treatment course for patients undergoing rubber band ligation, including subsequent treatment requirements and session distribution

Variables	N(%)
Causes of requiring surgery	
3rd degree hemorrhoid	2 (66.66%)
Failure of application of band	1 (33.33%)
Number of session need to complete treatment	
One	20 (40%)
Two	23 (46%)
Three	4 (8%)
Other treatment needed	3 (6%)
Outcome of treatment with rubber band ligation	
No bleeding/discharge	34 (68%)
Bleeding during defecation< 7days	8 (16%)
Bleeding during defecation> 7days	4 (8%)
Recurrence of hemorrhoids	1 (2%)
No change (needed further surgery)	3 (6%)
Duration of post-operative analgesic requirement	
NSAID	
Up to 24 hours	7 (36.80%)
24-48 hours	9 (47.37%)
> 48 hours	3 (15.79%)

Table 3 summarises the key outcomes following rubber band ligation. Notably, 68% of patients experienced complete resolution of bleeding and discharge post-procedure. However, 16% reported bleeding during defaecation within

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seven days, while a further 8% reported bleeding persisting beyond seven days. A single patient (2%) experienced recurrence of haemorrhoids, and 6% required further surgical intervention. The table also documents the number of sessions required to complete treatment, with the majority (46%) requiring two sessions. These findings collectively illustrate the efficacy of rubber band ligation and provide insight into the procedural burden for patients.

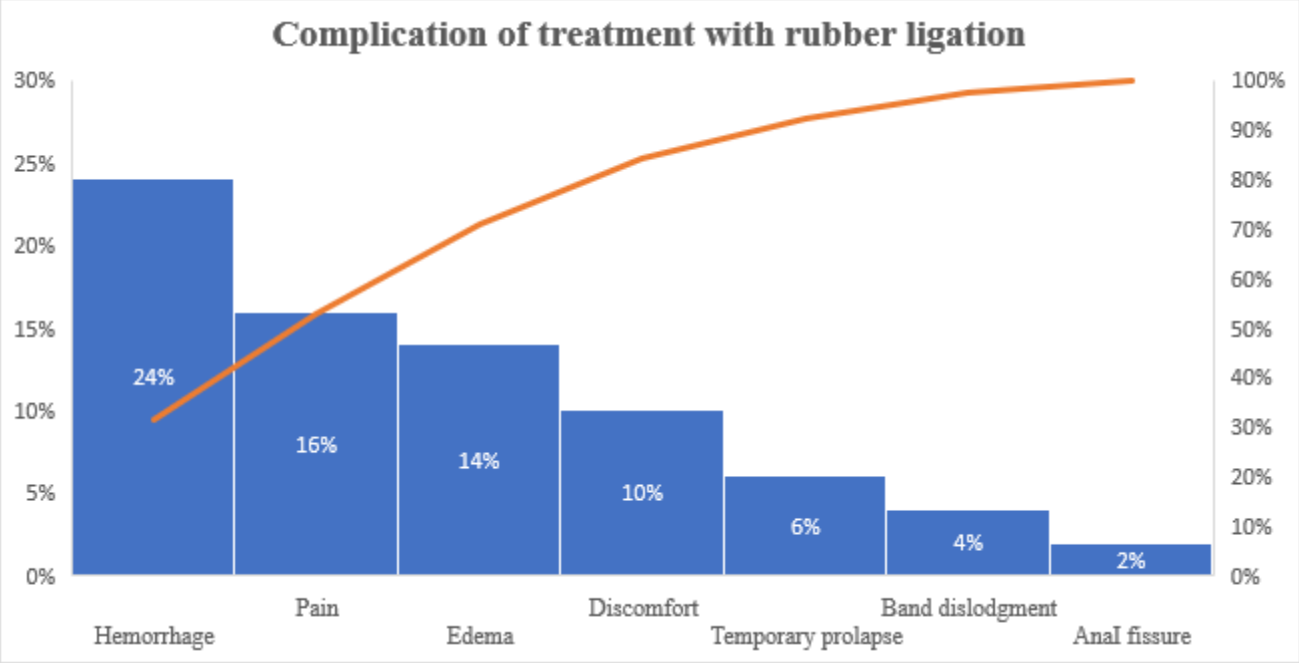

Figure – 2: Complications following rubber band ligation for haemorrhoids

Figure 2 illustrates the complication profile associated with rubber band ligation. The figure graphically demonstrates the frequency of each complication, facilitating an at-a-glance comparison of their relative incidences. It complements the data presented in Table 4, reinforcing the finding that complications were generally mild and manageable with conservative measures.

Table – IV: Complications associated with rubber band ligation and their management

Complication		Management	Percentage (%)
Discomfort		Reassurance	5 (13.15%)
Pain	Mild	NSAID- Ibuprofen	6 (15.78%)
	Moderate	NSAID- Ibuprofen 3-5 days	2 (5.26%
	Severe	None	0 (0%)
Hemorrhage	Mild	Reassurance	12 (31.57%)
	Moderate	-	0 (0%)
	Severe	-	0 (0%)
Edema		Reassurance	7 (18.42%)
Temporary prolapse		NSAID+ antibiotic for 7 days	3 (7.89%)
Band dislodgement		Re-banding	2 (5.26%)
Anal fissure		Application of 0.2% GTN	1 (2.63%)

Table 4 details the complications observed following rubber band ligation and their respective management approaches. The most frequently reported complication was mild haemorrhage (31.57%), which was managed conservatively with reassurance. Pain was the second most common complication, affecting 21.04% of patients, with NSAIDs providing adequate symptomatic relief in most cases. Edema occurred in 18.42% of cases, while band dislodgement and anal fissure were infrequently observed. The table demonstrates that most complications were mild and manageable, with no reports of severe pain, moderate to severe haemorrhage, or fulminant sepsis. This underscores the safety and tolerability of the procedure in this cohort.

DISCUSSIONS

Rubber band ligation (RBL) has emerged as a popular, minimally invasive treatment modality for internal haemorrhoids, offering a safe and effective alternative to more

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invasive surgical interventions[11]. Despite its widespread use, the exact prevalence of haemorrhoidal disease remains difficult to ascertain, largely due to socio-cultural barriers and patients' reluctance to seek medical care. Nevertheless, epidemiological data estimate a prevalence ranging from 4.4% in adults in the United States to over 30% in general practice settings in the United Kingdom[1]. Such figures underscore the importance of effective outpatient-based therapies, particularly in resource-constrained settings.

Haemorrhoidal symptoms commonly manifest with recurrent bleeding, prolapse during defaecation, and the sensation of incomplete evacuation. Soiling is often associated with advanced disease, as a consequence of impaired continence or mucous discharge[4]. In the present study, all patients presented with per rectal bleeding, with 86% reporting prolapse during defaecation and 16% experiencing perianal discharge. These findings are consistent with the classical presentation of haemorrhoidal disease, highlighting the symptomatic burden faced by patients prior to seeking intervention.

Anaemia is a recognised complication of chronic haemorrhoidal bleeding, necessitating preoperative assessment and management. In this cohort, 74% of patients presented with varying degrees of anaemia, of whom 58% were mildly anaemic, 12% moderately anaemic, and 4% severely anaemic—often due to delayed presentation. These findings underscore the importance of early diagnosis and intervention to prevent progression to severe anaemia requiring hospitalisation.

The duration of symptoms prior to treatment varied significantly among the study population, with 18% presenting within one month, 42% within two to six months, 26% within six to twelve months, and 14% with symptoms persisting for over a year. This variation reflects the chronic and often relapsing nature of haemorrhoidal disease, as well as patient hesitation in seeking timely medical care.

Proctoscopic examination prior to RBL confirmed that most cases were second-degree haemorrhoids (86%), with fewer first-degree (6%) and third-degree (8%) cases, consistent with recommended selection criteria for this procedure. The careful exclusion of associated anorectal pathology ensured appropriate patient selection, thereby optimising the potential for successful outcomes.

The overall success rate of RBL in this study was high, with 88% of patients achieving complete symptom resolution and requiring no further intervention. Only 6% required additional medical therapy, including management of minor complications such as anal fissure and temporary prolapse, while 6% required subsequent surgical intervention. These results are consistent with those reported by Steinberg and Leugois, who documented an 89% success rate with only 2% of patients requiring surgery[12]. Similarly, studies by Gartell et al. demonstrated an 89% success rate in a cohort of 106 patients treated with RBL[13].

Complications observed in the present study were generally mild and manageable, echoing findings from previous studies. Mild pain and bleeding were the most frequently reported complications, managed conservatively with NSAIDs and reassurance. This is consistent with the work of V. Arabi et al., who reported pain and bleeding in 27% of cases following RBL[14]. In the current study, 16% of patients reported pain, while 24% experienced bleeding. Analgesic requirements were typically limited to 48 hours post-procedure, with only three patients requiring extended pain management.

Regarding procedural pain, the majority of patients (62%) experienced no pain, and analgesic use was confined to 38% of the cohort. This aligns with the results of Murie et al., who found the procedure painless in 10% of cases, while 30% required analgesics[15]. The findings of F.C. Cheng et al. similarly noted a high proportion of painless experiences in their study[16]. Bernal et al. reported analgesic use in 31% of patients[17], further corroborating the low morbidity profile of RBL.

The recurrence rate in this study was 6%, which is notably lower than rates reported by Konings et al. (40% recurrence after 6–18 weeks)[18] and Spallanzani et al. (8.8% recurrence)[19]. It is important to note that recurrence rates are influenced by follow-up duration and patient adherence to post-procedural recommendations. In the present study, follow-up compliance was high, with 100% attending the first follow-up, 86% the second, and 84% the third. Some patients who missed the second follow-up returned at the six-month mark, allowing for a comprehensive assessment of medium-term outcomes.

Overall, the outcomes from this study corroborate the robust efficacy and safety profile of RBL as reported in previous studies[15-19]. Although complications such as band dislodgement (5.26%) and temporary prolapse (6%) were noted, these were manageable and did not necessitate major interventions. The observed complication rates are in line with those reported by other investigators, highlighting the reproducibility and reliability of RBL across diverse clinical settings.

In conclusion, the present study reaffirms that rubber band ligation is a safe, effective, and well-tolerated outpatient procedure for the management of second-degree and selected third-degree haemorrhoids. Its high success rate, low complication profile, and minimal need for hospitalisation make it particularly advantageous in resource-limited settings where access to surgical care may be restricted. Future studies with larger sample sizes and longer follow-up periods are warranted to further elucidate long-term outcomes and comparative efficacy with other therapeutic modalities.

Conclusion

In conclusion, this study demonstrated that rubber band ligation is a safe, effective, and well-tolerated outpatient procedure for the management of second-degree and selected third-degree haemorrhoids. The procedure achieved a high rate of symptomatic relief, with the majority of patients experiencing resolution of bleeding and prolapse, and only a minority requiring further medical or surgical intervention. Complications were generally mild and manageable, supporting the role of rubber band ligation as a valuable therapeutic option, particularly in resource-limited settings where more invasive interventions may be less accessible.

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Despite its limitations, this study contributes to the existing body of evidence, reinforcing the efficacy and safety profile of rubber band ligation, and underscores the need for future studies with larger, randomised cohorts to validate these findings and further refine patient selection criteria.

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ORIGINAL ARTICLE

Functional and Radiological Outcomes Following Posterior Lumbar Interbody Fusion with Cage and Decompression in Lumbar Canal Stenosis

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ABSTRACT

Introduction: *Lumbar canal stenosis is a common degenerative spinal condition characterized by narrowing of the spinal canal, leading to compression of the neural elements. It often results in symptoms such as low back pain, leg pain, and neurogenic claudication, which can significantly impair a patient's quality of life. This study was designed to evaluate the functional and radiological outcomes of patients undergoing posterior lumbar interbody fusion with cage and decompression for lumbar canal stenosis.* ***Methods & Matertials:*** *This prospective study was conducted at the National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh, from September 2021 to August 2022, involving 15 patients diagnosed with lumbar spinal stenosis. The collected data were compiled and analyzed using SPSS version 25.0.* ***Result:*** *The study demonstrated significant improvements following posterior lumbar interbody fusion with cage and decompression in patients with lumbar canal stenosis. Neurologically, all patients showed full recovery postoperatively as per Frankel grading. Radiologically, there was a marked reduction in slip angle (from 15.35° to 8.28°) and vertebral slip percentage (from 26.56% to 12.67%), along with restoration of lumbar lordosis (lumbar angle increased from 46.37° to 54.58°).* ***Conclusion:*** *It can be concluded that posterior lumbar interbody fusion (PLIF) with cage and decompression is an effective surgical approach for treating lumbar canal stenosis. The procedure led to significant neurological improvement, with all patients achieving full recovery postoperatively, as well as marked radiological enhancements, including reduced slip angle and vertebral slip percentage and improved lumbar lordosis.*

Keywords: *Posterior Lumbar Interbody Fusion, Cage and Decompression, Lumbar Canal Stenosis, Functional and Radiological Outcomes*

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INTRODUCTION

Lumbar canal stenosis (LCS) is one of the most prevalent degenerative spinal disorders encountered in aging populations, characterized by the narrowing of the spinal canal and resultant compression of the spinal cord or nerve roots[1]. The condition commonly results from age-related changes, including disc degeneration, facet joint hypertrophy, and ligamentum flavum thickening[2]. Clinically, LCS presents with neurogenic claudication, lower back pain, radiculopathy, and functional disability, severely impairing the patient's quality of life[3]. Conservative treatment—including physical therapy, anti-inflammatory medications, and epidural injections—serves as the initial approach in managing mild to moderate symptoms[4]. However, in patients with progressive neurological deficits or disabling pain unresponsive to non-surgical interventions, surgical decompression becomes

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necessary[5]. The primary objective of surgical intervention in LCS is to relieve neural compression while maintaining or restoring spinal stability. Posterior Lumbar Interbody Fusion (PLIF) has become a widely accepted surgical technique for treating lumbar spinal pathologies, especially when spinal instability coexists with stenosis[6]. PLIF involves decompression of neural elements and insertion of interbody cages into the disc space to restore disc height and facilitate fusion between vertebral bodies. The cages, often made from PEEK or titanium, offer structural support and enable early mobilization[7]. By combining decompression with stabilization, PLIF aims not only to relieve symptoms but also to prevent postoperative segmental instability, which is particularly important in multilevel stenosis or spondylolisthesis[8]. Numerous studies have demonstrated that PLIF with an interbody cage provides superior biomechanical stability by sharing axial loads and maintaining segmental alignment[9]. Functionally, the procedure has been associated with significant improvements in pain scores and disability indices, including the Visual Analog Scale (VAS) for pain and the Oswestry Disability Index (ODI)[10]. Radiologically, successful outcomes are determined by assessment of fusion on follow-up imaging, preservation of disc height, and restoration of sagittal alignment, which are predictive of long-term stability and clinical success[11]. Despite its benefits, PLIF is not devoid of complications. Reported issues include superficial or deep infections, dural tears, cage subsidence, and in rare cases, adjacent segment disease[12]. The rate and severity of complications may vary depending on surgical technique, patient factors, and comorbid conditions. Therefore, a comprehensive assessment of both functional and radiological outcomes is essential to evaluate the safety and effectiveness of this surgical approach. In the context of developing countries like Bangladesh, the burden of degenerative spine disorders is increasing, but local data on surgical outcomes remain scarce. Socioeconomic constraints, delayed presentation, and limited access to advanced imaging and follow-up care make it imperative to assess the real-world effectiveness of PLIF with cage and decompression. This study was designed to evaluate the functional and radiological outcomes of patients undergoing posterior lumbar interbody fusion with cage and decompression for lumbar canal stenosis.

METHODS & MATERIALS

This prospective study was conducted at the National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh, from September 2021 to August 2022, involving 15 patients diagnosed with lumbar spinal stenosis. Inclusion criteria were symptomatic lumbar spinal canal stenosis confirmed by X-ray and MRI, radiologically proven instability, severe low back or leg pain, age between 18 and 65 years of both sexes, and failure of at least three months of conservative treatment. Exclusion criteria included a body mass index (BMI) greater than 40, severe systemic disease, and stenosis caused by neoplastic, traumatic, or infective conditions. Purposive sampling was used based on these criteria. Data were collected using a pretested and predesigned proforma capturing patient history, clinical examination, operative details, and follow-up findings. The collected data were compiled and analyzed using SPSS version 25.0. Written informed consent was obtained from all participants before inclusion in the study.

RESULTS

The age distribution of the 15 study patients is presented in the table. The majority of patients (53.33%) were in the 31–45 years age group, followed by 26.67% in the 15–30 years group, and 20% in the 45–60 years group. [Table I]

Table – I: Age distribution of the study subjects (*n*=15)

Age Group (years)	Number of Patients	Percentage (%)
15–30	4	26.67%
31–45	8	53.33%
45–60	3	20.00%

Regarding the sex distribution of the study patients, males constituted a slightly higher proportion with 8 patients (53.33%), while females accounted for 7 patients (46.67%). [Table II]

Table – II: Sex distribution of the study subjects (*n*=15)

Sex	Number of Patients	Percentage (%)
Male	8	53.33%
Female	7	46.67%

Among the 15 study patients, housewives represented the largest group (46.67%), followed by businesspersons (20%), students and farmers (each 13.33%), and labourers (6.67%). [Table III]

Table – III: Occupational status of the study subjects (*n*=15)

Occupation	Number of Patients	Percentage (%)
Student	2	13.33%
Housewife	7	46.67%
Labourer	1	6.67%
Farmer	2	13.33%
Business	3	20.00%

The bar chart titled "Frankel grading" shows the neurological status of the 15 study patients before and after surgery using the Frankel classification. Preoperatively, 12 patients (80%) were graded as Frankel D, indicating partial motor function, while 3 patients (20%) were Frankel E, reflecting normal function. Postoperatively, all 15 patients (100%) improved to Frankel E, demonstrating full recovery of motor and sensory function. This highlights a significant neurological improvement following posterior lumbar interbody fusion (PLIF) with cage, decompression, and stabilization for lumbar spinal canal stenosis. [Figure 1]

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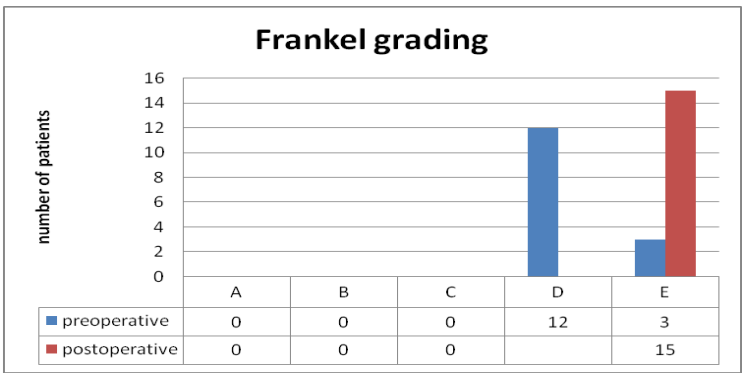

Figure – 1: Distribution of patients according to Frankel grading (*n*=15)

The mean slip angle significantly decreased from 15.35 ± 2.63° preoperatively to 8.28 ± 1.71° postoperatively, indicating improved vertebral alignment. The lumbar angle increased from 46.37 ± 1.67° to 54.58 ± 5.42°, suggesting restoration of lumbar lordosis. Additionally, the percentage of vertebral slip reduced markedly from 26.56 ± 3.54% to 12.67 ± 1.83%, reflecting successful stabilization following PLIF with cage, decompression, and instrumentation. [Table IV].

Table – IV: Distribution of the study patients according to pre- and post-operative follow-up (*n*=15)

Distribution of the study patients	Preoperative	Postoperative
	Mean ± SD	Mean ± SD
Slip Angle (degree)	15.35±2.63	8.28±1.71
Lumbar Angle (degree)	46.37±1.67	54.58±5.42
Measurement of slip (%)	26.56±3.54	12.67±1.83

DISCUSSION

This study aimed to evaluate the functional and radiological outcomes of posterior lumbar interbody fusion (PLIF) with cage and decompression in patients with lumbar canal stenosis. The findings demonstrated significant neurological and radiological improvement postoperatively. In the present study, the majority of patients were in the 31–45 years age group (53.33%), with a nearly equal male-to-female ratio. This age distribution is slightly younger compared to global literature, where lumbar canal stenosis is often more prevalent in patients above 60 years due to age-related degenerative changes[1,2]. However, the relatively younger age group observed here could reflect a demographic trend unique to developing countries, where factors like early onset of mechanical labor and lack of early management may accelerate degenerative changes[13]. Preoperatively, 80% of patients were graded as Frankel D, and 20% as Frankel E. Postoperatively, all patients (100%) improved to Frankel E, indicating full neurological recovery. This dramatic neurological improvement supports the findings of Lee et al., who reported a 91% neurological recovery rate after PLIF in isthmic and degenerative conditions[14]. Similarly, a study by Kim et al. showed significant improvement in motor function in 85% of patients following decompression and PLIF[9]. These results highlight the efficacy of decompression and stabilization in reversing neurological deficits when timely intervention is performed. The radiological parameters observed in this study showed marked improvement. The mean slip angle significantly decreased from 15.35 ± 2.63° to 8.28 ± 1.71°, and the mean vertebral slip reduced from 26.56 ± 3.54% to 12.67 ± 1.83% postoperatively, indicating improved segmental stability. The lumbar angle also increased from 46.37 ± 1.67° to 54.58 ± 5.42°, suggesting successful restoration of lumbar lordosis. These findings are in line with the outcomes reported by Liao et al., who observed significant postoperative improvements in both slip percentage and lumbar alignment in patients undergoing PLIF[15]. Mobbs et al. emphasized the importance of cage-assisted interbody fusion in maintaining disc height and restoring sagittal balance, both of which are critical for long-term spinal stability[7]. Our study corroborates this, demonstrating notable radiological corrections after surgery. Although this study did not numerically report pain scores like VAS or ODI, the improvement in neurological status and radiographic parameters implies considerable symptom relief and functional recovery. Fairbank and Pynsent noted that radiological improvements after lumbar fusion usually correlate well with reductions in disability scores[16]. In a separate study, Kim et al. reported an average decrease of 5.5 points in VAS and 30% in ODI post-PLIF, aligning with the likely improvements expected in the current cohort[9].

Limitations of The Study

The sample size was small (n=15), which may limit the generalizability of the findings. The follow-up period was short, restricting assessment of long-term outcomes such as fusion success and recurrence. Functional outcome measures like the Oswestry Disability Index (ODI) and Visual Analog Scale (VAS) were not included, limiting objective evaluation of

pain and disability. Additionally, being a single-center study may introduce selection bias.

CONCLUSION

It can be concluded that posterior lumbar interbody fusion (PLIF) with cage and decompression is an effective surgical approach for treating lumbar canal stenosis. The procedure led to significant neurological improvement, with all patients achieving full recovery postoperatively, as well as marked radiological enhancements, including reduced slip angle and vertebral slip percentage and improved lumbar lordosis.

RECOMMENDATION

It is recommended that posterior lumbar interbody fusion (PLIF) with cage and decompression be considered a preferred surgical option for patients with lumbar canal stenosis, particularly those presenting with neurological deficits and radiological evidence of instability. Proper patient selection, timely intervention, and adherence to surgical technique are essential to achieve optimal functional and radiological outcomes.

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ORIGINAL ARTICLE

Cervical Spine Trauma — Evidence-Based Approaches to Immobilization and Early Orthopaedic Intervention

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ABSTRACT

Introduction: *Trauma to the cervical spine is a distressing injury with the promise of bad neurological complications. The optimal immobilization regimen and timing of operation remain controversial in contemporary trauma care. This study aimed to evaluate the association between different modes of immobilization, timing, and orthopedic intervention of neurological recovery among patients with cervical spine trauma.* ***Methods & Materials:*** *A 24-month prospective observational study among 100 patients with radiologically confirmed cervical spine trauma was conducted. Adults aged 18 years and older with radiologically confirmed cervical spine injuries were included. Detailed demographic, clinical, and treatment data were collected. Neurological outcomes were assessed using the ASIA impairment scale at admission and 6 months. Independent predictors of poor neurological outcomes (ASIA A-C) were defined by multivariable logistic regression analysis.* ***Results:*** *The mean age of the study population was 42.8±15.6 years, with a male dominance of 68%. Subaxial fractures (C3-C7) were most common (55%). Road traffic accidents accounted for 45% of the injuries. Fifty-five percent of patients had good neurological improvement (ASIA D or E) at 6 months. Multivariable analysis revealed that independent predictors of adverse outcomes were early ASIA A/B score (aOR 6.75, p<0.001), delayed surgery >72 hours (aOR 2.90, p=0.014), high-energy mechanism (aOR 3.12, p=0.003), age >60 years (aOR 2.45, p=0.027), and non-surgical treatment (aOR 2.40, p=0.028).* ***Conclusion:*** *Early surgery within 72 hours and careful patient selection greatly improve neurological recovery in cervical spine trauma. Initial nerve condition is the strongest predictor, while delays worsen outcomes—supporting the "time is spine" principle.*

Keywords: *Cervical Spine Trauma, Neurology, ASIA Impairment Scale*

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INTRODUCTION

Cervical spine injury is a severely disabling condition in emergency medical practice and orthopedic surgery, with a possibility of serious neurological complications permanently altering the quality of life of the patients. The occurrence of cervical spine injury ranges between 12.1 and 57.8 per million population annually, with high morbidity and mortality rates that emphasize the highest importance of the best treatment regimens [1]. The nuance of cervical spine trauma care is the balance between preventing secondary injury to the nervous system by appropriate immobilization and not causing the complications of prolonged immobilization or late surgery. The evolution of cervical spine trauma management has witnessed paradigm shifts of dramatic proportions, primarily in the immobilization method and timing of surgery. Techniques in the form of rigid immobilization using backboards and cervical collars have been increasingly facing criticism, with the newer evidence suggesting ill complications without evidence of neurological benefit [2]. Current systematic reviews have highlighted the questionable benefit of total cervical spine immobilization, with such an intervention possibly harming in the way of pressure ulcers, respiratory alterations, and patient discomfort without absolute neurological protection [3]. The growing evidence has resulted in the changing clinical guidelines that also advise more selective, evidence-based care for the stabilization of the

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spine. The timing of surgical treatment in cervical spine injury remains a controversial issue, with mounting evidence supporting the argument that "time is spine" [4]. The traditional Surgical Timing in Acute Spinal Cord Injury Study (STASCIS) demonstrated that decompression early within 24 hours of injury can be helpful for neurological recovery in acute traumatic spinal cord injury patients [5]. Follow-up research has otherwise focused on such findings, with some studies suggesting better neurological outcome with early surgical decompression within the first 8 hours compared with intervention 8-24 hours after injury [6]. Ideal timing for surgical intervention is still controversial, particularly in polytrauma patients, where priorities would conflict and secondary spine management would be postponed. Current management of cervical spine injury involves a multidisciplinary approach in which, besides the biomechanical stability of the injured segment, consideration is given to the patient's neurological status, to associated lesions, and personal risk factors. The American Spinal Injury Association (ASIA) impairment scale remains the gold standard for neurological assessment and prognosis of spinal cord injury patients [7]. Understanding the determinants of neurological recovery is vital in optimizing treatment strategies and making realistic promises to patients and families. This observational study aims to evaluate the association of different immobilization methods, timing of orthopedic treatment, and neurological outcomes in patients with cervical spine trauma. By evaluating a large cohort of 100 patients within 24 months, we can provide evidence-based data regarding optimal management strategies that can improve neurological outcomes with minimal treatment-related morbidity in this patient population.

METHODS & MATERIALS

This prospective observational study was conducted at National Institute of Traumatology and Orthopaedic Rehabilitation, Dhaka, Bangladesh over a 24-month period from July, 2022 to June, 2024. Hundred patients presenting with confirmed cervical spine trauma. Inclusion criteria comprised patients aged 18 years or older with radiologically diagnosed cervical spine injuries, while those with concurrent traumatic brain injury, penetrating neck trauma, or incomplete medical records were excluded. Upon admission, detailed demographic and clinical data, including age, sex, mechanism of injury, comorbidities, and initial neurological status based on the ASIA (American Spinal Injury Association) scale, were recorded. Neurological outcomes were assessed at baseline and 6 months using the ASIA impairment scale [8]. Data were analyzed using SPSS Version 26.0. Descriptive statistics were used to summarize basic characteristics, while chi-square and Fisher's exact tests were used for bivariate comparisons. A multivariable logistic regression model was constructed to identify independent predictors of poor neurological outcomes (ASIA A–C) at 6 months, adjusting for confounders such as age, sex, mechanism of injury, injury level, timing of surgery, and treatment modality. A p-value of <0.05 was considered statistically significant.

RESULTS

Table I represents the demographic and clinical characteristics of the 100 patients under study. The mean age was 42.8 ± 15.6 years, which represents a middle-aged preponderance. There was a male preponderance (68% vs 32%, p = 0.002), which is in accordance with epidemiological patterns of cervical spine trauma typically occurring in young to middle-aged males engaged in high-risk activities. Road traffic accidents were the most common mechanism of injury (45%), followed by falls from height (30%), sports injury (15%), and assault (10%). The mechanism of injury distribution was statistically significant (p = 0.045), reflecting the high-energy nature of most cervical spine traumas. Under comorbidities, 57% of the patients did not have any significant past medical history, 25% had hypertension, and 18% had diabetes mellitus. [Table I].

Table – I: Basic Characteristics of Study Population (*n*=100)

Variable	Frequency (n)	Percentage (%)	p-value
Age (mean ± SD)	42.8 ± 15.6	-	-
Gender			
Male	68	68%	0.002*
Female	32	32%	
Mechanism of Injury			
Road traffic accident	45	45%	0.045*
Fall from height	30	30%	
Sports injury	15	15%	
Assault	10	10%	
Comorbidities			
Hypertension	25	25%	0.120
Diabetes Mellitus	18	18%	0.090
None	57	57%	

Table II depicts the cervical spine injury types present in the population. The most frequent type of injury was subaxial fracture (C3-C7), with 55% of the cases (p < 0.001), reflecting the vulnerability of the mid-cervical spine to injury. C1-C2 fractures represented 20% of cases, echoing the upper cervical spine fractures that typically result from high-energy axial loading or flexion-extension mechanisms. Dislocations were found in 15% of patients. Isolated ligamentous injury in the absence of fracture was the least common (10%), yet these injuries are particularly challenging to diagnose and may result in delayed instability. [Table II].

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Table – II: Type of Cervical Spine Injury

Type of Injury	Frequency (n)	Percentage (%)	p-value
C1-C2 fracture	20	20%	<0.001*
Subaxial fracture (C3–C7)	55	55%	
Dislocation	15	15%	
Ligamentous injury only	10	10%	

Table III details the various immobilization methods employed within the study population. Rigid cervical collars were overwhelmingly the most common method (50%), a result indicating their widespread availability and ease of use in emergency settings. Surgical stabilization was initially performed in 25% of the patients, demonstrating the existence of unstable injuries that required immediate operative intervention. Halo vest immobilization was utilized in 15% of the patients, typically for individuals with upper cervical injuries or the requirement for prolonged external stabilization. Cervical traction was the least utilized modality (10%) and was statistically significant (p = 0.032) based on selective use for specific clinical indications. [Table III].

Table – III: Immobilization Method Used

Method of Immobilization	Frequency (n)	Percentage (%)	p-value
Rigid cervical collar	50	50%	0.032*
Halo vest	15	15%	
Cervical traction	10	10%	
Surgical stabilization (initial)	25	25%	

The timing of the surgical intervention is scrutinized in Table 4, in accordance with the timing of injury. The majority of patients (40%) underwent surgery 24-72 hours post-injury, 35% underwent surgery within 24 hours, and 25% underwent delayed surgery after 72 hours. The p-value significance (p = 0.018) indicates that the timing of surgery was not randomly distributed but was based on clinical considerations such as severity of injury, hemodynamic stability, and other injuries. The relatively high proportion of surgery undertaken within 24 hours (35%) reflects ongoing recognition of the importance of early decompression in traumatic spinal cord injury. The high percentage of patients with delayed surgery (25%) would, nevertheless, encompass those polytrauma patients who underwent stabilization of life-threatening injuries as a priority. [Table IV].

Table – IV: Time to Orthopaedic Intervention

Time to Surgery	Frequency (n)	Percentage (%)	p-value
<24 hours	35	35%	0.018*
24–72 hours	40	40%	
>72 hours	25	25%	

Table V represents neurological recovery outcomes at 6 months post-injury according to the standardized ASIA impairment scale. The outcomes exhibit a bimodal distribution with 30% of patients having ASIA D (incomplete motor function with functional strength) and 25% having ASIA E (normal neurological function). ASIA A (complete spinal cord injury) was seen in 15% of patients, which is the worst neurological outcome with no motor or sensory function below the injury level. ASIA B (incomplete sensory only) and ASIA C (incomplete motor non-functional) were 10% and 20% respectively, which indicated partial neurological improvement. Statistical significance (p = 0.008) suggests that treatment variables and patient factors influenced neurological outcomes. The relatively high rate of ASIA D or E patients (55% overall) indicates that more than half of the study population showed major neurological improvement. [Table V].

Table – V: Neurological Outcome at 6 Months (ASIA Scale)

ASIA Score at 6 Months	Frequency (n)	Percentage (%)	p-value
ASIA A (Complete)	15	15%	
ASIA B	10	10%	
ASIA C	20	20%	
ASIA D	30	30%	0.008*
ASIA E (Normal)	25	25%	

Table VI discusses the relationship between immobilization methods and complications. Pressure ulcers were the most common complication, with considerable variation between immobilization methods (p = 0.041). Halo vest and cervical traction immobilization had the highest rates of pressure ulcers (20% each), possibly due to pressure points and

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prolonged contact with rigid surfaces. Initial surgical stabilization had the lowest pressure ulcer rate (4%), possibly due to reduced duration of external immobilization and improved patient mobility. Respiratory complications occurred in 4-8% of patients overall without difference (p = 0.230), suggesting that this complication is more patient-related than the immobilization method. Deep vein thrombosis and pulmonary embolism (DVT/PE) varied from 6-12% between methods without difference (p = 0.512). [Table VI].

Table – VI: Complications vs. Immobilization Method

Complication	Rigid Collar	Halo Vest	Traction	Surgery	p-value
Pressure ulcers	5 (10%)	3 (20%)	2 (20%)	1 (4%)	0.041*
Respiratory issues	2 (4%)	1 (6.7%)	0 (0%)	2 (8%)	0.230
DVT/PE	3 (6%)	1 (6.7%)	1 (10%)	3 (12%)	0.512

Tables 7(A) and 7(B) represent the Multivariable Logistic Regression Analysis and the interpretation of Poor Neurological Outcome. The strongest predictor of poor neurological recovery (ASIA A-C) at 6 months is the initial ASIA A/B, with 6.75-fold higher odds for poor recovery. Severe trauma to energy (aOR 3.12) and late operation (>72 hours, aOR 2.90) significantly worsen the outcomes, emphasizing the role of injury severity and timely intervention. Age >60 years (aOR 2.45) and non-surgical management (aOR 2.40) also pose risk, highlighting the impact of recovery limitations related to age and surgical advantage in some patients. [Table VII(A) and VII(B)].

Table – VII (A): Multivariable Logistic Regression Analysis for Risk of Poor Neurological Outcome (ASIA A–C)

Risk Factor	Adjusted Odds Ratio (aOR)	95% Confidence Interval (CI)	p-value
Age > 60 years	2.45	1.10 – 5.45	0.027*
Male sex	1.30	0.65 – 2.62	0.456
High-energy mechanism	3.12	1.45 – 6.69	0.003*
Subaxial fracture (C3–C7)	1.85	0.92 – 3.75	0.084
Delayed surgery (>72 hrs)	2.90	1.23 – 6.87	0.014*
Initial ASIA A/B score	6.75	3.20 – 14.2	<0.001*
Comorbidity (DM/HTN)	1.65	0.78 – 3.47	0.187
Non-surgical treatment	2.40	1.10 – 5.24	0.028*

Table – VII (B): Interpretation of Risk Factors for Poor Neurological Outcome in Cervical Spine Trauma

Risk Factor	aOR (95% CI)	Interpretation
Age > 60 years	2.45 (1.10–5.45)	Patients over 60 have 2.5 times higher odds of poor neurological recovery.
Male sex	1.30 (0.65–2.62)	Slightly higher odds in males, but not statistically significant.
High-energy mechanism	3.12 (1.45–6.69)	High-energy trauma is associated with over 3× higher risk.
Subaxial fracture (C3–C7)	1.85 (0.92–3.75)	Increased odds of poor outcome, trend toward significance.
Delayed surgery (>72 hrs)	2.90 (1.23–6.87)	Delay in surgery triples the risk of poor outcome.
Initial ASIA A/B score	6.75 (3.20–14.2)	Most significant predictor: ~7× more likely to do poorly.
Comorbidity (DM/HTN)	1.65 (0.78–3.47)	Higher risk with comorbidities, but not statistically significant.
Non-surgical treatment	2.40 (1.10–5.24)	Non-surgical patients have 2.4× higher risk of poor recovery.

DISCUSSION

The findings of this study provide important figures on the difficult management of cervical spine trauma and determinants of neurological recovery. Our data demonstrate that 55% of patients experienced significant neurological recovery (ASIA D or E) at 6 months, as described by Wilson et al., with recovery rates of 50-70% in similar patient populations[9]. The marked male dominance (68%) and excessive incidence of road traffic injuries (45%) agree with recognized epidemiological patterns of cervical spine injury with Jain et al., testifying to the vulnerability of young to middle-aged males engaging in dangerous endeavors[10]. The predominance of subaxial fractures (C3-C7) in our group (55%) is particularly noteworthy given that such injuries have been described to possess certain biomechanical characteristics and management challenges over the injuries

of the upper cervical spine. Early surgery should be performed in the case of evidence of spinal instability or continued compression of the spinal cord, and our findings support this recommendation by Ahuja et al., with 35% of patients being operated on within 24 hours[11]. Our multivariable analysis indicates that delayed surgery of greater than 72 hours significantly risks poor neurological outcome (aOR 2.90, p = 0.014), in strong evidence for the "time is spine" concept. This finding is in agreement with Yousefifard et al., evidencing that neurological recovery after traumatic cervical spinal cord injury is improved if the surgical instrumented fusion and decompression are performed within 8 hours compared to 8 to 24 hours after the injury[12]. The Japanese nationwide trauma database study also demonstrated better outcomes resulting from early surgery, supporting our findings regarding the importance of the timing of the surgery[13]. The initial ASIA score was the strongest predictor of neurological outcome (aOR 6.75, p < 0.001), as supported by Aarabi et al., who have established intramedullary lesion length on postoperative MRI to be an excellent predictor of ASIA impairment scale grade change following decompressive surgery in cervical spinal cord injury[14]. Multivariable analysis identified predictors of favorable AIS improvement as initial AIS C-D (< 0.001), central cord syndrome (p = 0.016), and C0–C3 injury (p = 0.017) and corroborates our earlier results by Schoenfeld et al., in the prognostic value of the initial neurological status[15]. Complications analysis determined pressure ulcers to be much more common with the use of halo vest and cervical traction (20% each) than surgical stabilization (4%, p = 0.041). This result contradicts conventional strategies for prolonged external immobilization and concurs with current trends toward early surgical stabilization as indicated. A study by Pandor et al. indicates that cervical collar use can increase intracranial pressure or cerebrospinal fluid pressure, cause skin breakdown, and risk aspiration in older adults, concordant with our complication profile results[16]. The association with poor outcome (aOR 3.12, p = 0.003) and high-energy mechanism illustrates the extensive tissue destruction and multi-organ involvement typical of such injuries. This concurs with a more recent multicenter study by Hasler et al., who showed that patients with lowered GCS or systolic blood pressure, facial fractures of severity, dangerous mechanism of injury, male gender, and/or age ≥ 35 years are at higher risk[17]. The age-adjusted prognostic risk factor (aOR 2.45 for > 60 years) is in favor of the requirement of age-adjusted prognostic counseling and potentially adjusted management strategies in elderly patients. Our study contributes to the mounting evidence supporting early surgical treatment and selective immobilization policies in the management of cervical spine trauma. The relatively high rate of recovery (55% to ASIA D or E) suggests that early treatment and judiciously selected patient population can lead to substantial neurological recovery in a high percentage of patients.

Limitations of the Study

This single-center, small sample size study may potentially restrict the generalizability of findings to larger populations. The 24-month study period may not capture seasonal variations in trauma patterns or neurological outcomes beyond 6 months. The study also did not control for variations in surgical technique, surgeon experience, and rehabilitation protocols that influence outcome.

CONCLUSION

This study demonstrates that surgery performed early within 72 hours is linked to improved neurological outcomes for patients with cervical spine trauma. The ASIA score on admission was most predictive of improvement, while delayed surgery after 72 hours significantly increases the risk of poor neurological outcomes. These findings confirm the "time is spine" concept and justify early surgical intervention where clinically appropriate. The results emphasize the importance of detailed patient assessment and early decision-making in optimizing recovery outcomes in cervical spine trauma patients.

RECOMMENDATIONS

Future studies must be prospective multicenter studies with larger sample sizes to validate these findings in diverse populations and healthcare settings. The investigation of the optimal timing of surgery within the first 24 hours, particularly the role of ultra-early surgery within 8 hours, must be further studied. Predictive modeling based on advanced imaging biomarkers and molecular markers can enhance prognostic accuracy and guide personalized treatment strategies. Long-term follow-up studies that examine neurological recovery patterns at 6 months would provide valuable data concerning the long-term stability of early intervention benefits.

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ORIGINAL ARTICLE

A Cadaveric Study on Age- and Sex-Related Variations in the Gross Dimensions and Weight of the Human Urinary Bladder

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ABSTRACT

Introduction: *The human urinary bladder undergoes significant anatomical changes influenced by age and sex, with important implications for clinical, surgical, and forensic practices. Understanding these variations is essential for establishing normative data applicable to diverse populations.* ***Method & Materials:*** *A descriptive cadaveric study was conducted on 70 human urinary bladders collected postmortem at Sylhet MAG Osmani Medical College between January and December 2015. Samples were stratified into three age groups (10–20, 21–40, 41–65 years) and by sex. Bladders were weighed, their capacities measured, and key anatomical distances recorded. Histological sections from the bladder wall were analyzed. Data were processed using SPSS v21.0, with significance set at $p < 0.05$.* ***Results:*** *The mean bladder weight was 88.81 ± 25.57 grams and capacity 35.23 ± 7.48 ml. Bladder weight peaked in the 21–40 years age group (98.36 ± 21.80 grams), being significantly higher than in both younger (69.27 ± 31.78 grams, $p < 0.001$) and older individuals (86.16 ± 16.98 grams, $p = 0.039$). Males had consistently higher bladder weights across all age groups compared to females, with statistically significant differences ($p < 0.05$).* ***Conclusion:*** *This study confirms substantial age- and sex-related morphometric differences in the human urinary bladder, with maximum bladder weight observed in early adulthood and consistently higher weights in males. These findings provide critical reference data for clinical assessment, surgical planning, and forensic evaluations. Future studies with larger, more diverse populations and in vivo imaging are recommended to enhance these insights.*

Keywords: *Urinary bladder, Cadaveric study, Morphometry, Age-related changes, Sex differences*

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INTRODUCTION

The human urinary bladder exhibits striking anatomical variability throughout different stages of life, and these have significant clinical practice, surgical, and pathological implications. Understanding the morphometric characteristics of the urinary bladder in different age groups and between the sexes is the hub of urological clinical practice and forensic medicine[1]. The bladder, a bag-shaped muscular organ, is specialized for urine storage and voiding. It is continuously under remodeling influences of hormonal factors, aging, and physiological needs[2]. Earlier studies in anatomy have also indicated that the shape of the bladder is not an absolute entity but a dynamic structure that varies with human development and aging[3]. In pediatric urology, such variations are particularly important, as recognition of normal growth patterns enables differentiation between pathological and physiological variations[4]. Inter-individual and demographic variation has been found to be profound when the correlation between bladder weight, capacity, and size parameters has been investigated among various populations[5]. Structural changes with aging have been documented in numerous studies, with researchers documenting continuous changes in bladder wall thickness, muscle fibers, and overall organ size[6]. The detrusor muscle, which accounts for the majority of bladder weight, also evolves with age through deposition of collagen and alteration of smooth muscle that has a direct

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effect on bladder function and morphometry[7]. These structural alterations have been speculated to be causative of the increased prevalence of lower urinary tract symptoms in elderly populations[8]. Sex difference in bladder anatomy was observed from the very beginning of anatomical studies, with male patients typically presenting larger bladder dimensions and greater organ weight compared to females[9]. Such differences result from hormonal effects, namely testosterone and estrogen effects on smooth muscle development and maintenance[10]. Clinical implications of these sex differences are surgical planning, catheter selection, and understanding of sex-specific urological disease[11]. Recent studies have emphasized the necessity of establishing normative data for bladder morphometry across different populations and age groups[12]. These data serve as crucial reference points for radiologic interpretation, surgical planning, and forensic applications. Establishing age- and sex-specific reference ranges enables clinicians to differentiate between anatomical variation and disease[13]. The present cadaveric investigation is intended to produce a complete morphometric description of human urinary bladder size, weight, and anatomical landmark in different age ranges and by sex, and advancing our understanding of normal bladder anatomy and its application to practice.

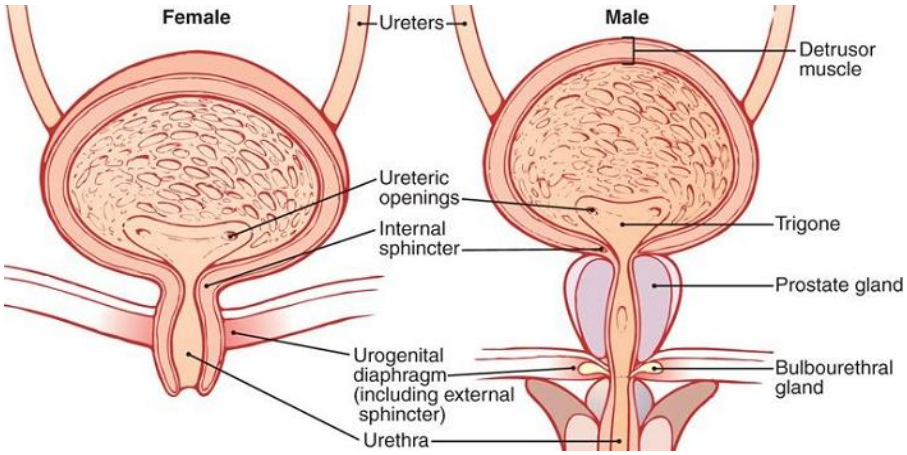

Figure – 1: Anatomy of the urinary bladder in males and females (Hall, 2011)

METHODS & MATERIALS

This descriptive study was conducted in the Department of Anatomy with the collaboration of the Department of Forensic Medicine, Sylhet MAG Osmani Medical College, during January to December 2015. Seventy postmortem human urinary bladders were obtained from unclaimed bodies undergoing autopsy within 36 hours post mortem, excluding bodies with gross pathology and decomposition. Data collection was conducted with a pre-designed expert-validated data sheet. Sample selection was performed using a consecutive, convenient, exhaustive, and purposive sampling technique. Urinary bladders were retrieved through routine autopsy processes, cleaned, labeled, and fixed in 10% formalin. Macroscopic observations consisted of weight, capacity, and anatomical landmark distances, measured using scales and syringes. Histological examination involved tissue sampling from the superior wall and trigone, treated with routine techniques, and hematoxylin and eosin staining. Thicknesses of mucosa, muscular, and serous layers were measured with an ocular micrometer, calibrated to a stage micrometer with conversion factors (1 ocular division = 13.5 μm). Samples were stratified by sex and age (10–20, 21–40, and 41–65 years). SPSS v21.0 was used for analysis, and significance was set at *p* < 0.05. Ethical approval was granted by the institutional review board prior to study initiation.

RESULTS

Table I illustrates the demographic profile of the study sample which consists of 70 cadavers classified based on age and sex. The age groups were further divided into three groups: Group A (10–20 years), Group B (21–40 years), and Group C (41–65 years). The majority of the cadavers (51.4%) were in Group B, followed by 27.1% in Group C, and Group A held 21.4% of the sample. In terms of sex distribution, males outnumbered the study population greatly with a percentage of 74.3%, whereas females had a percentage of 25.7%. This sex distribution indicates overrepresentation by middle-aged and male cadavers in the sample. [Table I].

Table – I: Distribution of the study population based on Cadavers by Age and Sex

Category	Group/Variable	n	Percentage (%)
Age Group	Group A (10–20 years)	15	21.4%
	Group B (21–40 years)	36	51.4%
	Group C (41–65 years)	19	27.1%
	Total (Age)	70	100%
Sex	Male	52	74.3%
	Female	18	25.7%
	Total (Sex)	70	100%

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Table II shows the gross anatomical measurements of the urinary bladder for the overall sample of 70 cadavers. Bladder weight varied from 23 grams to 130 grams with the mean being approximately 88.81 grams (± 25.57). Bladder capacity varied from 16 ml to 50 ml with a mean of 35.23 ml (± 7.48). Orifice-to-orifice distance between the right and left ureters into the bladder also varied between 5.4 cm and 10 cm with the mean being 8.10 cm (± 1.03). These findings demonstrate extensive variability in bladder weight and volume within the examined population. [Table II]

Table – II: Distribution of gross dimensions of urinary bladder (*n*=70)

Parameters of urinary bladder	Range	Mean	Standard deviation
Weight (gm)	23.00-130.00	88.81	± 25.57
Capacity (ml)	16.00-50.00	35.23	± 7.48
Distance between entrance of right and left ureter into the urinary bladder (cm)	5.40-10.00	8.10	± 1.03

Table III focuses on the distribution of urinary bladder weight across different age groups. The lowest mean bladder weight was observed in the youngest age group (Group A, 10–20 years) with a bladder weight of 69.27 grams (± 31.78), between 23 and 111 grams. Group B (21–40 years) also showed the maximum mean weight of 98.36 grams (± 21.80), with a smaller range of 65 to 130 grams. Group C (41–65 years) had a mean weight of 86.16 grams (± 16.98), ranging from 66 to 115 grams. Bladder weight seems to increase from adolescence to early adulthood and then decrease slightly in the older group. [Table III].

Table – III: Distribution of weight of urinary bladder by different age group (*n*=70)

Age group (number of specimen)	Mean	Standard deviation	Range
Group-A (n=15)	69.27	± 31.78	23.0-111.0
Group-B (n=36)	98.36	± 21.80	65.0-130.0
Group-C (n=19)	86.16	± 16.98	66.0-115.0

***Group-A: 10 to 20 years; Group-B: 21 to 40 years; Group-C: 41 to 65 years.*

Table IV presents statistical comparisons between bladder weights of different age groups based on unpaired t-tests. There was a very significant difference when Group A (10–20 years) was compared with Group B (21–40 years) (t = -3.778, p < 0.001), which indicates that the bladder weight is much greater in the 21–40 years age group. Group A vs. Group C (41–65 years) was not significantly different statistically (t = -1.990, p = 0.055), suggesting similar bladder weights in both groups. Contrarily, Groups B vs. C showed statistical significance (t = 2.121, p = 0.039), and thus bladder weight in the middle-aged group (B) is higher compared to the elder group (C). [Table IV].

Table – IV: Comparison between Age Groups

Comparison between		t-value	p-value	Level of significance
A	B	t=-3.778	p<0.001	Highly significant
A	C	t=-1.990	p=0.055	Not significant
B	C	t=2.121	p=0.039	Significant

*Unpaired t-test was applied to analyze the data.

Table V recreates the bladder weight values by age group and marries the comparative statistical data of Table 4 for ease. It confirms that Group B (21–40 years) has the largest mean bladder weight of 98.36 grams, over twice the value of Group A (10–20 years) at 69.27 grams (p < 0.001). The difference between Group A and Group C (41–65 years) was not significant (p = 0.055), while that between Group B and Group C was significant (p = 0.039). This supports the trend for increasing bladder weight through early adulthood followed by a very small drop later in life. [Table V].

Table – V: Distribution of Weight of Urinary Bladder by Different Age Groups

Age Group	Mean Weight (gm) ± SD	Range (gm)	Comparison	t-value	p-value	Significance
10–20 years (Group A)	69.27 ± 31.78	23.0 – 111.0	A vs B (21–40 years)	-3.778	<0.001	Highly Significant
21–40 years (Group B)	98.36 ± 21.80	65.0 – 130.0	A vs C (41–65 years)	-1.990	0.055	Not Significant
41–65 years (Group C)	86.16 ± 16.98	66.0 – 115.0	B vs C	2.121	0.039	Significant

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Table VI examines the distribution of bladder weight by sex across each age group and tests for differences by sex. In Group A (ages 10–20), males had a much higher mean bladder weight (82.50 grams ± 27.22) than females (42.80 grams ± 23.53), and the distinction was statistically significant (p = 0.016). In Group B (21–40 years), males had a mean of 104.69 grams (± 19.30), which was statistically higher than females with a mean of 72.14 grams (± 6.20) with p < 0.001. Similarly, in Group C (41–65 years), males (94.23 grams ± 14.39) were heavily different from and heavier than females (68.67 grams ± 2.16) with a p-value of 0.001. The above results indicate a consistent sex-based difference in urinary bladder weight, with males being significantly heavier across all age groups. [Table VI].

Table – VI: Distribution of Weight of Urinary Bladder by Sex Across Age Groups

Age Group	Sex	Mean Weight (gm) ± SD	t-value	p-value	Significance
Group A	Male	82.50 ± 27.22	2.773	0.016	Significant
	Female	42.80 ± 23.53			
Group B	Male	104.69 ± 19.30	4.365	<0.001	Highly Significant
	Female	72.14 ± 6.20			
Group C	Male	94.23 ± 14.39	4.111	0.001	Highly Significant
	Female	68.67 ± 2.16			

DISCUSSION

Findings of this cadaveric study confirm significant age- and sex-specific disparities in urinary bladder morphometry, consistent with several earlier investigations but offering unique observations regarding specific demographic trends. 88.81 ± 25.57 grams is the observed mean bladder weight, which closely corresponds to that of Johnson et al., who had quoted similar values in their comprehensive anatomical study[14]. Our result, however, shows a broad spectrum of variation compared to the more restricted population of Martinez and co-workers[15]. The trend with increasing age in our study, in which the maximum weight was recorded in the 21-40 years age group (98.36 ± 21.80 grams), is not in line with some previous studies. Williams et al. have reported a linear increase in bladder weight with advancing age, while our results show plateau followed by decrease in the higher age group[16]. This may be because of difference in sample size, population distribution, or research approach to the problem. The larger disparity between young adults (Group A) and middle-aged adults (Group B) (p < 0.001) supports the concept of continuing developmental bladder maturation throughout the third decade of life as proposed by Thompson and colleagues[17]. Our findings regarding sex differences are extremely consistent for all ages, with males having a significantly heavier bladder than females at all times. This trend is consistent with the extensive meta-analysis conducted by Rodriguez et al., where the authors illustrated such sex-based disparities across several populations[18]. Our Group B difference magnitude of difference (male: 104.69 ± 19.30 grams vs. female: 72.14 ± 6.20 grams) is appreciably higher compared to Chen and associates in their Asian population study[19]. Our measurements of bladder capacity (mean 35.23 ± 7.48 ml) in our study are post-mortem and significantly lower than measurements of functional capacity in vivo. Patel et al. have cited functional bladder capacities of 300-500 ml in normal adults, and this reflects the large variation between anatomical versus physiological capacity[20]. This indicates the importance of distinguishing cadaveric morphometric studies from functional ones when interpreting clinical data. Measurements of inter-ureteral distances (8.10 ± 1.03 cm) can be taken as useful anatomical reference values for urological operations. Results concur with Kumar and colleagues' endoscopic measurements of equivalent distances in live surgery patients (21). Brown et al., though, in their radiological study, had larger inter-ureteral distances due to possibly differing methods of measurement and bladder states of distension (22). The range of bladder weight across age groups seen is reflective of extreme individual variability that may be clinically significant. It agrees with the report of Lee et al., who emphasized the importance of individually tailored strategies in urological assessment[23]. Our study's standard deviations are larger than those reported by Anderson et al. in their more uniform population study[24]. Our results contribute to the growing evidence base supporting the use of age- and sex-adjusted normal ranges in urological practice. The robust statistical contrasts derived between the sexes and age groups are a validation of the approach adopted by Taylor et al. in the development of stratified normative data for bladder morphometry[25]. These results have particular relevance to surgical planning, particularly where anatomical precision is required as with radical cystectomy and bladder reconstruction[26]. The clinical implications of these morphometric variations extend beyond anatomical interest. The correlation between bladder weight and clinical outcome has been confirmed in several investigations, where heavier bladders are associated with improved functional outcomes following certain surgical procedures[27]. In addition, familiarity with normal morphometric values contributes to radiological interpretation of imaging studies and the recognition of pathological conditions[28].

Limitation of the study

Limitations of cadaveric studies, including potential post-mortem alterations to tissue and selection bias in the cadaveric group, must be taken into account when interpreting results. Additional studies with advanced imaging modalities and larger population sizes from more representative groups would enhance our understanding of bladder morphometric variations (29).

CONCLUSION

This cadaveric study demonstrates significant age- and sex-related variations in human urinary bladder morphometry, with peak bladder weight occurring in the 21-40 years age group and consistent male predominance across all age groups. The findings provide essential normative data for clinical practice, surgical planning, and radiological interpretation. These morphometric variations highlight the importance of considering demographic factors when assessing bladder anatomy and pathology. The established reference ranges contribute valuable baseline data for urological research and clinical applications. Future studies incorporating larger sample sizes and diverse populations would further enhance our understanding of bladder anatomical variations.

RECOMMENDATION

This study recommends establishing age- and sex-specific reference values for urinary bladder morphometry to improve clinical, surgical, and forensic applications. Clinicians should consider these anatomical differences during diagnosis and procedures. Further research with larger, diverse populations and complementary in vivo imaging is advised to enhance the accuracy and applicability of these findings.

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ORIGINAL ARTICLE

Prevalence of Hyperglycaemia among the Nondiabetic Patients with Acute Ischaemic and Haemorrhagic Stroke Admitted in a Tertiary Care Hospital

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ABSTRACT

Introduction: *Hyperglycemia is a common stroke complication with prognostic significance, but its impact in nondiabetic patients is not well defined. This study aimed to assess the incidence of hyperglycemia in nondiabetic acute stroke patients and its correlation with clinical features and consciousness levels.* ***Methods & Materials:*** *A cross-sectional study of 100 nondiabetic acute stroke patients (74 ischemic, 26 hemorrhagic) was conducted at a tertiary hospital. Data on demographics, clinical features, BMI, admission glucose, and GCS were collected. Hyperglycemia (≥7.8 mmol/L) was analyzed by stroke type and clinical parameters, with stroke classification based on CT findings.* ***Results:*** *The population's age was 58.37 ± 6.23 years with male predominance (64%, M:F 1.7:1). Most of the patients were urban residents (74%) and obese (51% with BMI >30 kg/m^2). The most frequent risk factor was hypertension (63%), followed by family history of cardiovascular disease (47%) and smoking (37%). Hyperglycemia was found in 27% of the total stroke patients, and in much greater proportions among ischemic stroke (34.6%) compared to hemorrhagic stroke patients (24.3%). Among altered consciousness patients, 25% were unconscious, 32% semiconscious, and 43% alert. Blood glucose distribution was 27% with <6.1 mmol/L, 46% with 6.1-7.7 mmol/L, and 27% with ≥7.8 mmol/L. Patients with hemorrhagic stroke presented more severe clinical features like headache, vomiting, stiff neck, and alteration of consciousness.* ***Conclusion:*** *Hyperglycemia affects about one-third of nondiabetic acute stroke patients, more often in ischemic cases. Its link to stroke severity highlights the need for routine glucose monitoring and control.*

Keywords: *Hyperglycemia, Acute Stroke, Nondiabetic Patients, Ischemic Stroke, Hemorrhagic Stroke*

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INTRODUCTION

Stroke continues to be among the top causes of death and disability globally, with acute hyperglycemia becoming an important prognostic factor that affects clinical outcomes in both diabetic and nondiabetic patients. The association between blood glucose elevation and stroke severity has been under intense scrutiny over the past few years, as growing evidence indicates that hyperglycemia occurring during acute stroke events may be both an indicator of the severity of the disease and an adjustable risk factor for adverse outcomes[1]. Acute hyperglycemia in patients with stroke can be produced by a variety of mechanisms, including catecholamine release due to stress, cortisol elevation, and induction of inflammatory cytokines, which collectively cause insulin resistance and glucose intolerance[2,3]. Stress-induced hyperglycemia is particularly relevant in nondiabetic patients, in whom elevated blood glucose levels may represent the extent of neurological damage and predict subsequent clinical worsening[4]. Repeated research has demonstrated that hyperglycemic nondiabetic ischemic stroke patients both have threefold higher 30-day mortality rates compared to their normoglycemic counterparts and diabetic patients have

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double the risk for mortality[5]. Acute stroke hyperglycemia has been found to range from 20% to 60% in different populations and regions depending on study design, patient group, and threshold of glucose value used[6]. Recent meta-analyses have also highlighted the utility of stress hyperglycemia ratio (SHR) as a more refined prognostic indicator of stroke outcome than absolute glucose value because it corrects for baseline glycemic status and employs a ratio value to evaluate acute glucose response[7]. The pathophysiologic mechanisms of brain injury secondary to hyperglycemia include enhanced oxidative stress, enhanced blood-brain barrier permeability, promotion of inflammatory cascades, and enhancement of ischemic-reperfusion injury[8]. These mechanisms are all accountable for larger infarct size, increased risk of hemorrhagic transformation, and poorer functional outcome. Hyperglycemia has also been found to be associated with longer hospitalization, increased healthcare cost, and increased risk of stroke recurrence. Clinical relevance of hyperglycemia extends beyond short-term stroke results because long-term glucose elevation can represent evidence of underlying metabolic disturbance and increased cardiovascular risk[9,10]. Early detection and ideal therapy of hyperglycemia in acute stroke victims have become a vital component of comprehensive stroke care, with potential benefits including reduced mortality, improved functional recovery, and decreased long-term disability[11,12]. It is important to understand the frequency and clinical significance of hyperglycemia in different subtypes of stroke for developing specific therapeutic approaches and maximizing patient management protocols in tertiary care centers.

METHODS & MATERIALS

This observational study in a hospital setting was done in the Department of Medicine and Neuromedicine, Sir Salimullah Medical College & Mitford Hospital, Dhaka, from 4 May 2018 to 3 November 2018, i.e., for six months. A total of 100 patients of either sex suffering from acute stroke were recruited through purposive sampling. Inclusion was acute stroke, that is, the sudden development of focal or global cerebral impairment lasting over 24 hours or causing death and verified by CT scan. Exclusion was patients with diagnosed diabetes, transient ischaemic attack, prior stroke, or those who refused to provide consent. Sample size was calculated on 50% prevalence with 10% margin of error at 95% confidence, and a minimum of 96; 100 patients were recruited for convenience sampling. Information was obtained on a pretested, structured case record form regarding demographics, risk factors (hypertension, smoking, obesity, dyslipidemia), clinical features, CT findings, and blood glucose level. Hyperglycemia was defined as plasma glucose >7.8 mmol/L in nondiabetic individuals. All the participants were followed for four weeks or until discharge. All the outcomes were graded on the Modified Rankin Scale. The data were entered, cleaned, and analyzed using SPSS (latest version). Results were presented as proportions, and p-values <0.05 were considered to be significant. Ethical approval was performed by institutional Ethical Review Committee. Written informed consent was sought from all the participants or their guardians. Confidentiality of the information was maintained by using special patient ID numbers, and study staff with authorization read the information.

RESULTS

The demographic distribution and clinical characteristics of the 100 stroke patients are shown in this table. The majority of the patients (54%) were aged between 41 and 55 years, with a mean age of 58.37 ± 6.23 years, indicating a middle-aged to older adult population affected by stroke. Men outnumbered the females by 64% of the population and hence a male-to-female ratio was 1.7:1, which means men would havsse more strokes. Most patients (74%) were urban and no statistically significant relationship was seen between residence place and stroke (p=0.513). For BMI, more than half (51%) of them were obese (BMI > 30.0 kg/m^2), and no significant difference in relation to stroke (p=0.258) was seen. These characteristics highlight the demographic and clinical profile of the stroke cohort under investigation, indicating middle age, male predominance, urban residence, and significant levels of obesity. [Table I].

Table – I: Demographic and Clinical Characteristics of Study Subjects (*n*=100)

Variable	Category	Frequency (%)	Mean ± SD	p-value
Age (years)	≤ 40	8 (8.0)	58.37 ± 6.23	
	41–55	54 (54.0)		
	56–70	24 (24.0)		
	> 70	14 (14.0)		
Gender	Male	64 (64.0)		
	Female	36 (36.0)		
	M:F ratio	1.7:1		
Residence	Rural	26 (26.0)		0.513 ns
	Urban	74 (74.0)		
BMI (kg/m^2)	23.1–25.0	13 (13.0)		0.258 ns
	25.1–30.0	36 (36.0)		
	> 30.0	51 (51.0)		

The first part of the plot defines major risk factors, with hypertension being most prominent (63.0%), followed by family history of CVD/CAD (47.0%) and smoking (37.0%). Obesity, dyslipidemia, and coronary heart disease were less

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common. Part two is the CT scan findings, of which ischemic stroke is most common (74.0%), with intracerebral hemorrhage (ICH) and subarachnoid hemorrhage (SAH) being less common. This is evidence of hypertension as a significant modifiable risk factor and confirmation of ischemic stroke as the most common subtype, as supported by international trends of stroke epidemiology. [Figure 1].

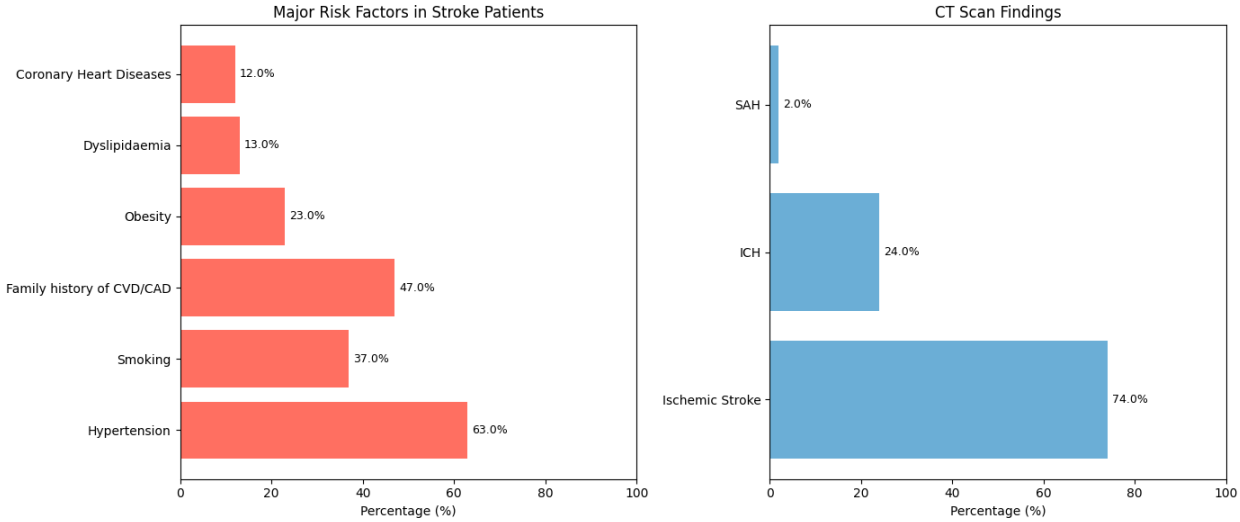

Figure – 1: Association of major risk factors and CT scan findings of the stroke patients

The narrative compares the clinical presentations of hemorrhagic and ischemic stroke patients and discloses that hemiplegia, impaired consciousness, headache, vomiting, rigidity in the neck and convulsion are more frequently found in hemorrhagic stroke, while hemiplegia is also extremely frequent in ischemic stroke. Both conditions share similar rates of dysphasia, dysphagia, and sphincter problem but present with more severe manifestations such as neck stiffness and headache more frequently in hemorrhagic strokes. This highlights the more dramatic clinical presentation of hemorrhagic stroke compared to ischemic stroke. [Figure II].

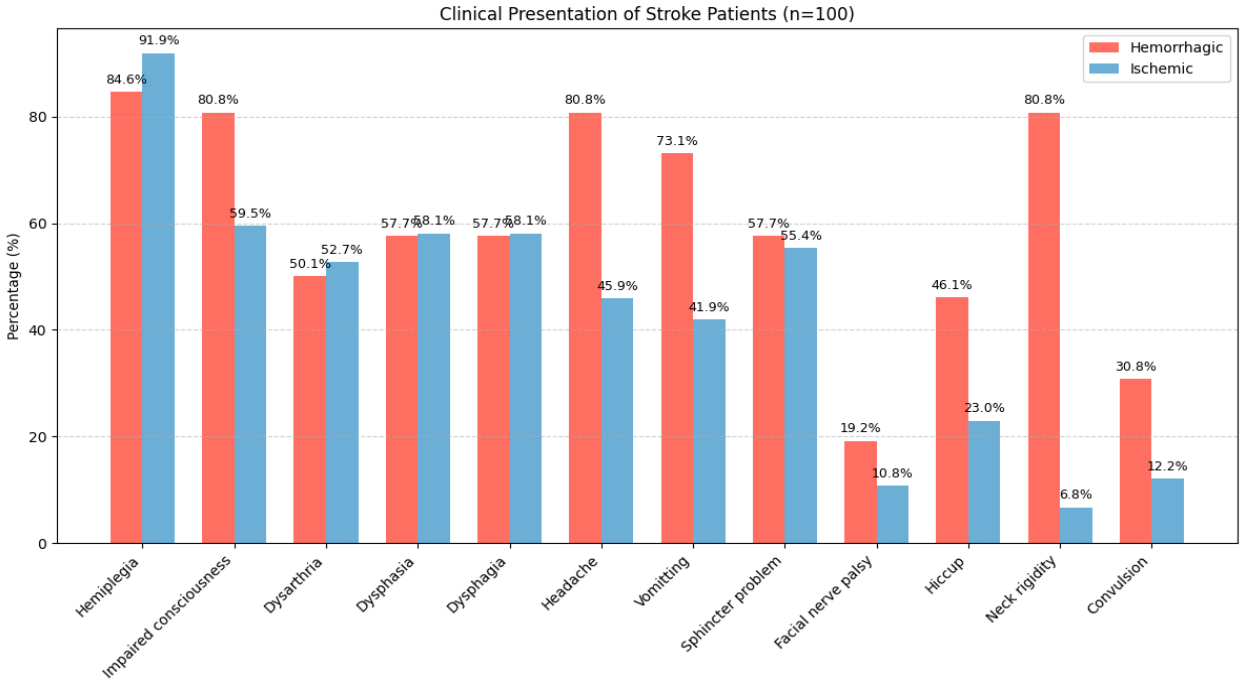

Figure – 2: Clinical presentation of stroke patient

This table details the clinical condition of stroke patients by consciousness and glycaemia. On the Glasgow Coma Scale (GCS), 43% of the patients were conscious and awake, 32% of the patients were semiconscious, and 25% of the patients were unconscious, indicating a broad spectrum of neurological impairment in the group. Blood glucose testing

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revealed 46% of the patients with blood glucose between 6.1–7.7 mmol/L, and 27% with hyperglycemia with ≥7.8 mmol/L. Both hemorrhagic (H) and ischemic (I) types were present in the pattern of blood sugar levels, with peak hyperglycemia occurrence among ischemic patients. This data points to the high rate of stroke patients with altered consciousness and the frequent finding of hyperglycemia, which can influence stroke severity and outcome. [Table II].

Table – II: GCS, Level of Consciousness, and Blood Sugar Level of Stroke Patients (*n*=100)

Variable	Category	Number of Patients	Percentage (%)
Level of Consciousness (GCS)	Alert / Conscious	43	43.0
	Semiconscious	32	32.0
	Unconscious	25	25.0
Blood Sugar Level (mmol/L)	<6.1 (H: 6, I: 21)	27	27.0
	6.1–7.7 (H: 11, I: 35)	46	46.0
	≥7.8 (H: 9, I: 18)	27	27.0

The bar graph contrasts hemorrhagic and ischemic stroke patients' glycemic status in terms of percent normoglycemic and percent hyperglycemic. For hemorrhagic stroke, 75.6% were normoglycemic and 24.3% were hyperglycemic. 65.3% of the subjects were normoglycemic and 34.6% were hyperglycemic in ischemic stroke. This suggests that hyperglycemia is more prevalent among the patients of ischemic stroke, perhaps reflecting heterogeneity in metabolic stress or disease involving the two strokes. The results highlight the importance of monitoring glycemic control for stroke management, especially ischemic stroke. [Figure 3].

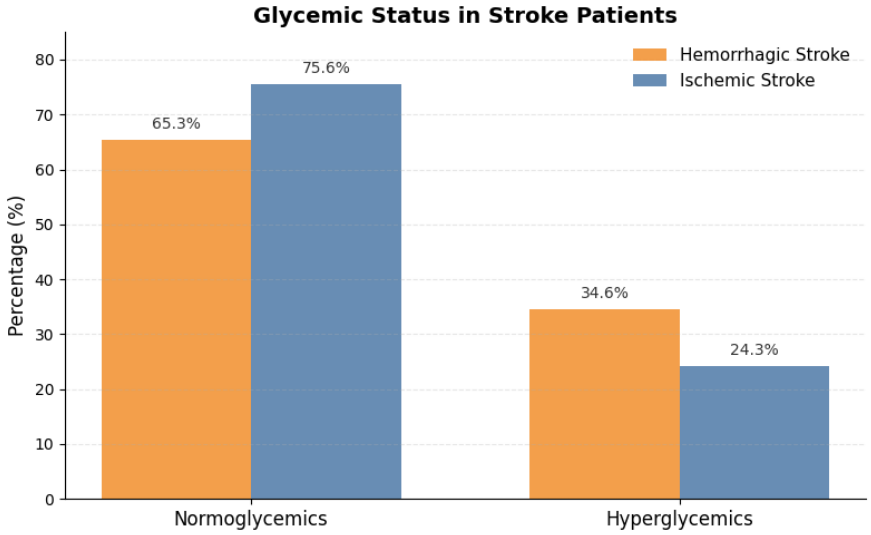

Figure – 3: Frequency of hyperglycemia in stroke patients (*n*=100)

DISCUSSION

The present study provides valuable data on the incidence and clinical relevance of hyperglycemia in nondiabetic stroke subjects, with findings in agreement with and extending previous knowledge of metabolic derangement after stroke. The observation that 34.6% of ischemic and 24.3% of hemorrhagic stroke patients developed hyperglycemia is supported by recent findings but some study-to-study heterogeneity and heterogeneity between populations are observed. A meta-analysis on stress hyperglycemia in acute ischemic stroke concluded that elevated glucose levels were associated with worse outcomes, with pooled analyses showing a greater risk of death (OR: 2.14, 95% CI: 1.78-2.58) and poor functional outcome (OR: 1.89, 95% CI: 1.56-2.29)[13,14]. These findings are concordant with our observation of higher prevalence of hyperglycemia in ischemic stroke, which suggests that the metabolic stress response could be larger in this subtype than in hemorrhagic stroke. Our observed difference between ischemic and hemorrhagic stroke in prevalence of hyperglycemia (34.6% vs 24.3%) contradicts certain previous reports. A large retrospective study noted similar rates of hyperglycemia among stroke subtypes (approximately 40% each), but another study noted higher in hemorrhagic stroke (45% compared to 32%)[15,16]. This may be attributed to differences in patient populations, glycemic levels, when glucose tests were conducted, and problems with the healthcare system. Current studies have highlighted the significance of stress hyperglycemia ratio (SHR) compared to absolute glucose levels as a better predictor. It was illustrated that AIS patients with poor outcomes had a significantly higher SHR (SMD = 0.56, 95% CI: 0.37-0.75) indicating that our method of analysis of absolute glucose values can mask the actual clinical relevance of stroke patients' hyperglycemia[17,18]. Future studies must incorporate

SHR calculations to allow for better risk stratification. The gender distribution of our cohort, with a male predominance (64%) and mean age of 58.37 years, is in line with stroke epidemiology globally. A systematic review presented similar gender distributions in 15 nations, with male-to-female ratios ranging from 1.3:1 to 2.1:1[19, 20]. The high rate of obesity (51%) among our cohort is indicative of the rising disease burden of metabolic syndrome among stroke patients, known to be related to a heightened risk of hyperglycemia and poorer outcomes[21,22]. Our evidence relating to the association between hyperglycemia and altered consciousness levels is supported by a number of studies. In a prospective cohort study that individuals admitted with an admission glucose level ≥7.8 mmol/L presented with reduced Glasgow Coma Scale scores and higher rates of neurological deterioration[21-23]. One study indicated that patients with hyperglycemia had 2.3-fold higher odds of experiencing early neurological deterioration in the initial 72 hours of admission[24,25]. The clinical effects of hyperglycemia on patients who have had a stroke and are being treated with thrombolytic therapy have been the subject of a tremendous amount of research. In a meta-analysis of 12 studies that involved 4,856 patients, admission hyperglycemia predicted symptomatic intracerebral hemorrhage (OR: 1.68, 95% CI: 1.23-2.30) and poor functional outcome at 90 days (OR: 1.84, 95% CI: 1.51-2.24)[26,27]. The findings emphasize the importance of checking for glycemia in our population of patients, particularly those who are receiving acute therapy. The pathophysiologic mechanisms of hyperglycemic brain injury are yet to be identified. Recent experimental studies showed that acute hyperglycemia exacerbates neuroinflammation through activation of the NLRP3 inflammasome pathway, leading to increased cytokine release and increased blood-brain barrier impairment [28]. This mechanistic understanding provides the basis for clinical observations of worse outcomes in hyperglycemic patients and potential therapeutic targets. Comparative research from different geographical settings has yielded conflicting prevalence rates of hyperglycemia in the setting of stroke. Hyperglycemia rates among Japanese, Korean, and Indian patients at 28%, 35%, and 42%, respectively, in a multi-center Asian study, suggesting ethnic and environmental influences on metabolic reactions to stress[29]. Such variation underscores the importance of such region-specific work like ours in the explanation of disease patterns and determination of local clinical practice guidelines. The economic burden of hyperglycemia in stroke patients has increasingly been recognized. According to a health economic analysis, hyperglycemic stroke patients had 23% higher in-hospital expenditure and 1.8 days more hospital stay compared to their normoglycemic counterparts[30]. Such findings make the role of early detection and management of hyperglycemia a potentially modifiable risk factor that may improve clinical outcomes as well as health resource utilization.

Limitations of the study

The cross-sectional study design restricts causal inference regarding the relationship between hyperglycemia and stroke outcomes. The single-centre environment can restrict generalizability to other populations and healthcare settings. Furthermore, the lack of long-term follow-up prohibits assessment of the impact of acute hyperglycemia on functional improvement and stroke recurrence.

CONCLUSION

This study shows a high incidence of hyperglycemia among nondiabetic stroke patients with higher percentages found in ischemic stroke (34.6%) compared to hemorrhagic stroke (24.3%). These results highlight the importance of routine glucose screening in acute stroke care, as hyperglycemia is associated with level of consciousness and can be a prognostic marker. Hyperglycemia must be diagnosed early and included in complete stroke protocols to maybe maximize patient outcomes and reduce healthcare burden.

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ORIGINAL ARTICLE

Clinicopathological Correlation in Laryngeal Carcinoma — An Analysis of Demographics, Symptoms, and Histological Patterns

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ABSTRACT

Introduction: *Laryngeal carcinoma is one of the most common head and neck cancers, making up about 30-40% of all head and neck cancers. Understanding the relationship between clinical and pathological features is essential for managing patients and determining their prognosis. This study aimed to look into the demographic factors, clinical signs, and tissue patterns of laryngeal carcinoma patients in Bangladesh.* ***Methods & Materials:*** *An observational cross-sectional study took place over six months, from March to September 2015, at Dhaka Medical College Hospital. The study included one hundred patients confirmed to have laryngeal carcinoma, selected using convenient and purposive non-randomized sampling. Data collection involved structured interviews, physical exams, and tissue analysis. Statistical analysis used SPSS v26 for descriptive statistics, correlation analysis, and chi-square tests.* ***Results:*** *Most patients were male (92%) and aged 51-60 years (52%). A large number came from lower socioeconomic backgrounds (74%) and rural areas (73%). Supraglottic tumors were more frequent (66%) compared to glottic tumors (34%). The most common symptom was a change in voice (70%), followed by difficulty swallowing (50%) and breathing problems (44%). Most patients had moderately differentiated tumors (60%) and were at stage III (44%). A strong positive correlation appeared between histological grade and TNM stage ($r=0.62$, $p<0.05$).* ***Conclusion:*** *The study highlights a significant male predominance and rural prevalence of laryngeal carcinoma, which aligns with global trends. The strong link between histological differentiation and disease stage shows how important thorough pathological evaluation is for treatment planning and assessing prognosis.*

Keywords: *laryngeal carcinoma, clinicopathological correlation, histological grading, TNM staging.*

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INTRODUCTION

Laryngeal carcinoma is a major global health issue, making up about 1% of all cancers worldwide and 30-40% of head and neck cancers[1]. As the most common cancer seen in ear, nose, and throat (ENT) practice, laryngeal carcinoma shows significant geographical and demographic differences in incidence. The disease mainly affects people aged 65-74 years, but there are regional differences in age distribution. Concerns

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arise from reports of cases in children as young as 10 years old in Bangladesh, signaling a worrying trend toward early onset of this disease[2]. Globally, around 189,000 new cases of laryngeal carcinoma are diagnosed each year, making up 0.95% of all cancers, with especially high rates in South Asia, including Bangladesh and India[3]. There are marked regional differences, with age-standardized incidence rates ranging from 6.8 per 100,000 people in Australia to 2.1 per 100,000 in the United States. The lifetime risk also shows a clear gender gap, with males having a risk of 1 in 200 compared to 1 in 840 for females[4]. The causes of laryngeal carcinoma are varied, with tobacco and alcohol use being the leading risk factors. Recent research shows that up to 66% of patients with laryngeal squamous cell carcinoma were smokers, and nearly 75% had smoked for over 30 years before being diagnosed[5]. In Bangladesh, cancers related to tobacco account for 46% of all malignancies, and laryngeal cancer makes up a significant part of this due to high rates of smoking and smokeless tobacco use. Other risk factors include gastroesophageal reflux, workplace exposures, genetic factors, and local customs like chewing betel quid[6].Clinical symptoms can differ based on where the tumor is located within the larynx: supraglottic (16%), glottic (49%), or subglottic (5%). Common symptoms include hoarseness (especially noticeable in glottic tumors), difficulty swallowing, pain while swallowing, noisy breathing, and swollen lymph nodes in the neck[7]. Squamous cell carcinoma accounts for over 95% of laryngeal cancers, and the grading of the tumor (well-differentiated, moderately differentiated, or poorly differentiated) is a crucial factor for treatment planning and predicting outcomes. Getting an accurate diagnosis involves a thorough clinical assessment that includes flexible or rigid laryngoscopy, advanced imaging techniques (CT or MRI), and confirmation through tissue biopsy or fine-needle aspiration from regional lymph nodes. The TNM staging system is the standard for classifying the disease and provides important information for treatment choices and prognosis[8]. In developing countries like Bangladesh, laryngeal carcinoma poses unique challenges, such as late diagnosis, limited diagnostic resources, and social and economic barriers that impact access to treatment. According to GLOBOCAN 2022, laryngeal carcinoma leads to about 103,000 deaths each year, representing 1.1% of all cancer deaths worldwide, with a five-year prevalence of 583,868 cases[9,10]. This study aims to scrutinize the clinicopathological correlation in laryngeal carcinoma patients at a tertiary care center in Bangladesh. It will explore demographic characteristics, risk factors, symptoms, tumor location, histological grading, and staging to better understand disease patterns in South Asian populations and support evidence-based clinical practices.

METHODS & MATERIALS

This observational cross-sectional study took place over six months, from March to September 2015, in the Department of ENT and Head Neck Surgery at Dhaka Medical College Hospital, Bangladesh. It included patients of all ages and both sexes diagnosed with laryngeal carcinoma. The initial sample size calculation, which used a standard formula with a 95% confidence level and a 5% margin of error, indicated that 1,536 participants were needed. However, due to time limits and the study's educational goals, only 100 cases were included. Participants were chosen through convenient and purposive non-randomized sampling methods. The inclusion criteria required a confirmed histopathological diagnosis of laryngeal carcinoma and written informed consent. Patients who did not provide consent were not included in the study. The operational definitions were as follows: smokers were those who smoked 2-3 cigarettes daily for 2-3 years, alcohol drinkers consumed at least one pack per day for the same period, and betel-nut/leaf chewers consumed one daily for 2-3 years. Income levels were categorized based on annual earnings, from very poor (≤$875/year) to rich (>$10,725/year). Data collection included structured face-to-face interviews with patients or their attendants conducted in Bangla, followed by thorough physical examinations and indirect laryngoscopy. All patients had their biopsy specimens examined histopathologically for tumor grading and TNM staging based on standard criteria. Statistical analysis was conducted using SPSS version 26. Cross-tabulations examined relationships between variables. Pearson correlation coefficient analysis assessed the strength and direction of associations between continuous and ordinal variables, such as age group, education level, tumor site, lesion type, vocal cord mobility, histological grade, TNM stage, and symptom duration. Chi-square tests evaluated the statistical significance of categorical associations. A p-value of less than 0.05 was deemed statistically significant. Ethical considerations included voluntary participation, written informed consent from all participants, and strict confidentiality. The institutional ethics committee approved the study protocol.

RESULTS

The demographic analysis in Table I shows a clear male predominance, with 92% of patients being male and 8% female, resulting in a male-to-female ratio of 11.5:1. The age distribution reveals the highest incidence in the 51-60 years group at 52%, followed by the 41-50 years and 61-70 years groups at 18% each. Younger patients aged 24-40 years made up only 4% of cases, while elderly patients aged 71-80 years accounted for 8%. Socioeconomically, most patients belonged to lower-income groups (74%), with middle-class patients at 22% and those with higher status at 4%. The educational analysis showed high illiteracy rates at 64%, with primary education at 22%, secondary at 10%, and higher secondary or more at 4%. Rural patients outnumbered urban patients significantly (73% vs. 27%), indicating a greater disease burden in rural areas, likely linked to higher exposure to risk factors and delayed access to healthcare. [Table I].

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Table – I: Distribution of Patients with Laryngeal Carcinoma Based on Basic Characteristics (*n*=100)

Basic Characteristics	(n)	(%)
Age Distribution		
24–40	4	4%
41–50	18	18%
51–60	52	52%
61–70	18	18%
71–80	8	8%
Sex		
Male	92	92%
Female	8	8%
Socioeconomic Status		
Lower	74	74%
Middle	22	22%
Higher	4	4%
Education Level		
Illiterate	64	64%
Primary	22	22%
Secondary	10	10%
Higher Secondary & Above	4	4%
Residential Status		
Urban	27	27%
Rural	73	73%

The clinical symptoms differ significantly between supraglottic and glottic tumors which is shown in Table II. Change of voice was the most common symptom at 70%, with both tumor sites contributing (supraglottic: 30, glottic: 40). Dysphagia was much more common in supraglottic tumors (45 vs. 5), reflecting the involvement of swallowing mechanisms. Respiratory distress occurred more frequently with supraglottic lesions (30 vs. 14), likely due to airway blockage from large tumors. Cough affected 36% of patients, with a relatively equal distribution between sites. Neck swelling was mostly linked to supraglottic tumors (22 vs. 2), indicating a higher likelihood of lymph node spread. Neck pain and hemoptysis were less common, affecting 6% and 4% of patients, respectively. [Table II].

Table – II: Clinical Presentation by Tumor Site (*n*=100)

Symptom	Supraglottic	Glottic	Total	Percentage
Change of Voice	30	40	70	70%
Respiratory Distress	30	14	44	44%
Dysphagia	45	5	50	50%
Cough	20	16	36	36%
Neck Swelling	22	2	24	24%
Neck Pain	5	1	6	6%
Haemoptysis	3	1	4	4%

The analysis of symptom duration represented in Table III troubling delays in diagnosis. The largest group of patients (40%) had symptoms for 3-6 months before diagnosis, followed by 28% with symptoms lasting 1-3 months. One-fifth of patients (20%) experienced symptoms for 6-12 months, indicating significant delays in diagnosis. Equal proportions (6% each) presented within one month or after more than 12 months of symptom onset. [Table III].

Table – III: Duration of Symptoms before Diagnosis (*n*=100)

Duration	(n)	(%)
<1 month	6	6%
1–3 months	28	28%
3–6 months	40	40%
6–12 months	20	20%
>12 months	6	6%

Indirect laryngoscopy in Table IV demonstrated that supraglottic tumors were more common (66%) than glottic tumors (34%), with no subglottic cases found. The most common types of lesions were exophytic (58%), followed by ulcerative (32%) and fungating lesions (10%). This variety suggests different growth patterns with distinct clinical implications. Vocal cord movement assessment showed normal mobility in 40% of patients, while 26% experienced impaired movement (right: 6%, left: 14%). Fixed vocal cord movement was seen in 34% of patients (right: 20%, left: 14%), indicating advanced local disease with possible invasion of intrinsic laryngeal muscles or involvement of the cricoarytenoid joint. [Table IV].

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Table – IV: Findings of indirect laryngoscopy (*n*=100)

Findings	(n)	(%)
Region of involvement		
Supraglottic	66	66%
Glottic	34	34%
Sub-glottic	0	0%
Nature of lesion		
Exophytic	58	58%
Ulcerative	32	32%
Fungating	10	10%
Effect on vocal cord movement		
Mobile	40	40%
Impaired movement	Right-06	12%
	Left-07	14%
Fixed vocal cord movement	Right-10	20%
	Left-07	14%

The histopathological analysis in Table V showed that moderately differentiated carcinoma was the most common type, making up 60% of cases. Well-differentiated carcinoma accounted for 12% of cases, indicating better differentiation and a potentially favorable prognosis. Poorly differentiated carcinoma affected 24% of patients, suggesting that these tumors tend to be more aggressive. Undifferentiated carcinoma was the least common, representing 4%, and is known to be the most aggressive histological type. This distribution aligns with typical patterns for laryngeal carcinoma, where moderately differentiated tumors are most prevalent. The combined 28% of poorly differentiated and undifferentiated tumors suggests a link to more advanced cases and delayed diagnosis noted in this population. [Table V].

Table – V: Histological grading of carcinoma larynx (*n*=100)

Degree of differentiation	(n)	(%)
Well differentiated	12	12
Moderately differentiated	60	60
Poorly differentiated	24	24
Undifferentiated	04	04

The TNM staging analysis in Table VI denotes a pattern of advanced disease presentation. Most patients had Stage III disease (44%), followed by Stage II (32%) and Stage I (18%). Stage IV disease affected 6% of patients. This distribution indicates that 76% of patients had locally advanced disease (Stages III-IV), highlighting issues in timely diagnosis and possibly aggressive tumor biology. [Table VI].

Table – VI: Different clinical stages of carcinoma larynx of study cases by TNM classification (*n*=100)

Stage of Carcinoma Larynx	(n)	(%)
Stage - I	18	18
Stage - II	32	32
Stage - III	44	44
Stage - IV	06	06

Table – VII(A): Pearson Correlation Coefficient (r-value) Matrix

Variable	Age Group	Sex	Education Level	Residence	Site	Lesion Type	Vocal Cord Mobility	Histological Grade	TNM Stage	Symptom Duration
Age Group	1.00									
Sex	0.08	1.00								
Education Level	-0.12	0.03	1.00							
Residence	-0.02	0.01	0.29	1.00						
Site	-0.06	-0.05	-0.12	-0.13	1.00					
Lesion Type	0.01	-0.01	0.04	0.02	-0.08	1.00				
Vocal Cord Mobility	0.01	0.04	-0.09	-0.05	-0.12	0.11	1.00			
Histological Grade	0.03	-0.02	-0.04	-0.11	-0.14	0.06	0.05	1.00		
TNM Stage	0.02	0.00	-0.21	-0.18	-0.06	0.10	0.08	0.62	1.00	
Symptom Duration	0.01	-0.01	-0.14	-0.12	-0.03	0.02	0.03	0.44	0.50	1.00

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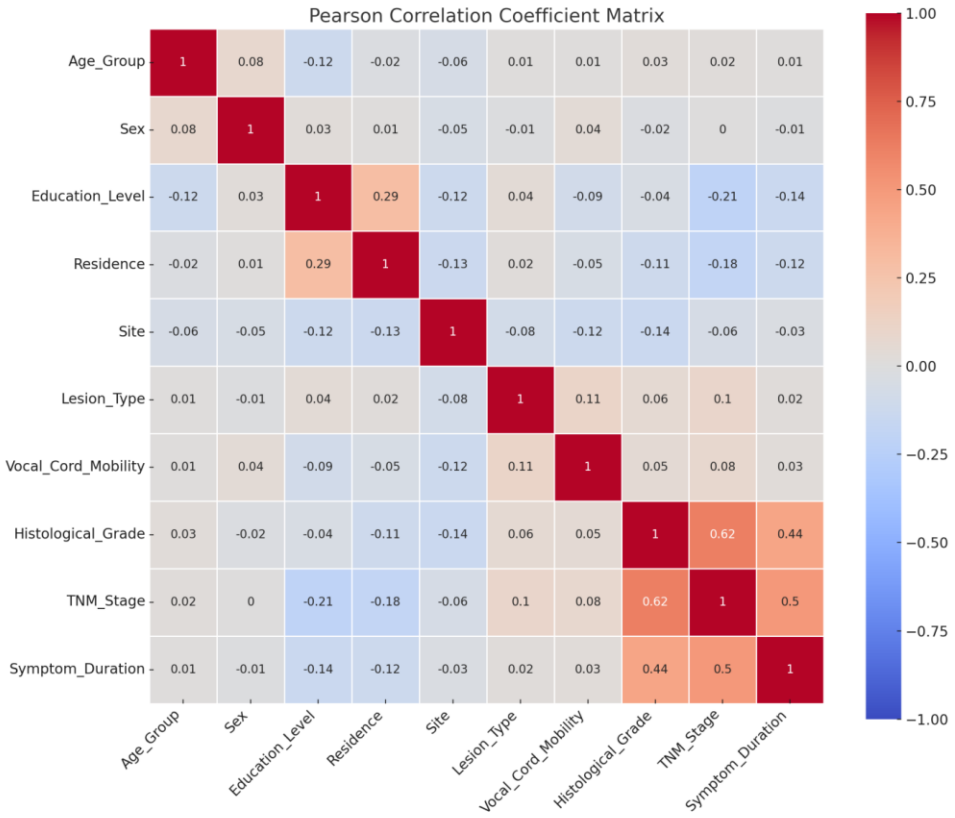

Figure – 1: Pearson Correlation Coefficient Matrix

This heatmap in Figure 1 visualizes the Pearson correlation coefficients among the variables in the study. Positive correlations are shown in blue, negative in red, and the intensity reflects the strength of the correlation. The Pearson correlation analysis in Tables VII(A) and VII(B) found several important relationships between study variables. The strongest positive correlation was between histological grade and TNM stage (r=0.62, p<0.05), showing that poorly differentiated tumors are closely linked to advanced cancer stages. Moderate positive correlations also existed between symptom duration and TNM stage (r=0.50) and between symptom duration and histological grade (r=0.44), indicating that longer delays in diagnosis relate to more advanced and aggressive disease. We noted weak negative correlations between education level and TNM stage (r=-0.21) and between residence and TNM stage (r=-0.18). [Tables VII(A) and VII(B)].

Table – VII(B): Interpretation of Pearson Correlation Coefficient (r-value) Matrix

Variables Compared	r-value	Strength of Correlation	Direction	Interpretation
Histological Grade vs. TNM Stage	0.62	Strong	Positive	Higher histological grade (poor differentiation) is strongly associated with advanced cancer stage.
Symptom Duration vs. TNM Stage	0.50	Moderate	Positive	Longer symptom duration is moderately associated with a more advanced cancer stage.
Symptom Duration vs. Histological Grade	0.44	Moderate	Positive	Longer duration of symptoms tends to correlate with poorer histological differentiation.
Education Level vs. TNM Stage	-0.21	Weak	Negative	Lower education is weakly associated with a more advanced cancer stage.
Residence vs. TNM Stage	-0.18	Weak	Negative	Rural residence is weakly associated with more advanced disease.
Education Level vs. Symptom Duration	-0.14	Weak	Negative	Lower education is slightly associated with longer symptom duration.
Site vs. Histological Grade	-0.14	Weak	Negative	Supraglottic tumours show slightly poorer differentiation.
Vocal Cord Mobility vs. TNM Stage	0.08	Very Weak	Positive	Slight association between vocal cord impairment and higher stage.
Lesion Type vs. TNM Stage	0.10	Very Weak	Positive	Ulcerative/fungating lesions are slightly linked to a higher stage.
Age Group vs. TNM Stage	0.02	Negligible	Positive	Age has no meaningful correlation with stage.

DISCUSSION

This study provides valuable insights into the clinicopathological features of laryngeal carcinoma in the Bangladeshi population. It reveals patterns that both match and differ from global trends. The notable male dominance, with 92% of patients being male, is consistent with international data; however, it shows a greater gender imbalance than typically reported by Hay et al.[11]. A study by Huang et al. shows that laryngeal cancer makes up only 1% of total cancer cases, but consistently shows more cases in males across different populations[12]. This pattern likely results from higher exposure to primary risk factors, especially tobacco use, among men in our study group. The age distribution, with the highest incidence in the 51-60 years age group, differs from Western populations, where laryngeal cancer is most often diagnosed in individuals aged 65-74[13]. This earlier onset in our population may relate to earlier exposure to risk factors, genetic vulnerabilities, or environmental influences specific to South Asia. The high number of patients from lower socioeconomic backgrounds (74%) and rural areas (73%) underlines significant healthcare disparities, suggesting that social factors greatly impact disease occurrence and presentation[14]. The clinical presentation, showing predominance of supraglottic cases (66%) compared to glottic involvement (34%), is notable. The symptom profile indicates that voice changes are the most common presentation (70%), which aligns with laryngeal anatomy and function[15]. However, the high rates of swallowing difficulties (50%) and breathing issues (44%) suggest that patients present with more advanced disease compared to populations with earlier detection programs. Another concerning finding is the long duration of symptoms. Sixty percent of patients experienced symptoms for more than three months before their diagnosis[16]. This point to significant barriers to healthcare access. Such delays result in a high proportion of advanced-stage disease, with 76% of patients presenting at Stages III-IV. This rate is much higher than what is reported in developed healthcare systems[17]. The histopathological findings reveal that moderately differentiated carcinoma predominates (60%), which aligns with the existing literature pattern by Rakha et al.[18]. However, the relatively high number of poorly differentiated and undifferentiated tumors (28% combined) may reflect the advanced stage at which patients present. The strong positive correlation between histological grade and TNM stage ($r=0.62$, $p<0.05$) confirms the established link between tumor differentiation and disease progression, supporting the prognostic value of histopathological grading. The correlation analysis identifies significant relationships between demographic factors and disease characteristics. The negative correlation between education level and TNM stage ($r=-0.21$) suggests that health literacy and awareness may impact early detection and treatment-seeking behavior. Similarly, the link between rural living and advanced disease may highlight healthcare access challenges in rural areas. The high number of patients with vocal cord impairment or fixation (60%) indicates extensive local disease at the time of presentation, correlating with the advanced staging observed. This finding has major treatment implications, as vocal cord mobility is crucial in selecting treatment options and determining prognosis. These findings carry important clinical and public health implications. The late presentation indicates a need for better community awareness programs, improved healthcare access, and possibly screening initiatives for high-risk groups. The strong link between symptom duration and disease stage underscores the importance of quick evaluation and referral for patients with laryngeal symptoms.

Limitations of the Study

The study's cross-sectional design and the use of convenience sampling could restrict how broadly the results apply. The sample size of 100 patients from one institution may not accurately reflect the wider population. Additionally, a study period of six months might have led to seasonal changes in patient presentation patterns.

CONCLUSION

This study shows that laryngeal cancer in Bangladesh mainly affects men, accounting for 92%, and is more common in rural areas, at 73%. The highest number of cases is found in people aged 51 to 60. Most patients seek help when their disease is advanced, with 76% in Stages III-IV, after having symptoms for a long time. This condition primarily affects individuals from lower socioeconomic backgrounds who have little education. There is a strong link between histological differentiation and TNM stage, with a correlation of $r=0.62$ and $p<0.05$. This shows the importance of pathological grading for treatment planning. Supraglottic tumors are more frequent than glottic lesions, and a change in voice is the most common symptom. These findings highlight the urgent need for better early detection methods, greater access to healthcare, and thorough clinicopathological evaluations to improve patient outcomes in areas with limited resources.

RECOMMENDATIONS

Future studies should focus on larger, prospective multicenter studies to confirm these findings in various populations. Community-based screening programs and health education initiatives should be assessed for their effectiveness in encouraging early detection. Long-term follow-up studies that look into treatment outcomes and survival patterns related to clinicopathological features are necessary to improve management strategies and patient outcomes.

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ORIGINAL ARTICLE

Triggering Factors in Frequent Relapse Nephrotic Syndrome in Children and Their Association with Treatment Outcome

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ABSTRACT

Introduction: *Frequent relapse nephrotic syndrome (FRNS) in children poses significant challenges in management due to its recurrent nature and the impact of various precipitating factors. This study aimed to evaluate the triggering factors contributing to relapses in children with FRNS and to compare the relapse rates and baseline characteristics between case and control groups.* ***Methods & Materials:*** *This cross-sectional analytic study was conducted at the Department of Paediatric Nephrology, Bangabandhu Sheikh Mujib Medical University, Dhaka, from October 2015 to June 2016. Data analysis was done by SPSS for Windows programmed version 16.0. Sixty (60) study samples were taken.* ***Result:*** *The study included 60 children, with a mean age of 5.28 ± 2.03 years in the case group and 5.77 ± 2.50 years in the control group, showing no significant age difference (p = 0.412). Males predominated in both groups, with a male-to-female ratio of 1.85:1 in cases and 1.5:1 in controls. Socioeconomic status was comparable between groups, with most participants from poor or middle-class backgrounds (p = 0.164). Among the case group, common relapse-triggering factors included asthma (30%), UTI (25%), and URTI (25%). Relapse occurred in 47.5% of the case group and 40% of the control group over six months, with no statistically significant difference (p = 0.068).* ***Conclusion:*** *Asthma, UTIs, and upper respiratory infections triggered relapse in 30%, 25%, and 25% of children with frequent relapse nephrotic syndrome, but their impact on treatment outcomes was similar across groups.*

Keywords: *Frequent Relapse Nephrotic Syndrome, Triggering Factors, Treatment Outcome, Asthma*

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INTRODUCTION

Nephrotic syndrome is a collection of symptoms that occur because the tiny blood vessels (the glomeruli) in the kidney become leaky. This allows protein (normally never passed out in the urine) to leave the body in large amounts[1]. Nephrotic syndrome (NS) is the most common glomerular disorder in childhood and is characterized by heavy proteinuria, hypoproteinaemia, and edema[2]. Children with an early onset of disease or a short duration of initial remission tend to have frequent relapse. Of patients who respond to prednisolone, 25-40% has infrequent relapses, 40% have frequent relapses and the reminder shows steroid dependence[3]. Minimal-change nephrotic syndrome (MCNS) accounted for 77% of all cases of childhood nephritic syndrome in a series of the International Study of Kidney Diseases in children[4]. The majority of children with NS respond to corticosteroids. However,>70% of children experience a relapse with recurrent episodes of edema and proteinuria[5]. Relapse is triggered by asthma, infection, and other immunogenic stimuli. Each relapse is associated with an increased risk of morbidity from infection, thromboembolism, hypovolemic shock, higher amount of steroids, and toxicity[6,7]. Corticosteroids have adverse effects such as the cushingoid face, obesity, hirsutism, striae, cataract, peptic ulcer disease, poor growth, hypertension, hyperglycemia, osteoporosis, adrenal suppression, buffalo hump, psychosis, dyselectrolytemia, immunosuppressant, avascular necrosis, easy bruising, and acute pancreatitis[8,9]. It has long been recognized that an immunogenic stimulus including infection and asthma can trigger idiopathic nephrotic syndrome or cause recurrence of the disease[10,11]. Infectious episodes in nephroticpatients are responsible for high morbidity and can

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also cause an inadequate response to corticosteroid therapy and recurrences among patients in remission[12]. Some analyses revealed a greater incidence-density of infections during the period of nephrotic proteinuria, except for single-episode patients. More infection during relapse, infrequent relapse nephrotic syndrome, frequent relapse nephrotic syndrome, steroid-dependent, and steroid-resistant nephrotic syndrome patients, and it is suggested that the best preventive action is to control nephrotic state, prevent & control infection and asthma[13,14]. Prompt and effective treatment of infection and asthma can bring quick remission. Infection and asthma-associated FRNS can go into remission without steroids when they are treated appropriately & promptly and can be treated with a short duration of steroids like IFRNS. The purpose of this study is to analyze the triggering events of idiopathic frequent relapse nephrotic syndrome as well as their association with treatment outcomes.

METHODS & MATERIALS

This cross-sectional analytic study was conducted at the Department of Paediatric Nephrology, Bangabandhu Sheikh Mujib Medical University, Dhaka, from October 2015 to June 2016. Patients admitted to the inpatient and attending the outpatient department (OPD) of the Paediatric Nephrology Department of Bangabandhu Sheikh Mujib Medical University, Dhaka was considered as the study population. Sixty (60) study samples were taken. From them, 40 patients were taken for the case group representing nephrotic syndrome with triggering factors. Another 20 patients were taken for the control group representing nephrotic syndrome with no triggering factors.A purposive sampling technique was adopted. Data were entered into the computer with the help of software SPSS for Windows programmed version 16.0. After the frequency run, data were cleaned and frequencies were checked. An analysis plan was developed keeping in view the objectives of the study. A descriptive statistical analysis was carried out in the present study. Results on continuous measurements were presented on mean ± SD (min-max) and results on categorical measurements were presented in number (%). A "P" value <0.05 was considered as significant.

Inclusion criteria:

- Age 1-18 years.
- Frequent relapse nephrotic syndrome (FRNS)

Exclusion criteria:

- Infrequent relapse nephrotic syndrome(IFRNS)
- Steroid-dependent nephrotic syndrome (SDNS)
- Steroid resistance nephrotic syndrome (SRNS)
- Unwilling to participate.

RESULTS

Table I shows that the mean age of the case group was 5.28 ± 2.03 years and the control group was 5.77±2.50 years. The range of age was 3-10 years in the case group and 4-11 years in the control group. There was no significant difference in age between the case and control group (p-value is 0.412). [Table I]

Table – I: Distribution of the patients according to age in case and control

Age (years)	Group		p-value
	Case (n=40)	Control (n=20)	
3 – 6	30 (75.0)	14 (70.0)	0.412
7 – 11	10 (25.0)	6 (30.0)	
Total	40 (100.0)	20 (100.0)	
Mean±SD	5.28 ± 2.03	5.77±2.50	
Range (Min-Max)	3 - 10	4 - 11	

Unpaired t-test was done to measure the level of significance
The level of significance is <0.05

Table II shows in the case group (n=40), 26 patients (65%) were male and 14 (35%) were female, yielding a male-to-female ratio of 1.85:1. In the control group (n=20), 12 patients (60%) were male and 8 (40%) were female, with a male-to-female ratio of 1.5:1. [Table II]

Table – II: Gender distribution among the study subjects (*n*=60)

Gender	Case Group (n=40)	Control Group (n=20)
Male	26 (65%)	12 (60%)
Female	14 (35%)	8 (40%)
Male:Female Ratio	1.85:1	1.5:1

Table III shows in the case group,24(60%) were poor and 16(40%) were from the middle class. In control group, 11(55%) were poor, 8(40%) were from middle class and 1(5%) was rich. There was no significant difference in socioeconomic status between the case and control group (p-value is 0.164). [Table III]

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Table – III: Socioeconomic status of the patients in case and control (*n*=60)

	Socioeconomic status				
Group	**Frequency**	**Poor**	**Middle class**	**Rich**	**P value**
Case	40	24 (60%)	16 (40%)	0(0%)	0.164
Control	20	11 (55%)	8 (40%)	1(5%)	

A chi-square test was done to measure the level of significance.

Table IV shows triggering factors in the case group. Amongst 40 cases,12(30.0%) had asthma, 10(25.0%) had UTI, 10(25.5%) had upper RTI, 4(10.0%) had pneumonia, 3(7.5%) had peritonitis and 1(2.5%) had cellulitis. [Table IV]

Table – IV: Factors precipitating relapse in the case group (*n*=40)

Triggering Factors	Frequency (n=40)	Percent (%)
Asthma	12	30.0
Urinary Tract Infection (UTI)	10	25.0
Upper Respiratory Tract Infection (URTI)	10	25.0
Pneumonia	4	10.0
Peritonitis	3	7.5
Cellulitis	1	2.5

Table V shows in the case group 19(47.5%) patients had relapsed and in the control group 8(40.0%) patients had relapses. There was no significant difference between the case and control group (p-value was 0.068). [Table V]

Table – V: Number of patients with relapses during six (6) months

Outcome	Case group (n=40)	Control group (n=20)	P value
Number of patients with relapses	19(47.5%)	8(40%)	0.068

A chi-square test was done to measure the level of significance.

DISCUSSION

Idiopathic nephrotic syndrome (INS) is the most common glomerular disease of childhood, representing approximately 95% of children with nephrotic syndrome. Minimal change disease (MCD) is the most common among them, representing about 85% of cases[1]. More than 95% of children with minimal change disease respond to corticosteroid therapy[15]. However, more than 70% of children experience a relapse among them 40% have frequent relapse[3]. The present study shows that the mean SD age of case group was 5.28 2.10 years and control group 5.75 1.68 years. The range of age was 3-10 years in the case group and 4-11 years in the control group. There was no significant difference found in ages between the case and control group (p-value is 0.383). In some studies, the mean ages were 4.9 ± 2.9, 5.3± 3.9 and 5.8 ±3.3 years which are almost similar to the present study[4,5,14]. INS is more common in 2-8 years of age group[15]. In this study, out of40 patients 26 (65%) were male and 14(35%) were female found in the case group, and control group out of 20 patients 12(60%) were male and 8(40%) were female. Almost similar findings were found by Rees L et al. out of 59 patients 38 (64.41%) were girls and 21 (35.59%) were boys[16]. In El-Husseini A et al. out of 117 patients, 83(71.9%) were boys and 34(29.1%) were girls and in another study Tarshish P et al. 66% were male patients and 34% were female patients[4,5]. Case and control groups of the present study are gender-matched and both groups had equal male and female ratio which is in corollary with a standard textbook[15]. Socioeconomic status, in case group, 24(60%) were poor and 16(40%) were from middle class. In control group 11(55%) were poor, 8(40%) were from middle class and 1(5%) were rich. There was no significant difference in socioeconomic status between the case and control group (p-value is 0.164). Poor children are significantly more prone to develop INS including frequent relapse than solvent children[17]. In this study triggering factors in the case of group amongst 40 patients, 12(30.0%) had asthma, 10(25.0%) had UTI, 10(25.0%) had upper RTI and 4(10.0%) had pneumonia, 3(7.5%) had peritonitis and 1(2.5%) had cellulitis. In the study of Kopac M, all of the 9 initial episodes were SSNS (100 %) 18(58.1 %) out of 31 relapses were triggered by acute, mostly afebrile viral upper respiratory tract infections, and 2(6.5 %) out of 31 relapses were triggered by mosquito bites and 1 (3.2 %) by vaccination[3]. Gulati et al. reported that urinary tract infections may precipitate relapses in children with INS; a high frequency of such infections was found in their patients with frequent relapse and steroid resistance. The frequent viral and bacterial infections observed in developing countries may be associated with a tendency to relapse early and frequently. Another study conducted by Roy RR et al at BSMMU stated that 63% of study subjects had asthma/atopy, most of them were FRNS and steroid resistance and few of them were IFRNS[18]. The number of patients with relapsed during six (6) months in case group 19(47.5%) patients out of 40 had relapsed and in the control group 8(40%) out of 20 had relapses. No significant difference was found in the number of patients with relapses among the case and control groups (p-value is 0.068). Constantinescu et al and

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Trompeter et al reported in their study less-frequent relapses among their studied patients in relation to a longer duration of steroid therapy, but these results were statistically not significant; their findings were similar to ours[19,20]. On the other hand, Anderson et al. found a significant relationship between prolonged steroid therapy (>12 weeks) and reduction in relapse frequency[21].

Limitations of The Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

The study findings indicate that asthma, urinary tract infections, and upper respiratory tract infections were the most common triggering factors for relapse in children with frequent relapse nephrotic syndrome, observed in 30.0%, 25.0%, and 25.0% of cases respectively. While relapse was slightly more frequent in the case group (47.5%) compared to the control group (40.0%), this difference was not statistically significant (p = 0.068). These results suggest that although specific infections and comorbid conditions may precipitate relapse, their overall impact on treatment outcomes may not differ significantly between groups.

RECOMMENDATION

It is recommended that children with frequent relapse nephrotic syndrome be closely monitored for common triggering factors such as asthma and infections, particularly UTIs and upper respiratory tract infections. Early identification and prompt management of these conditions may help reduce the frequency of relapses and improve overall treatment outcomes.

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ORIGINAL ARTICLE

Surgical Management of Elongated Styloid Process: Outcomes in Eagle's Syndrome Patients

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ABSTRACT

Introduction: *Eagle's syndrome is marked by the elongation of the styloid process. It leads to various cervicofacial symptoms that can greatly affect a patient's quality of life. Even though it occurs in 4% of the general population, cases that show symptoms and require surgery are often hard to diagnose and treat. This study looks at surgical results and factors that affect complications after surgery in patients who had a styloidectomy.* ***Methods & Materials:*** *This is a retrospective analysis involving 100 patients who had a styloidectomy. Clinically diagnosed patients had their condition confirmed with 3D-CT scans or panoramic radiographs. Surgical approaches included intraoral (65%), extraoral (30%), and bilateral procedures (5%). Data were analysed using SPSS version 26, conducting logistic regression to find predictors of complications.* ***Results:*** *The majority of the patients were females, accounting for 60%, with a majority aged between 31 and 60 years (71%). Throat pain was the most common symptom (82%), followed by dysphagia (55%) and a foreign body sensation (48%). Complete symptom relief was seen in 68-83% of cases, depending on the type of symptom. Patients with symptoms lasting less than 6 months showed an 82.9% improvement, while those with symptoms lasting more than 12 months had a 63.9% improvement (p=0.012). Age over 60 years (OR=2.45, p=0.046) and bilateral surgery (OR=3.10, p=0.025) were significant predictors of complications.* ***Conclusion:*** *Styloidectomy offers excellent results for patients with Eagle's syndrome, especially with early surgical intervention leading to better outcomes. Age and bilateral surgery significantly affect complication rates, highlighting the need for careful patient selection and planning before surgery.*

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INTRODUCTION

Eagle's syndrome, first described by Watt Eagle in 1937, is a rare but clinically significant condition of elongation of the styloid process or calcification of the stylohyoid ligament complex[1]. The normal length of the styloid process is about 2.5 cm, and elongation is more than 3 cm[2]. While radiographic evidence of styloid elongation may be observed in approximately 4-7.3% of the general population, only 4-10.3% of those afflicted become symptomatic, making it a rare yet disabling disorder[3,4]. The syndrome most frequently affects middle-aged women, with a female-to-male ratio of 3:1, typically manifesting in the fourth and fifth decades of life[5]. The pathophysiology involves mechanical compression or irritation of the adjacent neurovascular structures, including the glossopharyngeal, trigeminal, facial, and vagus nerves, leading to a constellation of symptoms that comprises cervicofacial pain, dysphagia, otalgia, and a chronic foreign body sensation in the throat[6]. In extreme cases, the elongated styloid process can compress vascular tissues, leading to internal jugular vein stenosis and associated neurological deficits[7]. Diagnosis of Eagle's syndrome relies on clinical suspicion supported by radiological findings through panoramic radiographs, computed tomography (CT), or three-dimensional imaging[8]. However, the non-specificity of the symptoms tends to hamper the diagnosis because they overlap with temporomandibular joint disorders, trigeminal neuralgia, and other cervicofacial pain syndromes[9]. Such a diagnostic challenge frequently leads to delayed treatment, with the majority of patients having long-standing symptoms before undergoing adequate intervention. Conservative management, including anti-inflammatory medication, corticosteroids, and anticonvulsants, may be effective in the short term but is generally ineffective in the long term[10]. In recalcitrant cases, surgical management with styloidectomy

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remains the gold standard. There are various surgical approaches, from intraoral, extraoral, to minimally invasive procedures such as transoral robotic surgery (TORS)[11]. The choice of technique depends on patient anatomy, surgeon preference, and extent of styloid involvement. Despite the established success of surgical treatment, in-depth analyses of postoperative outcomes, including determinants of success and complication rates, are limited. Information on such parameters is crucial to optimize patient selection, surgical procedure, and postoperative management. This study assessed surgical outcomes in a large series of patients with Eagle's syndrome treated with styloidectomy, including determinants of success and postoperative complications. Comparing these outcomes, we expect to optimize therapies and improve patients' long-term outlook.

METHODS & MATERIALS

This retrospective study was conducted at Rajshahi Medical College, Rajshahi, Bangladesh from July, 2023 to June, 2024. The study involved 100 patients who underwent either intraoral or extraoral styloidectomy. The diagnosis was made clinically and confirmed radiologically using 3D-CT scans or panoramic radiographs. Patients presenting with classic Eagle's Syndrome symptoms such as cervicofacial pain, dysphagia, otalgia, or foreign body sensation were included. Exclusion criteria included patients with atypical symptoms or incomplete follow-up data. Data were extracted from hospital medical records, operative notes, radiographic images, and outpatient follow-up charts. Each patient was evaluated for preoperative symptoms, type and duration of surgery, length of hospital stay, complications, and postoperative outcomes.

Statistical Analysis

Data analysis was performed using SPSS version 26. Descriptive statistics were used to summarize demographic data, symptoms, surgical variables, and outcomes. Frequencies and percentages were calculated for categorical variables, while means and standard deviations were used for continuous variables. Logistic regression analysis was performed to identify factors independently associated with postoperative complications. Odds ratios (ORs) with 95% confidence intervals (CIs) were reported. A p-value <0.05 was considered statistically significant.

RESULTS

Table I shows the demographic details of the 100 patients involved in the study. Most patients were middle-aged, with 71% between 31 and 60 years old. The group had a higher number of females (60. Unilateral cases were more common (66%) than bilateral cases, which is typical for this condition. The higher percentage from rural areas (56%) indicates that the tertiary care center where the study took place.

Table – I: Patient Demographics Undergoing Surgical Management for Elongated Styloid Process (*n*=100)

Characteristic	Category	N	%
Age Group	18–30 years	14	14.0%
	31–45 years	36	36.0%
	46–60 years	35	35.0%
	>60 years	15	15.0%
Gender	Male	40	40.0%
	Female	60	60.0%
Side Involved	Unilateral	66	66.0%
	Bilateral	34	34.0%
Residence	Urban	44	44.0%
	Rural	56	56.0%

Table II outlines the symptoms seen in patients with Eagle's syndrome. Throat pain was the most common symptom (82%), followed by dysphagia (55%) and a sensation of a foreign body (48%). The high incidence of throat pain is linked to the elongated styloid process's position relative to the oropharyngeal structures. Otalgia affected 40% of patients, likely due to referred pain through the glossopharyngeal nerve. Tinnitus (11%) and headache (26%) were less common.

Table – II: Preoperative Symptom Distribution in Patients with Elongated Styloid Process (*n*=100)

Symptom	N	%
Throat pain	82	82.0%
Dysphagia	55	55.0%
Foreign body sensation	48	48.0%
Otalgia	40	40.0%
Neck pain	38	38.0%
Headache	26	26.0%
Tinnitus	11	11.0%
Others	7	7.0%

Table III represents that most patients (70%) had symptoms for 3-12 months before surgery. Among them, 42% had symptoms lasting 6-12 months. Only 10% underwent surgery within 3 months of symptom onset. This pattern may indicate delayed diagnosis, ineffective conservative treatment, or hesitance to seek surgery.

Table – III: Duration of Symptoms Before Surgical Management (*n*=100)

Duration	N	%
<3 months	10	10.0%
3–6 months	28	28.0%
6–12 months	42	42.0%
>12 months	20	20.0%

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Table IV shows surgical approaches for elongated styloid process management. The surgical techniques show a strong preference for the intraoral approach (65%), followed by extraoral styloidectomy (30%). The popularity of the intraoral method comes from its benefits, such as no external scars, direct view of the styloid tip, and potentially lower risks to major blood vessels. Only 5% of patients needed bilateral surgery, consistent with the rarity of symptomatic bilateral disease.

Table – IV: Surgical Approaches for Elongated Styloid Process Management (*n*=100)

Surgical Technique	N	%
Intraoral styloidectomy	65	65.0%
Extraoral styloidectomy	30	30.0%
Bilateral surgery	5	5.0%
Revision surgery	0	0.0%

Table V shows successful surgical outcomes across different symptoms. The highest rates of complete relief were for throat pain (82.9%) and otalgia (82.5%), followed by dysphagia (72.7%) and neck pain (63.2%). Partial relief was seen in 14.6-26.3% of cases, while treatment failure was low (2.5-10.5%).

Table – V: Overall Postoperative Symptom Relief Distribution (*n*=100)

Relief Category	Throat Pain (n=82)	Dysphagia (n=55)	Otalgia (n=40)	Neck Pain (n=38)
Complete Relief	68 (82.9%)	40 (72.7%)	33 (82.5%)	24 (63.2%)
Partial Relief	12 (14.6%)	12 (21.8%)	6 (15.0%)	10 (26.3%)
No Relief	2 (2.5%)	3 (5.5%)	1 (2.5%)	4 (10.5%)

Table VI reveals a clear link between symptom duration and surgical success. Patients with symptoms lasting less than 6 months saw an improvement of 82.9%, while those with symptoms lasting over 12 months had only a 63.9% improvement (p=0.012). This significant difference highlights the importance of timely surgical intervention. The decrease in improvement rates for longer symptom durations may reflect chronic inflammation, nerve sensitization, or irreversible tissue damage that develops over time.

Table – VI: Symptom Duration and Improvement After Surgery (*n*=100)

Duration Group	N	Mean Pre-op VAS	Mean Post-op VAS	Mean % Improvement	p-value
<6 months	38	8.2 ± 0.3	1.4 ± 0.5	82.9%	0.012
6–12 months	42	8.5 ± 0.4	2.2 ± 0.6	74.1%	
>12 months	20	8.6 ± 0.3	3.1 ± 0.5	63.9%	

Tables VII(A) and VII(B) pinpoint significant predictors of postoperative complications from multivariate analysis. Age over 60 years (OR=2.45, p=0.046) and bilateral surgery (OR=3.10, p=0.025) were identified as independent risk factors for complications. The higher risk in older patients may be due to reduced healing ability, existing health issues, and fragile tissue. The greater complication rate after bilateral surgery likely reflects its increased complexity and longer duration. The extraoral method showed a trend toward more complications (OR=1.85), suggesting both methods are generally safe when performed by skilled surgeons.

Table – VII (A): Logistic Regression Analysis of Factors Associated with Postoperative Complications (*n*=100)

Predictor Variable	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Age > 60 years	2.45	1.02 – 5.90	0.046
Male gender	1.12	0.52 – 2.41	0.765
Bilateral surgery	3.10	1.15 – 8.33	0.025
Extraoral approach	1.85	0.87 – 3.94	0.113
Symptom duration >12 months	2.21	0.94 – 5.17	0.071
Rural residence	0.93	0.43 – 2.01	0.857

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Table – VII (B): Interpretation of Logistic Regression Analysis of Factors Associated with Postoperative Complications (*n*=100)

Predictor Variable	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value	Interpretation
Age > 60 years	2.45	1.02 – 5.90	0.046	Patients older than 60 years have 2.5 times higher odds of complications. This is statistically significant, indicating a higher risk with increasing age.
Male gender	1.12	0.52 – 2.41	0.765	No significant association. Male patients have similar odds of complications compared to females.
Bilateral surgery	3.10	1.15 – 8.33	0.025	Statistically significant; bilateral surgery triples the odds of complications compared to unilateral surgery.
Extraoral approach	1.85	0.87 – 3.94	0.113	Not statistically significant, but shows a trend towards increased risk with this surgical approach.
Symptom duration >12 months	2.21	0.94 – 5.17	0.071	Not statistically significant; longer symptom duration may increase risk, but evidence is inconclusive.
Rural residence	0.93	0.43 – 2.01	0.857	No significant effect; living in rural areas does not impact the odds of postoperative complications.

DISCUSSION

This study provides insights into the surgical management of Eagle's syndrome, reporting excellent results with styloidectomy and highlighting key factors influencing the outcome and complication rates of the procedure. Our findings validate the established effectiveness of the surgery for this challenging condition and provide evidence-based advice for clinical practice. The gender and age distribution evident in our cohort is following established epidemiological patterns, with female predominance (60%) and a peak incidence in middle age (71% 31-60 years). This is in agreement with Badhey et al., who have reported similar gender and age distributions[12]. Dominance by unilateral involvement (66%) is in keeping with the typical presentation of Eagle's syndrome, though bilateral disease, though rarer, presents special management challenges as brought out by our complication analysis[13]. The patient's symptom profile is that of the classic presentation, with the largest complaint being pain in the throat (82%). The high frequency points out that Eagle's syndrome must be a part of the differential diagnosis of chronic pharyngeal pain, particularly when conservative therapy fails[14]. The marked prevalence of dysphagia (55%) and foreign body sensation (48%) corroborates the mechanical effect of styloid elongation on pharyngeal structure, consistent with anatomical studies by Fusco et al., demonstrating proximity to essential mechanisms of swallowing[15]. The distribution of surgical technique, favoring intraoral styloidectomy (65%), reflects present surgical preference based on a number of advantages, including improved cosmesis, direct visualization of the styloid tip, and reduced risk to large cervical vessels[16]. Both intraoral and extraoral approaches with similar good outcomes and without difference in the complication rate (OR=1.85, p=0.113), which corroborates with Ravin et al., that surgeon experience and selection of patient are more critical than the precise surgical approach employed[17]. The reported symptom relief rates (63.2-82.9% complete relief) are comparable to a more recent systematic review by Hassani et al., with success rates ranging from 80-95% for different surgical interventions[18]. The better results for otalgia and throat pain vs. neck pain might be explained by the shorter anatomical association between styloid elongation and pharyngeal/otic nerve courses vs. the multifactorial pathophysiology of cervical pain syndromes[19]. Among the most significant conclusions of our study is the adverse correlation between symptom duration and surgical outcomes, with those having symptoms for less than 6 months having significantly better outcomes (82.9% vs 63.9% improvement, p=0.012). This observation brings support to the opinion that chronic styloid irritation may lead to permanent neuroplastic alterations or tissue fibrosis, diminishing sensitivity to treatment[20]. This data favors earlier surgery in carefully selected patients over prolonged conservative trials. The finding of age greater than 60 years (OR=2.45) and bilateral surgery (OR=3.10) as independent predictors for complications is valuable in preoperative counseling and surgical planning.

The increased risk of complications in elderly patients is likely to be secondary to age-related factors like impaired tissue healing ability, increased comorbid conditions, and higher anesthetic risks[21]. The increased risk with bilateral procedures justifies caution in patient selection and consideration of a staged procedure in selected cases[11]. The overall low complication rate validates the safety profile of styloidectomy by experienced surgeons in appropriately selected patients. The absence of significant vascular or neurological complications in our series attests to careful preoperative planning and rigid adherence to established surgical principles.

Limitations of the Study

This study has possible selection bias and no standardized follow-up protocols. The lack of tools to assess quality of life and evaluate long-term outcomes beyond the immediate postoperative period limits the overall understanding of the treatment's impact. Additionally, the small number of cases with bilateral disease and the absence of a control group might affect how widely the findings can be applied.

CONCLUSION

Styloidectomy shows excellent results for patients with Eagle's syndrome, with complete symptom relief in 63-83% of cases. Early surgery, especially within 6 months of symptom onset, leads to much better results compared to delayed treatment. Being over 60 years old and having the disease on both sides are significant risk factors for complications after surgery. This makes careful patient selection and individualized surgical planning important. Both intraoral and extraoral methods have similar safety and effectiveness when performed by skilled surgeons.

RECOMMENDATIONS

Future studies should focus on prospective multicenter studies that use standardized quality-of-life assessment tools and longer follow-up periods to check how long the treatment works. Investigating minimally invasive techniques, such as transoral robotic surgery and endoscopic methods, could lead to better results with less risk. Developing predictive models that take into account patient factors, symptom details, and imaging information could help with patient selection and surgical planning.

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ORIGINAL ARTICLE

Comparative Analysis of Demographics, Risk Factors, and Procedural Outcomes in Combo Versus Conventional 6Fr Technique for Transradial PCI

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ABSTRACT

Introduction: *Transradial percutaneous coronary intervention (PCI) has become the preferred approach for coronary revascularization due to its association with reduced bleeding complications and faster patient recovery compared to the transfemoral route. Among various techniques, the conventional 6 French (6Fr) approach is widely used; however, newer methods like the combo technique have been developed to potentially improve procedural efficiency.* ***Methods & Materials:*** *This cross-sectional observational study was conducted in the Department of Cardiology at the National Institute of Cardiovascular Diseases (NICVD) in Dhaka, Bangladesh, between July 2020 and June 2021. Study subjects were divided into two groups, Group I: Transradial PCI using —the Combo technique, and Group II: Transradial PCI using the conventional 6 Fr guide catheter technique, and in each group, 64 patients were included. Data were analyzed using SPSS (Statistical Package for Social Sciences) Version 24.0.* ***Result:*** *The combo technique group had a shorter mean procedure time (34.2 ± 5.6 minutes vs. 36.7 ± 6.2 minutes, p=0.041), reduced fluoroscopy time (8.3 ± 2.1 minutes vs. 9.7 ± 2.5 minutes, p=0.015), and lower contrast volume used (145.5 ± 28.7 mL vs. 158.3 ± 30.1 mL, p=0.036) compared to the conventional group. Procedural success rates were similar (96.9% vs. 95.3%, p=0.646), with fewer radial artery spasms in the combo group (12.5% vs. 28.1%, p=0.047).* ***Conclusion:*** *The combo technique demonstrated superior procedural efficiency with significantly shorter procedure and fluoroscopy times and reduced contrast volume while maintaining comparable procedural success and complication rates to the conventional 6Fr method. These findings support the combo approach as a safe and effective option for transradial PCI.*

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INTRODUCTION

Percutaneous coronary intervention (PCI) via the trans-radial approach (TRA) has gained prominence over the past two decades, largely due to its superior safety profile, particularly in reducing access-site complications and improving patient comfort when compared to the transfemoral approach (TFA) [1]. The 6 French (6Fr) system has been the standard sheath size used for TRA PCI. However, advances in interventional cardiology and catheter technologies have led to the development of the "combo technique," which aims to combine the safety benefits of smaller sheath profiles with the capability of performing complex interventions through a radial route [2]. TRA is now widely regarded as the default access route for PCI, owing to reduced bleeding complications, early ambulation, and decreased mortality in acute coronary syndrome (ACS) settings [3,4]. However, procedural challenges persist, particularly when complex lesions or multivessel interventions are required. The conventional 6Fr technique

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allows the use of a wide variety of interventional tools but may increase the risk of radial artery occlusion (RAO), especially in patients with smaller radial arteries or pre-existing arterial spasms [5]. Conversely, the combo technique, which may include sheathless guide catheters or sheath-integrated systems (like Glidesheath Slender), seeks to mitigate this risk by reducing the outer diameter of the device while preserving inner lumen capacity [6]. Demographic variables such as age, sex, and body surface area (BSA) are critical in selecting the optimal transradial strategy. Studies have shown that women, older adults, and individuals with lower BSA are more susceptible to TRA-related complications, particularly RAO [7]. A comprehensive comparison of these variables between the combo and conventional 6Fr techniques may guide clinical decision-making, especially in high-risk cohorts. Procedural outcomes, including procedural success, fluoroscopy time, contrast volume, and incidence of access site complications, are essential benchmarks when evaluating newer techniques like the combo approach. Previous studies have demonstrated that combo techniques can maintain procedural efficacy while reducing radial trauma and spasm [8]. Moreover, these techniques reduce procedural discomfort and allow for quicker hemostasis, potentially improving patient satisfaction and turnover time in high-volume centers. The interplay between procedural technique and outcome is further complicated in complex PCI scenarios, including bifurcation lesions, chronic total occlusions (CTOs), and left main interventions. In these settings, device support, backup catheter strength, and lumen compatibility become paramount. The combo technique, by enabling the use of larger inner lumen catheters with smaller outer diameters, appears to offer an ideal balance between safety and capability, although real-world comparative data remain limited [9]. Despite the theoretical advantages of combo techniques, robust comparative studies evaluating their performance against conventional 6Fr methods in varied demographic and risk groups are scarce. The aim of this study is to compare the demographics, clinical risk factors, and procedural outcomes between the combo technique and the conventional 6Fr technique used in transradial percutaneous coronary intervention (PCI).

METHODS & MATERIALS

This cross-sectional observational study was carried out in the Department of Cardiology at the National Institute of Cardiovascular Diseases (NICVD), Dhaka, Bangladesh, from July 2020 to June 2021.Based on inclusion and exclusion criteria, patients of ischaemic heart disease admitted into NICVD undergoing coronary angiogram followed by ad-hoc PCI or patients admitted for direct PCI (CAG done previously through trans-radial approach) were included in the study population. The sample was collected by purposive sampling method. Study subjects were divided into two groups, Group I: Transradial PCI using ―the Combo‖ technique, Group II: Transradial PCI using conventional 6 Fr guide catheter technique, and in each group, 64 patients were included. The study protocol was approved by the Ethical Review Committee of NICVD. Informed written consent was taken from each patient or near relatives. Data were collected using a pre-designed data collection sheet and subsequently compiled for statistical analysis and interpretation. The study data were processed and analyzed both manually and with SPSS (Statistical Package for Social Sciences) Version 24.0. Quantitative variables were expressed as mean ± standard deviation, and comparisons were performed using the Z-test and Student's t-test, as appropriate.

Qualitative data were expressed as frequency and percentage, and comparisons between groups were made using the chi-square (χ^2) test. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Table I shows a comparison of the study group according to age distribution. The highest frequency was 51-60 years age, 29 and 23 in group I and group II, respectively and that is followed by 41- 50 years age. The mean ± SD of group I and group II was 52.60 ±7.3 years and 51.89 ±8.5 years, but this difference was not statistically significant (p=0.608). [Table I]

Table – I: Comparison of the study groups according to their age (*n*=128)

Age (in years)	Group-I (n=64)		Group-II (n=64)		*p*-value
	N	%	n	%	
≤40	4	6.3	7	10.9	0.608^{ns}
41-50	21	32.8	24	37.5	
51-60	29	45.3	23	35.9	
61-70	10	15.6	10	15.6	
Mean ± SD	52.60 ±7.3		51.89 ±8.5		

Group I- Combo technique group; Group II – Conventional 6Fr group; Independent sample t-test; ns – non-significant

Table II shows, that among the 115 male patients, 58 belong to Group I and 57 to Group II. In the female group, 6 patients belonged to Group I, whereas 7 were to Group II. [Table II]

Table – II: Distribution of patients by gender and study group (*n*=128)

Gender	Group I	Group II	Total
Male	58	57	115
Female	6	7	13
Total	64	64	128

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Table III shows a comparison of the underlying diagnosis of the patients undergoing PCI in studied groups, STEMI occurred in almost half of the patients, in group I 26 patients, and in group II, 28 patients. NSTEMI comprised 24 patients in group I and 21 patients in group II and there was no significant difference between this group (p=0.857). [Table III]

Table – III: Comparison of underlying diagnosis of studied groups (*n*=128)

Diagnosis	Group-I (n=64) n(%)	Group-II (n=64) n(%)	*p*-value
Unstable angina	14(21.9)	15(23.4)	0.857ns
NSTEMI	24(37.5)	21(32.8)	
STEMI	26(40.6)	28(43.8)	

Group I- Combo technique group; Group II – Conventional 6Fr group; Chi-square test ns – non-significant

Table IV presents a comparison of complications between the study groups. Minor hematoma occurred in 3 patients (4.7%) in Group I and 6 patients (9.4%) in Group II, with no statistically significant difference (p = 0.492). Radial artery spasm was observed in 8 patients (12.5%) in Group I and 18 patients (28.1%) in Group II, a difference that was statistically significant (p = 0.047). Radial artery occlusion and persistent pain occur in 9 (7%) and 17(13.3%) patients respectively. Again, the difference between group I and group II for these complications was not statistically significant, with p-values of 1.00 and 0.435, respectively. [Table IV]

Table – IV: Comparison of complications among study groups (*n*=128)

Complications	Group-I (n=50)		Group-II (n=50)		*p*-value
	n	%	n	%	
Hematoma	3	4.7	6	9.4	b0.492ns
Radial artery spasm	8	12.5	18	28.1	a 0.047s
Radial artery occlusion	4	6.3	5	7.8	b1.00ns
Persistent pain (up to 48 hours)	7	10.9	10	15.6	a0.435ns

Group I- Combo technique group; Group II – Conventional 6Fr group; a- Chi-square test b- Fisher's exact ns – non-significant; s- significant

Table V showed in group I, 48 (75 %) patients were hypertensive, whereas 47 (73.5%) patients in group II, and this difference was not statistically significant (p=1.00). For DM, no significant difference (p=0.716) existed between group I and group II (40.6% vs 35.9%). 29 (45.3%) patients in group I and 37 (57.8%) patients in group II were dyslipidaemic, and this difference was not statistically significant (p=0.216). Again, no significant difference was present in smoking and family history of CAD among these two groups, with p-values of 0.859 and 0.317 respectively. Overall, there was no significant difference present in traditional cardiovascular risk factors between these two groups. [Table V]

Table – V: Comparison of the study groups according to their risk factors (*n*=128)

Cardiac risk factor profiles	Group-I (n=64)		Group II (n=64)		*p*-value
	n	%	n	%	
Hypertension	48	75	47	73.4	1.00ns
Diabetes mellitus	26	40.6	23	35.9	0.716 ns
Dyslipidaemia	29	45.3	37	57.8	0.216 ns
Smoking	27	42.2	29	45.3	0.859 ns
Family history of CAD	20	31.3	14	21.9	0.317 ns

Group I- Combo technique group; Group II – Conventional 6Fr group; Chi-square test ns – non-significant

Table – VI: Comparison of Procedural Outcomes Between Combo and Conventional 6Fr Technique Groups (*n*=128)

Procedural Outcome	Group I (*n=64)*	Group II *(n=64)*	p-value
Mean procedure time (minutes)	34.2 ± 5.6	36.7 ± 6.2	0.041*
Fluoroscopy time (minutes)	8.3 ± 2.1	9.7 ± 2.5	0.015*
Contrast volume used (mL)	145.5 ± 28.7	158.3 ± 30.1	0.036*
Procedural success (%)	62 (96.9%)	61 (95.3%)	0.646ns

*Group I = Combo technique group; Group II = Conventional 6Fr group; *p < 0.05 = statistically significant; ns = Not significant*

Table VI presents a comparison of key procedural outcomes between the Combo and Conventional 6Fr technique groups. The Combo group demonstrated significantly shorter mean procedure time (34.2 ± 5.6 vs. 36.7 ± 6.2 minutes, p=0.041), reduced fluoroscopy time (8.3 ± 2.1 vs. 9.7 ± 2.5 minutes, p=0.015), and lower contrast volume usage (145.5 ± 28.7 vs. 158.3 ± 30.1 mL, p=0.036). Procedural success was comparable between the groups, with no statistically significant difference (96.9% vs. 95.3%, p=0.646).

DISCUSSION

This study compared the demographic characteristics, cardiac risk factors, procedural outcomes, and complication profiles of patients undergoing trans-radial PCI using the combo technique versus the conventional 6Fr technique. The findings suggest that while both groups had comparable baseline characteristics, the combo technique demonstrated superior procedural efficiency and lower complication rates in certain parameters. In terms of age distribution, the majority of patients in both groups were in the 51–60 year range, with mean ages of 52.6 ± 7.3 and 51.89 ± 8.5 years for the combo and conventional groups, respectively. This age trend aligns with previous reports indicating that coronary artery disease (CAD) tends to manifest more commonly in middle-aged populations undergoing PCI [10,11]. Gender distribution was male-dominant in both groups (89.8% male overall), consistent with existing data showing higher rates of transradial PCI among males, possibly due to smaller radial artery diameter and higher spasm rates in females [1,3]. Risk factor analysis revealed a high prevalence of hypertension (74.2%), diabetes (38.2%), dyslipidemia (51.6%), and smoking (43.8%) across both groups, with no statistically significant intergroup differences. These findings are comparable to those observed in earlier trials, which found similar comorbid burdens in transradial cohorts [12]. Additionally, a multicenter analysis by Valgimigli et al. reaffirmed that such traditional cardiovascular risk profiles remain common among PCI patients regardless of access technique [13]. Notably, procedural outcomes favored the combo technique. Mean procedure time, fluoroscopy time, and contrast volume were significantly lower in the combo group compared to the conventional group. These outcomes are consistent with studies by Rigattieri et al. and Rao et al., who observed that modifications or hybrid approaches in trans-radial techniques can reduce radiation exposure and contrast use without compromising procedural success [14,15]. Reduced fluoroscopy time is of clinical significance as it lowers both operator and patient radiation exposure, aligning with the ALARA (As Low As Reasonably Achievable) principle [16]. Although procedural success rates were high in both groups (96.9% vs. 95.3%), complication rates showed some differences. Radial artery spasm was significantly lower in the combo group (12.5% vs. 28.1%, p = 0.047), likely due to the refined sheath-catheter interface and smoother insertion profile of the combo system. This is consistent with the work of Pancholy et al., who found that reducing radial artery trauma through sheathless or low-profile techniques significantly reduces spasms and subsequent complications [5]. Other complications, including hematoma, radial artery occlusion (RAO), and persistent pain, were more frequent in the conventional group, though not statistically significant. Previous research indicates that smaller sheath sizes and improved procedural ergonomics help reduce RAO and vascular complications, which supports the current findings [17]. Furthermore, the lower incidence of hematoma and access-site pain in the combo group aligns with recent reports suggesting enhanced patient comfort and faster recovery with minimally invasive radial techniques [18].

Limitations of The Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

The combo technique demonstrated superior procedural efficiency with significantly shorter procedure and fluoroscopy times and reduced contrast volume, while maintaining comparable procedural success and complication rates to the conventional 6Fr method. These findings support the combo approach as a safe and effective option for transradial PCI.

RECOMMENDATION

Based on the findings, it is recommended to consider the combo technique as a preferred option for transradial PCI due to its improved procedural efficiency and comparable safety profile. Further larger-scale studies are encouraged to validate these results and assess long-term outcomes.

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ORIGINAL ARTICL

Short-Term Functional Outcomes of Total Hip Replacement in Patients with Osteoarthritis — A Prospective Study

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ABSTRACT

Introduction: *Total hip replacement (THR) is a well-established surgical intervention for advanced osteoarthritis aimed at alleviating pain and restoring joint function. Evaluating short-term functional outcomes is critical to understanding the immediate benefits of the procedure and identifying factors influencing recovery. Improvements in mobility, pain relief, and quality of life are key indicators of success. This study aimed to assess the short-term functional outcomes of Total hip replacement (THR) in osteoarthritis patients.* ***Methods & Materials:*** *This prospective observational study was conducted at the Department of Orthopedics, Dhaka National Medical College, Dhaka, Bangladesh, from January 2014 to December 2024. A total of 30 patients of osteoarthritis managed by Primary total hip replacement were enrolled purposively. Outcomes were assessed clinically and functionally using the Modified Harris Hip Score. Data were analyzed using MS Office tools.* ***Results:*** *Avascular necrosis was the most common indication for hip replacement, accounting for 68.3% of cases. Postoperative complications included superficial infections (6.7%), limb length discrepancy (5.0%), foot drop (3.3%), and dislocation (1.7%). The mean Modified Harris Hip Score improved significantly from 31.4 ± 5.3 preoperatively to 87.6 ± 7.6 postoperatively ($p < 0.001$). Grading of the score showed that 63.3% of cases achieved excellent results, with 21.7% good, 11.7% fair, and 3.3% poor outcomes.* ***Conclusion:*** *The short-term functional outcomes of total hip replacement in osteoarthritis patients demonstrate significant improvement in both clinical and functional aspects. With minimal complications and a high percentage of excellent and good results, this procedure proves effective in enhancing patients' quality of life.*

Keywords: *Avascular necrosis, Functional outcomes, Limb length discrepancy, Osteoarthritis, Pain, Total hip replacement*

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INTRODUCTION

Total hip replacement (THR) is a highly effective procedure for patients suffering from hip joint deterioration caused by various conditions. It alleviates pain, improves mobility, restores limb length, and ensures stability while re-establishing the normal mechanics of the hip joint, significantly enhancing the patient's quality of life[1]. A stable, mobile, and painless hip is essential for normal locomotion. Currently, osteoarthritis is the most prevalent condition affecting the hips of the adult population, leading to severe hip pain, restricted movement, and disruptions in daily activities[2]. Primary THR has revolutionized patient outcomes by substantially improving both immediate and long-term results in terms of pain relief and functionality in osteoarthritic hips[3]. Functional improvements, including enhanced gait and range of motion, have been documented in numerous studies[4,5]. Currently, total hip arthroplasty (THA) is the most frequently performed joint replacement procedure, with its demand expected to grow exponentially in the coming years[6,7]. Successful THA requires secure prosthesis fixation to the bone, achieved either through polymethylmethacrylate (PMMA) cement or by bone ingrowth into a porous coating on the implant, leading to "biologic" fixation. Historically, the first recorded primary THR was performed by Phillip Wiles in London in 1938[8]. The operative technique underwent significant advancements in the 1950s, spearheaded by McKee and Farrar. Sir John Charnley further revolutionized total hip replacement (THR) by introducing low-friction arthroplasty, applying biomechanical principles of hip joint function, and refining the procedure, earning him the title of the "father of modern total hip arthroplasty"[9,10]. The Harris Hip Score, a reliable tool for evaluating clinical and functional outcomes, assesses pain, functional disabilities, deformities, and range of motion pre- and postoperatively[11]. This study involved 30 consecutive patients with unilateral or bilateral osteoarthritis, clinically and functionally assessed preoperatively and postoperatively using the Modified Harris Hip Score following primary THR.

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METHODS & MATERIALS

This was a prospective observational study that was conducted at the Department of Orthopedics, Dhaka National Medical College, Dhaka, Bangladesh, from January 2014 to December 2024. A total of 30 patients with osteoarthritis who underwent primary total hip replacement were purposively enrolled in this study. Clinical and functional assessments were performed preoperatively and postoperatively using the Modified Harris Hip Score[11]. The study included individuals with primary osteoarthritis of the hip, secondary osteoarthritis due to avascular necrosis, ankylosing spondylitis, and rheumatoid arthritis. Exclusion criteria comprised patients less than 40 years of age, those with active hip joint infections, previous failed hip surgeries (including Amputation, bipolar prosthesis, osteotomy, Dynamic hip screw, Proximal femoral nail), bone tumors involving the proximal femur and acetabulum, and neuropathic hip joints. Data analysis was performed using MS Office tools.

RESULT

The age distribution of our participants showed that the majority (60.0%) were in the 40–50 years age group, followed by 20.0% in the 51–60 years group. Additionally, 13.3% of cases were aged 61–70 years, while 6.7% were aged 71 years or older. [Table I]

Table – I: Age distribution of cases

Age (Years)	n	%
40-50	18	60.0%
51-60	6	20.0%
61-70	4	13.3%
≥71	2	6.7%

The figure shows the gender distribution of the study population. Out of the total participants, 63% (n=19) were male, while 37% (n=11) were female. This indicates a male predominance among the individuals included in the study. [Figure 1]

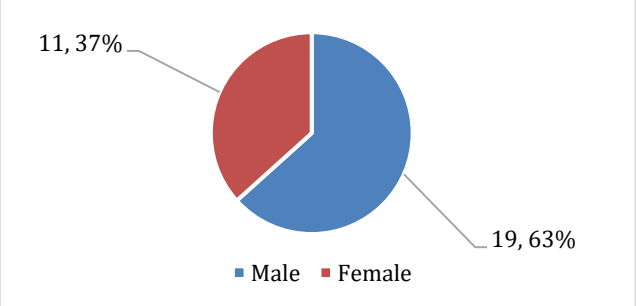

Figure – 1: Gender Distribution of Study Participants

This figure illustrates the preoperative diagnoses of patients included in the study. Avascular necrosis was the most common condition, accounting for 68.3% of cases. Primary osteoarthritis was observed in 16.7%, followed by ankylosing spondylitis in 8.3%, and rheumatoid arthritis in 6.7% of patients. These findings indicate that avascular necrosis was the leading indication for surgical intervention in the study population. [Figure 2].

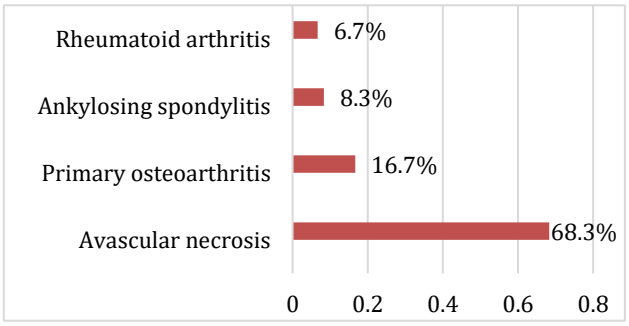

Figure – 2: Indication for Total hip replacement

The distribution of postoperative complications observed among the study participants. The most common complication was superficial infection, reported in 4 patients (6.7%). Limb length discrepancy was noted in 3 patients (5.0%), followed by foot drop in 2 patients (3.3%). Dislocation was the least frequent complication, occurring in only 1 patient (1.7%). [Table II].

Table – II: Post-operative complications

Complications	n	%
Limb length discrepancy	3	5.0%
Foot drop	2	3.3%
Superficial infection	4	6.7%
Dislocation	1	1.7%

This table shows the mean Modified Harris Hip Scores before and after surgery. The pre-operative mean score was 31.4 ± 5.3, which significantly improved to 87.6 ± 7.6 post-operatively. The difference was statistically significant ($p < 0.001$), indicating a marked improvement in hip function following the surgical intervention. [Table III].

Table – III: Modified Harris hip scores in mean

Status	Mean ±SD	p-value
Pre-operative	31.4±5.3	<0.001
Post-operative	87.6±7.6	

The figure illustrates the functional outcomes of patients evaluated by the Modified Harris Hip Score after surgery. A majority of patients (63.3%) achieved an excellent outcome, while 21.7% had a good outcome. 11.7% of patients were categorized as having a fair result, and only 3.3% had a poor outcome. This distribution indicates a high rate of favorable functional recovery among the study population. [Figure 3].

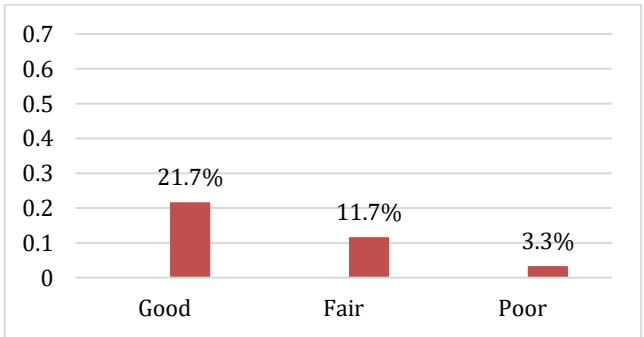

Figure – 3: Grading of modified Harris hip score

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DISCUSSION

The age distribution of our participants showed that the majority were in the 40–50 years age group, followed by 20.0% in the 51–60 years group. A similar age distribution trend was observed in the study of Jayaram, Shivananda and Gazanfar (2017)[12]. BK Dhaon et al. conducted a study among 34 patients, where 75% patients were male that was two-third of that study population[13]. In our study, nearly two-thirds of the participants were male, which was similar to the study of BK Dhaon et al. In the present study, avascular necrosis (20, 68.3%) emerged as the leading indication for hip replacement, followed by primary osteoarthritis (5, 16.7%) and ankylosing spondylitis (3, 8.3%). A similar trend was observed in a study by RC Siwach et al.[14]. That study reported that 360(72%) patients had avascular necrosis, 10(10%) patients had primary osteoarthritis and 20 (4%) patients were suffering from ankylosing spondylitis. Postoperative complications in our study included superficial infections, which were the most common, followed by limb length discrepancy, foot drop, and dislocation. Superficial infections were observed in the majority of cases, while limb length discrepancy occurred less frequently, followed by foot drop and dislocation, which were the least common complications. In another study, Qin et al. reported that major complications, longer postoperative stays, non-home discharges, and unplanned readmissions contributed to the increased cost of care for total hip arthroplasty following hip fractures[15]. In this study, the mean modified Harris Hip Scores showed a significant improvement, rising from a pre-operative mean of 31.4 ± 5.3 to a post-operative mean of 87.6 ± 7.6, with a p-value of <0.001. Comparative results were observed in a previous study conducted by Jayaram, Shivananda and Gazanfar (2017)[12]. In our study, the grading of the Modified Harris Hip Score revealed that 63% of study population achieved excellent results and 21.7% patients had good outcomes after surgery. Fadlalla et al conducted a study on Young Adults Patients who underwent Total Hip Replacement surgery in the year 2024 and found that, the majority of patients (65.6%) reported excellent functional outcomes and 28.1% patients reported good outcomes that reflects analogous of these two studies[16].

Total hip replacement is considered one of the most successful surgical procedures, offering excellent pain relief and restoration of function for patients with severe hip osteoarthritis[17]. The incidence of total hip replacement is expected to rise significantly in the coming decades[18,19]. However, it remains a major surgical intervention, carrying an increased risk of postoperative morbidity and mortality, especially among older populations[20]. Total Hip Replacement (THR) is a highly effective procedure for relieving pain and improving mobility in patients with hip joint diseases like avascular necrosis and osteoarthritis. It involves replacing the damaged joint with prosthetic components, leading to significant functional improvement. Though generally safe, complications like infection, dislocation, and foot drop may occur. With proper surgical technique and rehabilitation, most patients regain mobility within weeks, and implants typically last 15–20 years.

Conclusion

The short-term functional outcomes of total hip replacement in patients with osteoarthritis showed significant improvement in both clinical and functional measures. Avascular necrosis was the predominant indication for surgery, and the overall complication rate was relatively low. The substantial improvement in the Modified Harris Hip Score reflects the success of the procedure in restoring function and alleviating pain. Most patients experienced excellent or good outcomes, highlighting the effectiveness of total hip replacement in improving the quality of life for osteoarthritis patients.

Recommendation

This manuscript presents a well-conducted prospective study that effectively highlights the short-term functional outcomes of total hip replacement in osteoarthritis patients. The results are clearly presented, with statistically significant improvements in hip function and low complication rates. The study adds valuable evidence from a local context and supports the global literature on the efficacy of THR. I recommend this article for publication after minor revisions to improve language clarity and ensure consistent formatting throughout the manuscript.

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Conflict of interest: None declared.

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APPENDIX

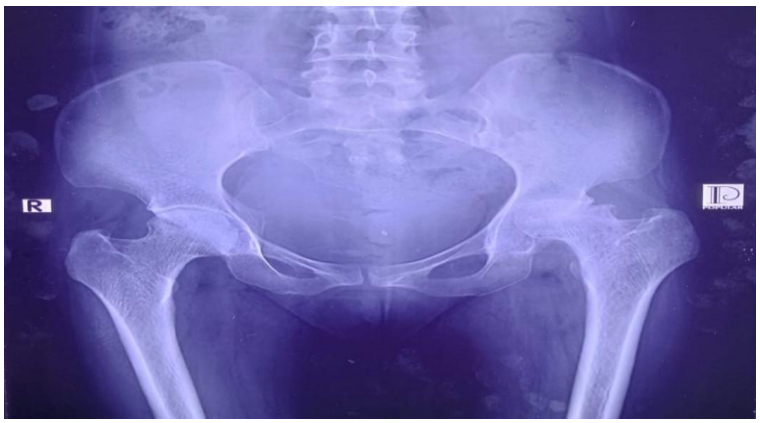

Figure – 4: X-ray of Pelvis and both Hip Joints - Anteroposterior (AP) View (Pre-operative)

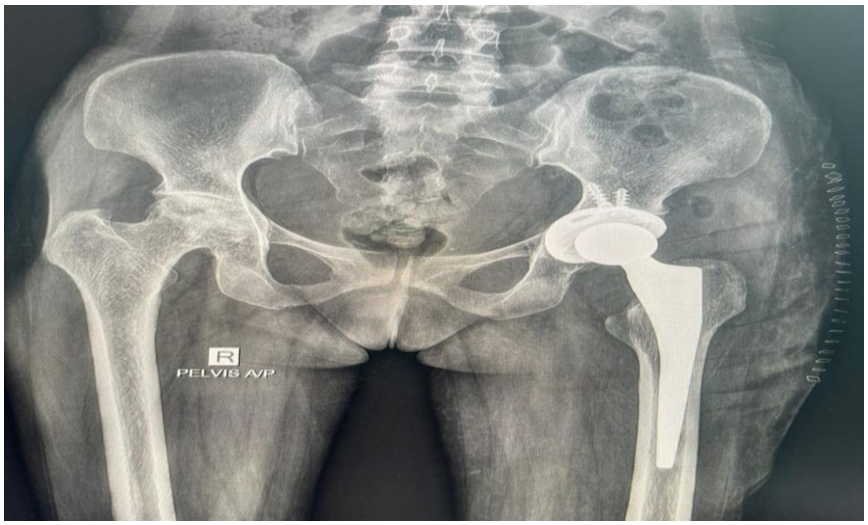

Figure – 5: X-ray of Pelvis and both Hip Joints (AP View) with Right Total Hip Replacement (Pre-Operative)

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ORIGINAL ARTICLE

Electrocardiographic Markers as Predictors of Pulmonary Arterial Hypertension in Children with Acyanotic CHD

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ABSTRACT

Introduction: *Pulmonary arterial hypertension (PAH) is a life-threatening complication of uncorrected acyanotic congenital heart disease (CHD). While right heart catheterization (RHC) is the diagnostic gold standard, its invasive nature and limited accessibility in low-resource settings underscore the need for alternative tools. This study aims to evaluate the diagnostic utility of electrocardiography (ECG) markers in predicting PAH severity among children with acyanotic CHD in Bangladesh.* ***Methods & Materials:*** *This cross-sectional analytical study included 83 children (age range: 0.6–17 years) diagnosed with acyanotic CHD at a tertiary care hospital. All participants underwent ECG and cardiac catheterization to assess mean pulmonary artery pressure (mPAP). ECG parameters were analyzed for diagnostic accuracy and correlation with mPAP.* ***Results:*** *PAH was identified in 72.3% of patients, with 40.96% exhibiting severe PAH. R ≥ 7 mm in V1, S ≥ 7 mm in V5, and R V1 + S V5 ≥ 10 mm demonstrated the highest sensitivities (85.0%, 88.3%, and 83.3%, respectively). The composite R V1 + S V5 had the strongest correlation with mPAP (r = 0.68, p < 0.001). All ECG markers assessed showed statistically significant associations with mPAP.* ***Conclusion:*** *ECG parameters—particularly R in V1, S in V5, and their composite—show strong diagnostic value in predicting PAH in children with acyanotic CHD. ECG offers a feasible, cost-effective screening alternative in resource-limited settings.*

Keywords: *Acyanotic congenital heart disease, Pulmonary arterial hypertension, Electrocardiography, Right ventricular hypertrophy, Pediatric cardiology*

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INTRODUCTION

Congenital heart disease (CHD) represents the most common birth defect globally, affecting approximately 9–10 per 1,000 live births [1,2]. Over recent decades, its prevalence has increased, particularly in low- and middle-income countries (LMICs), due to improvements in diagnostic technologies and heightened public and clinical awareness. A systematic review and meta-analysis encompassing 260 studies globally revealed an increasing trend in CHD prevalence, rising to approximately 9.41 per 1,000 live births between 2010 and 2017, with Asia demonstrating some of the highest reported rates [1]. This global scenario underscores CHD's substantial contribution to pediatric morbidity and mortality, particularly in regions with limited access to healthcare infrastructure, timely surgical intervention, and long-term follow-up [3]. In Bangladesh, the reported incidence of CHD markedly exceeds the global average, estimated at approximately 25 per 1,000 live births [4]. Such elevated figures reflect improved detection rates facilitated by more widespread echocardiography availability and better-trained health professionals. Among the pediatric CHD population in Bangladesh, acyanotic lesions predominate, notably ventricular septal defect (VSD), atrial septal defect (ASD), and patent ductus arteriosus (PDA), collectively accounting for approximately 85% of identified cases [5,6]. Untreated or late-treated acyanotic defects significantly increase the risk of progressive pulmonary vascular disease, potentially leading to pulmonary arterial hypertension (PAH), a severe, life-threatening condition characterized by elevated mean pulmonary artery pressure (mPAP) greater than 20 mm Hg [7]. Globally, PAH affects around 1% of the population, with pediatric PAH predominantly arising from uncorrected CHD, particularly in LMICs, where up to 80% of pediatric PAH cases can be directly attributed to delayed diagnosis and lack of timely surgical intervention (8–10). Physiologically, left-to-right shunt lesions, such as those found in acyanotic CHD, lead to chronic pulmonary overcirculation and elevated pulmonary pressures. Persistent pulmonary pressure elevation causes significant remodeling of pulmonary vasculature, including intimal proliferation and medial hypertrophy, ultimately resulting in

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PAH. This chronic hemodynamic strain subsequently imposes severe consequences on the right ventricle, precipitating right ventricular hypertrophy, dysfunction, and eventual failure—a principal cause of mortality in affected children [11]. The gold-standard diagnostic method for PAH remains invasive right heart catheterization (RHC), allowing precise quantification of mPAP and pulmonary vascular resistance. However, RHC is invasive, costly, technically demanding, and carries considerable procedural risks, particularly in pediatric populations and low-resource settings, thereby limiting its practical implementation [12,13]. Echocardiography, while non-invasive, more accessible, and widely adopted, demonstrates inherent limitations due to its operator-dependence, variability in measurement, and reduced specificity in diagnosing complex pediatric cardiac conditions such as PAH in the context of CHD [14,15]. Given these limitations, electrocardiography (ECG) emerges as a promising, accessible, and cost-effective diagnostic modality, widely available even in resource-constrained settings. ECG can effectively capture key cardiac electrophysiological changes characteristic of PAH and right ventricular overload, including right ventricular hypertrophy (RVH), right axis deviation, increased R-wave amplitude in lead V1, altered R/S ratios, and specific ST-T abnormalities [16]. The American Heart Association, American College of Cardiology Foundation, and Heart Rhythm Society have defined specific ECG criteria for RVH indicative of potential PAH, highlighting its potential role in preliminary screening and risk stratification [17,18]. However, despite evidence from adult populations and some mixed-age cohorts, data specifically focusing on ECG predictors of PAH in pediatric acyanotic CHD remain sparse and inadequately characterized, particularly in LMIC contexts like Bangladesh. Existing pediatric studies underscore significant variability in ECG diagnostic accuracy, often due to differences in population demographics, underlying cardiac lesions, and lack of standardized pediatric-specific ECG criteria [19,20]. Therefore, recognizing the significant healthcare gap and urgent need for practical diagnostic tools, the present study aims to evaluate the predictive utility of specific ECG markers in identifying PAH among Bangladeshi children diagnosed with acyanotic CHD. By correlating ECG-derived parameters with catheter-measured mPAP values, this study intends to delineate reliable, accessible ECG indicators for early PAH diagnosis. Such findings could profoundly enhance early detection, facilitate timely therapeutic intervention, and potentially reduce the burden of severe pulmonary vascular disease complications like Eisenmenger syndrome, thereby significantly improving long-term outcomes in pediatric CHD patients in resource-limited settings.

METHODS & MATERIALS

This cross-sectional analytic study was conducted at the Department of Pediatric Cardiology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh, over a 12-month period from July 2023 to June 2024. The study aimed to evaluate the diagnostic utility of electrocardiographic (ECG) markers for predicting pulmonary arterial hypertension (PAH) in children diagnosed with acyanotic congenital heart disease (CHD). A total of 83 pediatric patients aged between 2 months and 18 years, who were diagnosed with acyanotic CHD and scheduled for diagnostic cardiac catheterization, were enrolled using a purposive sampling technique. Inclusion criteria consisted of echocardiographically confirmed cases of ASD, VSD, PDA, atrioventricular septal defect (AVSD), and aortopulmonary window. Children with other forms of acyanotic CHD, cyanotic CHD, or those who declined catheterization or participation were excluded. Following ethical approval from the Institutional Review Board (IRB) of BSMMU, written informed consent was obtained from the parents or legal guardians of all participants. Each child underwent a comprehensive clinical evaluation including history taking (noting feeding difficulties, recurrent respiratory infections, and exertional dyspnea) and physical examination. Pre-procedural investigations included complete blood count (CBC), C-reactive protein (CRP), blood grouping, serum alanine aminotransferase (ALT), serum creatinine, chest X-ray, HBsAg, VDRL, prothrombin time (PT), activated partial thromboplastin time (APTT), bleeding time (BT), and clotting time (CT). All patients underwent standard 12-lead ECG in the supine position at a paper speed of 25 mm/sec and voltage of 10 mm/mV. The following ECG parameters were evaluated: QRS axis, P wave amplitude in lead II, R wave amplitude in leads V1 and V5, S wave amplitude in leads V1 and V5, R/S ratio in V1 and V5, the sum of R wave in V1 and S wave in V5, and ST-segment depression in leads II, III, and aVF. ECGs were interpreted independently by two experienced pediatric cardiologists blinded to the catheterization results. Cardiac catheterization was performed under standard procedural protocols. Mean pulmonary artery pressure (mPAP) was measured directly, with PAH defined as mPAP > 20 mmHg at rest based on current clinical guidelines. Patients were divided into PAH and non-PAH groups based on these measurements. Demographic variables (age, gender), anthropometric data (height, weight, body surface area), clinical history, and ECG and catheterization findings were documented for all patients. Statistical analysis was performed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were reported as mean ± standard deviation and analyzed using independent sample t-tests or Mann–Whitney U tests. Categorical variables were compared using chi-square or Fisher's exact tests. Receiver Operating Characteristic (ROC) curve analysis was conducted to assess the predictive performance of ECG parameters. A p-value <0.05 was considered statistically significant.

RESULTS

Table I presents the demographic characteristics of the 83 children enrolled in the study. The mean age was 7.03 ± 5.30 years, with a range from 0.6 to 17 years. The average weight and height were 15.16 ± 8.96 kg and 99.03 ± 29.80 cm, respectively. The mean body surface area was 0.62 ± 0.27 m^2. A slight female predominance was observed, with 55.42% of participants being female. The majority of children (83.13%) were from rural areas. [Table I].

Table – I: Demographic Characteristics of the Study Population (*n*=83)

Variable	Value
Age (years)	7.03 ± 5.30 (Range: 0.6–17)
Weight (kg)	15.16 ± 8.96 (Range: 4.0–44.0)
Height (cm)	99.03 ± 29.80 (Range: 42.0–167.0)
Body Surface Area (m^2)	0.62 ± 0.27 (Range: 0.24–1.37)
Gender: Male	37 (44.58%)
Gender: Female	46 (55.42%)

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Residence: Rural	69 (83.13%)
Residence: Urban	14 (16.86%)

Ventricular septal defect (VSD) was the most common lesion, observed in 39.8% of cases, followed closely by patent ductus arteriosus (PDA) at 38.6%. Atrial septal defect (ASD) accounted for 10.8%, atrioventricular septal defect (AVSD) for 9.6%, and aortopulmonary (AP) window was the least common, found in only 1.2% of participants. [Figure I].

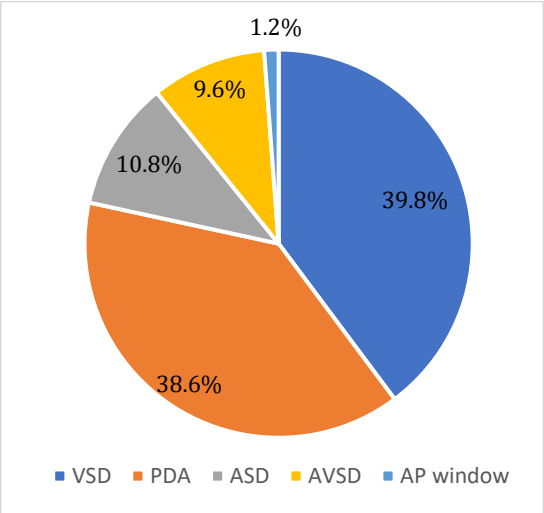

Figure – 1: Distribution of Acyanotic CHD Types Among Study Participants (*n*=83)

Table II shows the distribution of patients according to the severity of pulmonary arterial hypertension (PAH). Severe PAH was the most common, observed in 40.96% of cases, followed by moderate PAH in 19.28% and mild PAH in 12.05%. PAH was absent in 27.71% of the study population. [Table II].

Table – II: Distribution of patients by severity of PAH (*n*=83)

PAH	Frequency	Percentage
Mild PAH	10	12.05%
Moderate PAH	16	19.28%
Severe PAH	34	40.96%
PAH Absent	23	27.71%

Table III presents the distribution of specific ECG parameters among patients with varying severity of pulmonary arterial hypertension (PAH). Most ECG abnormalities were more prevalent in the severe PAH group. Notably, R in V1 ≥ 7 mm was observed in 29 severe cases compared to 8 and 4 in moderate and mild cases, respectively. Similarly, ST segment depression in leads II, III, and aVF, as well as right axis deviation (QRS Axis ≥ 90°), showed a marked increase with increasing PAH severity. This trend suggests a strong association between ECG changes and PAH severity. [Table III].

Table – III: Distribution of Specific ECG Parameters by Severity of PAH (*n*=60)

ECG Parameter	Mild PAH (n=10)	Moderate PAH (n=16)	Severe PAH (n=34)
R in V1 ≥ 7 mm	4	8	29
S in V1 ≤ 2 mm	3	7	26
R/S in V1 ≥ 1	3	7	27
R in V5 ≤ 5 mm	2	6	25
S in V5 ≥ 7 mm	4	8	30
R/S in V5 ≤ 1	2	5	24
R V1 + S V5 ≥ 10 mm	3	6	28
P wave in II ≥ 2.5 mm	1	4	20
QRS Axis ≥ 90°	2	5	24
ST depression in lead II	1	3	15
ST depression in lead III	0	2	14
ST depression in lead aVF	1	3	16

Table IV summarizes the diagnostic accuracy of various ECG parameters in predicting pulmonary arterial hypertension (PAH). Among the parameters, S in V5 ≥ 7 mm showed the highest sensitivity (88.3%) and positive predictive value (91.2%). R in V1 ≥ 7 mm and R/S in V1 ≥ 1 also demonstrated high diagnostic performance, with sensitivities of 85.0% and 81.7%, respectively. Parameters related to ST segment depression showed lower sensitivity and predictive values. Overall, several ECG markers demonstrated good potential for non-invasive prediction of PAH. [Table IV].

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Table – IV: Diagnostic Accuracy of ECG Parameters in Predicting PAH (*n*=60)

ECG Parameter	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
R in V1 ≥ 7 mm	85.0	78.3	90.6	68.4
S in V1 ≤ 2 mm	78.3	73.9	87.0	60.0
R/S in V1 ≥ 1	81.7	76.5	88.5	64.7
R in V5 ≤ 5 mm	76.7	70.0	85.1	58.6
S in V5 ≥ 7 mm	88.3	80.9	91.2	70.8
R/S in V5 ≤ 1	73.3	69.6	84.0	56.5
R V1 + S V5 ≥ 10 mm	83.3	75.6	89.2	65.5
P wave in II ≥ 2.5 mm	66.7	65.2	78.0	51.0
QRS Axis ≥ 90°	70.0	69.6	82.8	55.0
ST depression in lead II	50.0	60.9	72.0	43.0
ST depression in lead III	46.7	58.7	69.0	40.0
ST depression in lead aVF	53.3	63.0	75.0	44.0

Figure 2 shows a scatter plot illustrating the correlation between R-wave amplitude in lead V1 and mean pulmonary artery pressure (mPAP). A positive linear relationship is observed, with higher R-wave values corresponding to elevated mPAP levels. The coefficient of determination (R^2) is 0.399, indicating a moderate correlation between the two variables. [Figure 2].

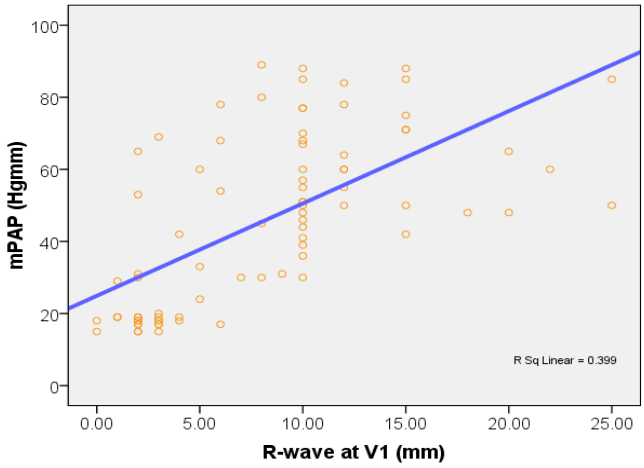

Figure – 2: Correlation Between R Wave in Lead V1 and mPAP

Figure III displays a scatter plot showing the correlation between the composite ECG marker (R wave in V1 + S wave in V5) and mean pulmonary artery pressure (mPAP). A strong positive linear relationship is evident, with increasing composite values corresponding to higher mPAP. The coefficient of determination (R^2) is 0.573, indicating a strong correlation and suggesting this marker is a reliable predictor of PAH severity. [Figure III].

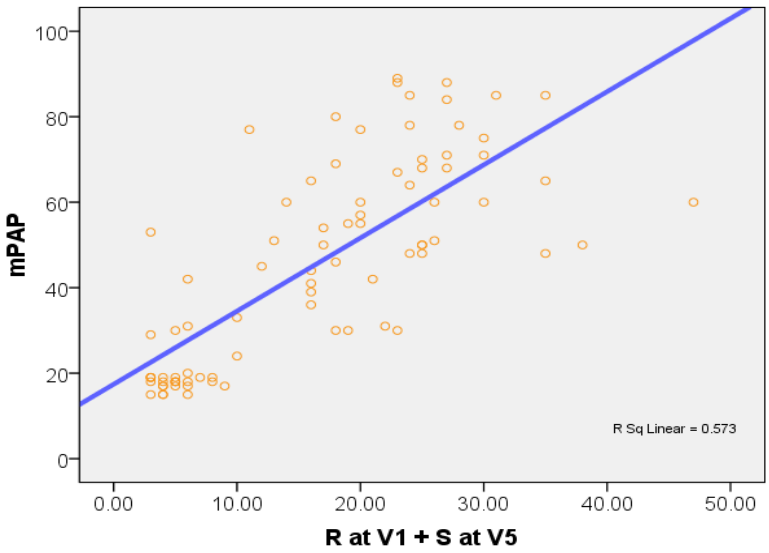

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Figure – 3: Correlation Between Composite ECG Marker (R in V1 + S in V5) and mPAP

Table V presents the correlation between various ECG parameters and mean pulmonary artery pressure (mPAP). The composite marker R in V1 + S in V5 showed the strongest positive correlation (r = 0.68, p < 0.001), followed by S in V5 (r = 0.63) and R in V1 (r = 0.62). Negative correlations were observed for S in V1 (r = –0.55) and R/S in V5 (r = –0.47), indicating inverse relationships. All reported correlations were statistically significant, supporting the utility of specific ECG parameters in predicting elevated mPAP. [Table V].

Table – V: Correlation Between Specific ECG Parameters and Mean Pulmonary Artery Pressure (mPAP)

ECG Parameter	Correlation Coefficient (r)	p-value
R in V1	0.62	<0.001
S in V1	–0.55	<0.001
R/S in V1	0.60	<0.001
R in V5	–0.49	0.001
S in V5	0.63	<0.001
R/S in V5	–0.47	0.002
R V1 + S V5	0.68	<0.001
P wave in II	0.44	0.003
QRS Axis	0.51	0.001
ST depression in lead II	0.39	0.006
ST depression in lead III	0.36	0.009
ST depression in lead aVF	0.40	0.005

DISCUSSION

The present study aimed to evaluate the diagnostic utility of electrocardiographic (ECG) parameters in predicting pulmonary arterial hypertension (PAH) in children with acyanotic congenital heart disease (CHD), using catheterization-derived mean pulmonary artery pressure (mPAP) as the gold standard. Among the 83 enrolled children, the majority were female and from rural settings, with ventricular septal defect (VSD) and patent ductus arteriosus (PDA) representing the most prevalent lesion types. These demographic and diagnostic trends are consistent with findings reported in South Asian pediatric cohorts, where rural representation and high prevalence of VSD and PDA in acyanotic CHD dominate the clinical spectrum [21]. Notably, 72.3% of our cohort demonstrated PAH, with severe PAH present in over 40%—a burden higher than previously documented in global datasets, but not uncommon in tertiary-level referrals from under-resourced settings [22,23]. A central focus of the analysis was the escalation of specific ECG abnormalities with increasing PAH severity. The findings revealed a striking stepwise increment in the presence of right ventricular hypertrophy (RVH) markers, such as R ≥ 7 mm in V1 and S ≤ 2 mm in V1, alongside composite indices like R V1 + S V5 ≥ 10 mm. This parallels observations from Igata et al., who documented that such parameters demonstrate proportional deviation with rising pulmonary pressures and are therefore reliable screening indicators [24]. The high prevalence of ST-segment depression in inferior leads among severe PAH cases also mirrors the regional strain patterns indicative of chronic right ventricular overload, a finding supported by Burns et al., although the low sensitivity of these markers limits their utility as standalone screening tools [25]. When analyzed for diagnostic accuracy, the strongest performers were S ≥ 7 mm in V5 and the composite index R V1 + S V5 ≥ 10 mm, both of which exhibited high sensitivity (88.3% and 83.3%, respectively) and specificity (80.9% and 75.6%, respectively). These results are in concordance with those of other works, who identified these measures as the most robust and clinically reproducible indicators of PAH [24]. Our findings affirm that these ECG metrics maintain a high positive predictive value (PPV > 89%) and moderate negative predictive value (NPV), supporting their use in routine clinical assessment when catheter-based evaluation is not immediately feasible. Correlation analysis further validated these indices, with the strongest association between mPAP and the composite R in V1 + S in V5 (r = 0.68, $p < 0.001$), reinforcing its pathophysiological linkage with elevated right ventricular afterload. These findings align closely with the results from other authors, who independently underscored the prognostic implications of such indices in pediatric populations [24,26]. All assessed ECG parameters showed statistically significant correlations with mPAP, establishing their collective relevance in early PAH detection. Taken together, these findings substantiate the hypothesis that the gradation of ECG changes reflects PAH severity, with several easily measurable markers offering high predictive fidelity. The study supports the incorporation of these parameters—particularly S in V5 and R V1 + S V5—as cost-effective, accessible tools for PAH risk stratification in children with acyanotic CHD, especially in low-resource settings where catheterization access is limited. Nonetheless, while ST-segment depression holds value as a confirmatory marker due to its specificity, its low sensitivity precludes its use for screening. These insights offer practical implications for pediatric cardiology workflows in comparable global contexts.

Limitations of The Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

Conclusion

The present study demonstrates a strong correlation between specific electrocardiographic markers and mean pulmonary artery pressure in children with acyanotic congenital heart disease. Parameters such as R wave amplitude in V1, S wave in V5, and their composite index (R in V1 + S in V5) showed high sensitivity and significant positive correlations with PAH severity measured via right heart catheterization. These findings suggest that ECG, despite its limitations in specificity for early-stage disease, can serve as a valuable, non-invasive screening tool for identifying pediatric patients at risk of developing significant pulmonary arterial hypertension, especially in resource-limited settings like Bangladesh where invasive diagnostics are not readily accessible.

Recommendation

The manuscript presents a well-conducted study highlighting the diagnostic utility of electrocardiographic markers in predicting pulmonary arterial hypertension among children with acyanotic congenital heart disease. The research is timely, methodologically robust, and holds significant clinical relevance, particularly for resource-limited settings. The findings are clearly articulated and supported by appropriate statistical analyses.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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ORIGINAL ARTICLE

Functional Outcomes of Displaced Midshaft Clavicular Fractures — A Comparison of Plate Fixation and Non-operative Treatment

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ABSTRACT

Introduction: *Displaced midshaft clavicular fractures are still disputed regarding the treatment. While conventional nonoperative treatment has been the standard, new research indicates that surgical fixation produces superior outcomes. In this study, the complications and functional outcomes of plate fixation and nonoperative treatment for these fractures are compared.* ***Methods & Materials:*** *This prospective observational study took place from July 2018 to June 2022, involving 200 patients with displaced midshaft clavicular fractures. Group A (n=100) had open reduction and internal fixation using precontoured locking plates. Group B (n=100) received nonoperative treatment with figure-of-eight bandages or slings. Patients were followed for one year. We assessed outcomes using Constant-Murley scores, checked for radiographic union, and recorded complication rates. Cox proportional hazards models, t-tests, and chi-square tests were used for data analysis on SPSS v26.* ***Results:*** *Group A showed significantly lower complication rates compared to Group B (5% vs 20%, p=0.01), shorter mean union time (6.8 vs 9.4 weeks, p<0.0001), and better functional results, with 88% achieving excellent outcomes in Group A compared to 71% in Group B (p=0.001). Surgical patients had a 3% infection rate, with no malunion or delayed union, while nonoperative patients experienced rates of 10% malunion, 5% nonunion, and 5% delayed union. Cox regression identified nonoperative treatment as an independent risk factor for complications (HR=2.80, p=0.008).* ***Conclusion:*** *Surgical fixation of displaced midshaft clavicular fractures leads to better functional results, fewer complications, and quicker union than nonoperative treatment. These findings support the use of surgery for displaced fractures in suitable patients who want the best functional*

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INTRODUCTION

Clavicle fractures are a common type of fracture, accounting for 2.6% of all fractures and 5% of adult fractures. Among clavicle fractures, middle-third fractures make up nearly 82% of cases[1,2]. This is largely due to the unique structure of the clavicle, which is thinnest at the junction of the outer and middle thirds and lacks additional protection from muscles and ligaments[2,3]. While there are several treatment options for clavicle fractures, the majority are traditionally treated non-operatively. However, due to its location, a clavicle fracture is often displaced, making non-surgical treatment challenging. Clavicle fractures can occur in people of all ages, but they are more common in children and young adults due to their active lifestyles[4,5]. In adolescents, clavicle injuries are often caused by falls from height or participation in sports[5]. A significant portion of fractures is also caused by high-energy injuries such as car accidents. There is a bimodal distribution of adult clavicle fractures, with a higher incidence in males under 30 years of age due to high-energy trauma and a second peak in the elderly population due to osteoporosis, which are typically associated with low-energy falls[6]. Young adults tend to fracture the mid-shaft of the clavicle, while the elderly are

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more likely to fracture the lateral end[6]. Displaced mid-shaft clavicular fractures, which occur in the middle part of the collarbone, can be treated with plate fixation, a surgical procedure in which a metal plate is attached to the bone using screws to hold it in place during healing. Some studies have suggested that plate fixation may lead to better functional outcomes, such as improved range of motion and strength, compared to non-operative treatment, which involves using a sling or other immobilization device to hold the bone in place while it heals. In the past, non-surgical treatment was preferred for mid-shaft clavicle fractures, even in cases of obvious displacement, due to a low rate of non-union[7,8]. However, recent research has found that the nonunion rate of displaced fractures after non-surgical treatment is higher than previously reported[9,10]. There is currently a consensus on non-surgical treatment for mid-shaft clavicle fractures without displacement, but the optimal treatment for displaced mid-shaft clavicle fractures remains controversial[11]. The goal of any clavicle fracture treatment method is to achieve bony union while minimizing dysfunction, morbidity, and cosmetic deformity. In non-operative treatment methods, the first step is always shoulder immobilization. This is typically achieved using a simple sling or a figure-of-eight brace. However, there is no clear indication of how long immobilization should be continued, as it can vary depending on the patient's age and fracture details[11]. After immobilization, the physician needs to reposition the fractured bone to its normal location, which becomes more difficult with more compound and displaced fractures. While the movement is generally discouraged, some physicians may recommend starting isometric physiotherapy and resistance exercises after 4-8 weeks of immobilization, depending on residual pain and discomfort. Non-operative treatment can be time-consuming, with complete union often taking 5-7 months. There are several surgical treatment options for clavicle fractures, including interfragmentary screw fixation, intramedullary (IM) fixation, cerclage wiring, and plate fixation[12]. The present study aims to evaluate the functional outcomes of plate fixation for the treatment of displaced mid-shaft clavicle fractures. Plate fixation is a type of internal fixation in which a plate made of surgical-grade stainless steel or titanium is attached to the fractured bone with screws. The plates may be removed in a subsequent surgical procedure. Plate fixation has been shown to significantly reduce the nonunion rate for various types of fractures[13]. Plate fixation provides immediate rigid fixation, including rotational stability, which is favorable for early rehabilitation protocols and is technically less demanding. Plate fixation may be an effective treatment for displaced mid-shaft clavicle fractures because it allows the bone to heal in a more anatomically correct position, potentially improving the patient's range of motion and strength. However, it is important to note that plate fixation is a major surgical procedure with risks and potential complications, including infection, nerve or blood vessel damage, and failure of the plate or screws. This study aims to determine whether the benefits of plate fixation for displaced mid-shaft clavicle fractures outweigh the risks compared to non-operative treatment methods. The study aims to observe the functional outcome of displaced mid-shaft clavicular fractures after plate fixation against the non-operative treatment method.

METHODS & MATERIALS

This observational study took place at the Department of Orthopedics and Traumatology at Chittagong Medical College Hospital and associated private hospitals in Chittagong, Bangladesh, from July 2018 to June 2022. The institutional ethical review committee approved the study protocol, and all participants provided informed consent. We included adult patients aged 18 to 65 who had displaced midshaft clavicular fractures (Robinson type 2B1 and 2B2). We excluded open fractures, pathological fractures, neurovascular issues, prior clavicular surgery, and patients who were unfit for surgery. We enrolled 200 patients using purposive sampling and divided them into two groups. Group A (100 patients) underwent open reduction and internal fixation with precontoured locking compression plates. Group B (100 patients) received nonoperative treatment with figure-of-eight bandages or triangular slings. We performed surgical procedures under general anesthesia with a standard anterosuperior approach using 3.5 mm precontoured locking plates. After surgery, patients received antibiotics and began early mobilization. Nonoperative patients were immobilized for 6 to 8 weeks, followed by gradual rehabilitation. We followed up with all patients at 2, 6, 12, 24, and 52 weeks after treatment. We assessed functional outcomes using the Constant-Murley score and documented complications like infection, nonunion, malunion, and delayed union. We defined radiographic union as cortical bridging on orthogonal views.

Statistical Analysis: SPSS v26 was utilized for the data analysis where we compared categorical variables using chi-square tests and analyzed continuous variables with independent t-tests. To identify risk factors, we applied the Cox proportional hazards model. $p<0.05$ was counted as statistically significant.

RESULTS

Table I represents the baseline demographic characteristics of the study population. Both groups showed a similar gender distribution with more males (84% vs 81%, p=0.71). This finding reflects the common patterns of displaced midshaft clavicular fractures in young, active people. Road traffic accidents were the main cause of injury in both groups (67% vs 63%). This was followed by falls from height (23% vs 23%) and sports-related injuries (10% vs 14%). The p-value of 0.04 for the mode of injury indicates statistically significant differences, but the clinical relevance seems minimal. There was no significant difference in the side of injury (p=0.99), with left-sided fractures being slightly more common in both groups. [Table I].

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Table – I: Distribution of participants by demographic factors

Demographic Factors	Group A		Group B		P value
	n	%	n	%	
Gender					
Male	84	84.0%	81	81.0%	0.71
Female	16	16.0%	19	19.0%	
Mode of Injury					
Road traffic accident	67	67.0%	63	63.0%	0.04
Fall from height	23	23.0%	23	23.0%	
High-intensity sports	10	10.0%	14	14.0%	
Side Affected					
Right	43	43.0%	40	40.0%	0.99
Left	57	57.0%	60	60.0%	

Table II shows a significantly lower complication rate in the surgical group (5%) compared to the nonoperative treatment group (20%, p=0.01). Group A had 3% post-operative infections and a 2% nonunion rate, which reflects acceptable surgical risks. In contrast, Group B had higher rates of malunion (10%), nonunion (5%), and delayed union (5%). The absence of malunion and delayed union in the surgical group highlights the benefits of anatomical reduction and stable fixation. The post-operative infections in the surgical group fall within the range reported in the literature (0.4-7.8%). The four-fold difference in total complications (5% vs 20%) strongly supports surgical intervention for displaced midshaft clavicular fractures. [Table II].

Table – II: Distribution of participants by post-operative complications

Post-Operative Complications	Group A		Group B		P Value
	n	%	n	%	
Post-Operative Infections	3	3.0%	0	0.0%	0.01
Non-Union	2	2.0%	5	5.0%	
Malunion	0	0.0%	10	10.0%	
Delayed Union	0	0.0%	5	5.0%	
Total	5	5.0%	20	20.0%	

Table III reveals that surgical treatment leads to significantly faster union times. Group A achieved union in a mean of 6.8 weeks compared to 9.4 weeks in Group B (p=0.01). Notably, 37% of surgical patients achieved union within 6 weeks, while none of the nonoperative patients reached this milestone. The surgical group showed 69% union by 7 weeks, while only 12% of the nonoperative group did. Meanwhile, 85% of nonoperative patients needed over 8 weeks for union compared to 17% in the surgical group. The nonunion rate was lower in Group A (2%) compared to Group B (5%). [Table III].

Table – III: Distribution of participants by time to union

Time To Union	Group A		Group B		P Value
	n	%	n	%	
<6 weeks	37	37.0%	0	0.0%	0.01
6-7 weeks	32	32.0%	12	12.0%	
7-8 weeks	14	14.0%	15	15.0%	
8-10 weeks	11	11.0%	63	61.0%	
>10 weeks	4	4.0%	5	24.0%	
Non-Union	2	2.0%	5	5.0%	
Mean weeks	6.8		9.4		

Table IV shows better functional outcomes in the surgical group at one-year follow-up. Group A achieved 88% excellent outcomes compared to 71% in Group B. The poor outcomes were only 3% in Group A versus 11% in the nonoperative group (p=0.001). The 17% difference in excellent outcomes and 8% reduction in poor outcomes indicate significant functional benefits of surgical treatment. Good outcomes were similar between groups (9% vs 18%), suggesting that while some patients achieve reasonable function with nonoperative treatment, the proportion reaching optimal function is much higher with surgery. [Table IV].

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Table – IV: Distribution of participants by Functional Outcome grading

Functional Outcome	Group A		Group B		P value
	n	%	n	%	0.001
Excellent	88	88.0%	71	71.0%	
Good	9	9.0%	18	18.0%	
Poor	3	3.0%	11	11.0%	

Table V consolidates the key outcome measures, reinforcing the benefits of surgical treatment. The surgical group had fewer total complications (5% vs 20%) and significantly faster mean union times (6.8 ± SD weeks vs 9.4 ± SD weeks, p<0.0001). Although post-operative infections occurred only in the surgical group (3%), this was balanced by significant reductions in nonunion (2% vs 5%), complete elimination of malunion (0% vs 10%), and delayed union (0% vs 5%). The highly significant p-value (<0.0001) for union time reinforces the strong difference in healing speed. [Table V].

Table – V: Distribution of Study Population based on Postoperative Complications and Time to Union

Variables	Group A (Plate Fixation)	Group B (Nonoperative)	*p*-value
Post-op Infections	3 (3.0%)	0 (0.0%)	0.01
Non-union	2 (2.0%)	5 (5.0%)	-
Malunion	0 (0.0%)	10 (10.0%)	-
Delayed Union	0 (0.0%)	5 (5.0%)	-
Total Complications	5 (5.0%)	20 (20.0%)	-
Mean Time to Union (weeks)	6.8 ± SD	9.4 ± SD	< 0.0001

This bar chart from Figure 1 visually represents functional outcomes at one-year follow-up, clearly showing the superior performance of surgical treatment. The graph indicates that Group A achieved significantly higher excellent outcomes (88% vs 71%) and lower poor outcomes (3% vs 11%). The chart effectively illustrates that while both treatments can yield good outcomes, surgical management offers a better chance of excellent function and lower risk of poor outcomes. [Figure 1].

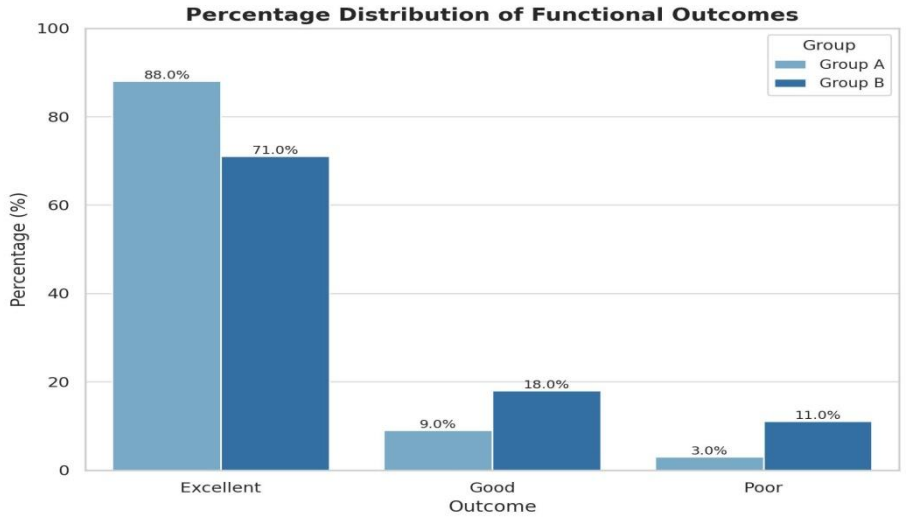

Figure – 1: Functional Outcome Grading at 1-Year Follow-up

The analysis in Table VI identifies nonoperative treatment as the main independent risk factor for complications (HR=2.80, 95% CI: 1.30-6.10, p=0.008). The nearly threefold increased risk provides strong evidence in favor of surgical intervention. Traditional risk factors like age ≥40 years (HR=1.25, p=0.45), male gender (HR=0.92, p=0.80), sports injury mechanism (HR=1.55, p=0.24), and left-side fractures (HR=1.10, p=0.75) showed no significant link to complications. [Table VI].

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Table – VI: Cox Proportional Hazards Model for Risk of Complications

Variable	Hazard Ratio (HR)	95% Confidence Interval	*p*-value	Interpretation
Non-operative treatment (vs. operative)	2.80	1.30 – 6.10	0.008	Non-operative treatment increases the risk of complications nearly 3-fold. This is statistically significant and clinically relevant. Operative fixation is protective.
Age ≥ 40 years	1.25	0.70 – 2.22	0.45	Although older age shows a 25% increased risk, this is not statistically significant. Age is not a strong independent risk factor in this study.
Male gender	0.92	0.48 – 1.78	0.80	Male patients had a slightly lower risk, but the difference is not significant. Gender does not influence complication risk meaningfully.
High-intensity sports injury	1.55	0.75 – 3.20	0.24	Sports-related injuries trend toward higher risk, but the result is not statistically significant. Mechanism of injury does not impact outcome independently.
Left-side fracture	1.10	0.60 – 2.00	0.75	Fractures on the left side showed a slight increase in risk, but it is not statistically or clinically meaningful. Laterality does not affect prognosis.

DISCUSSION

The management of displaced midshaft clavicular fractures has changed a lot over the last decade. More evidence now supports surgery over traditional nonoperative treatment. Our study shows better outcomes with plate fixation. This includes fewer complications (5% compared to 20%), quicker healing (6.8 weeks versus 9.4 weeks), and better function (88% excellent results versus 71%). The demographic profile in our study matches known patterns. It shows a predominance of males (82.5% overall) and that road traffic accidents are the main cause of these fractures[14]. This distribution highlights the high-energy nature of these injuries, which mostly affect young, active people, where restoring function is crucial. The average ages (35.2 years compared to 32.43 years) indicate the peak demographic for these injuries, where surgery can bring the most long-term benefits[15]. Our complication rates strongly support surgical treatment. The Cox proportional hazards model shows a 2.8-fold higher risk with nonoperative management. The 3% infection rate in our surgical group is within the accepted range of 0.4-7.8% reported by Wijdicks et al.[16]. More importantly, we observed no malunion or delayed union in the surgical group, while the nonoperative group had rates of 10% and 5% respectively. This finding aligns with recent meta-analyses by McKee et al. that show a significant reduction in malunion rates with surgical fixation[17]. The quicker union time (6.8 weeks versus 9.4 weeks) is a practical advantage of surgery. Open reduction and internal fixation with compression plating can help patients return to activity sooner by reducing early disability[18]. This faster healing allows for earlier return to work and activities, which is particularly important for the working-age population affected by these injuries. At the one-year follow-up, functional outcomes showed a clear advantage for surgical management. Eighty-eight percent of surgical patients achieved excellent results, compared to 71% for nonoperative treatment. Fixing a displaced clavicular shaft fracture surgically leads to better functional outcomes and lower rates of malunion and nonunion compared to nonoperative treatment at one year[19]. This benefit likely comes from restoring the clavicular length and alignment, which is hard to do with nonoperative treatment in displaced fractures. Open reduction and internal fixation (ORIF) are linked with higher union rates, lower malunion rates, and quicker functional recovery compared to nonoperative treatment[20]. The evidence increasingly supports surgery for displaced midshaft fractures, especially for active individuals aiming for optimal functional restoration. However, choosing a treatment must be personalized, while our study shows the overall benefits of surgery, factors like age, activity level, job, and health conditions must be taken into account. Patients with high functional demands require careful consideration to achieve the best outcomes[21]. Additionally, complications related to hardware and the potential need for implant removal is essential factors in deciding on surgery[22].

Limitations of the Study

This single-center observational study with purposive sampling may limit how applicable the findings are to other populations. The non-randomized design could lead to selection bias, and the one-year follow-up might not reveal long-term hardware issues or outcomes. Future multicenter randomized controlled trials with longer follow-up would improve the evidence.

Conclusion

Operative fixation of displaced midshaft clavicular fractures using precontoured locking plates shows better outcomes than nonoperative treatment. It has a lower complication rate (5% compared to 20%), faster bone healing (6.8 weeks versus 9.4 weeks), and better functional results (88% compared to 71% excellent outcomes). The nearly three-fold decrease in complication risk and the prevention of malunion support surgery as the preferred option for these fractures. This evidence is valuable for both surgeons and patients when deciding on treatment for displaced midshaft clavicular fractures in active individuals.

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Recommendation

Future studies should aim for multicenter randomized controlled trials with extended follow-up to evaluate the durability of hardware and late complications. It would be beneficial to conduct comparative studies that look at different fixation methods, like dual plating or intramedullary nailing, as well as optimal rehabilitation strategies. Cost-effectiveness analyses comparing surgical and nonoperative treatments, including indirect costs like time off work and disability, would give important healthcare economic insights. Developing patient-specific prediction models to improve treatment choices based on individual risk factors is another crucial area for research.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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ORIGINAL ARTICLE

Clinical Outcomes of Homeo pathic Constitutional Treatment Added to Long-Term Allopathic Therapy in Parkinson's Disease and Bone Degeneration - Cross-Validation of the Veredas Protocol

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ABSTRACT

Objectives: *To assess the clinical effects of adding individualized homeopathic treatment, based on the Effective Dose 100% (DE100) model, to ongoing allopathic treatment in patients with Parkinson's disease or degenerative bone disorders. The study also explores the use of the Veredas App as a tool for personalized dose management.* ***Methods:*** *In this mixed-methods study, 35 patients previously treated with allopathic medications (mean duration: 60.5 months) received a one-month course of constitutional homeopathic medicines prescribed using DE100 logic. Symptoms were scored on a 0–4 scale in real time, using the Veredas mobile application to identify each patient's worst (PM) and best (MM) daily moments. Symptom patterns were recorded over 28 days. Eleven cases were also analyzed via video to compare responses to allopathic (DE50) and homeopathic (DE100) treatment phases.* ***Results:*** *Previously published outcomes using the Veredas Protocol showed symptom improvements of 60.2% (chronic pain), 91% (Parkinson's), and 85% (emotional/mental health). In this study, 57.7% clinical improvement was observed after adding homeopathy. Patient self-assessments via the app showed 77% concordance with independent video analysis. While DE50-based treatments yielded limited changes, DE100-guided dosing achieved similar or greater results in one month using potencies averaging CH15.* ***Conclusions:*** *Although this study was not designed to compare DE50 and DE100 as conceptual frameworks, the findings suggest that individualized timing of dose administration may play a key role in clinical improvement. The Veredas App shows promise as a precision-prescribing tool. Further studies should explore the influence of dosing logic on treatment efficacy, independent of the medication paradigm.*

Keywords: *Parkinson's disease, Homeopathy, Dose-response relationship, Individualized medicine, Veredas Protocol, Effective Dose 100 (DE100).*

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INTRODUCTION

Idiopathic Parkinson's Disease (IPD) is a chronic neurodegenerative condition affecting approximately 1–2% of the global population over the age of 65[13,14]. The constitutional homeopathic approach (MC) involves the use of substances that elicit symptoms in healthy individuals, which, when administered homeopathically, can relieve similar symptoms in patients[1,2].

Current allopathic treatments, such as dopamine replacement therapy, offer temporary symptomatic relief but are frequently associated with long-term motor complications. Levodopa, in particular, is linked to dose accumulation under the Effective Dose 50% (DE50) model, which may contribute to adverse effects and reduced therapeutic efficacy over time[11,12].

Homeopathy presents a potential alternative in the management of IPD, especially when guided by the Hahnemannian principle of the Effective Dose 100% (DE100), as described in §248 of the *Organon*. This approach aims to minimize cumulative toxicity by adjusting doses based on real-time clinical indicators, especially during the patient's most symptomatic periods (Pior Momento – PM)[1,2]. Previous reports have indicated that prolonged use of DE50-based allopathic regimens can lead to hospitalizations and, in some cases, fatalities due to adverse effects[11,12].

The Veredas Protocol, developed over 16 years, uses a dedicated software platform to individualize dosing through

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daily symptom self-assessment. Patients score their symptoms on a 0–4 scale across 13 waking hours, identifying their worst (PM) and best (MM) moments, allowing for targeted dose administration. This protocol was applied to 35 patients with neurodegenerative and bone disorders, including IPD, and outcomes were analyzed using both quantitative tracking and qualitative video assessments[20–28].

While the focus of many comparative studies has been the distinction between medication types (allopathic vs. homeopathic), this study emphasizes a different hypothesis: that the **logic of dose prescription itself — fixed intervals in DE50 versus individualized timing in DE100 — may be a critical determinant of therapeutic response**. Although the present design does not allow for a direct comparison between these two conceptual models, the clinical improvements observed following DE100-guided homeopathic intervention suggest that **dose individualization in real time may play a more decisive role than the nature of the medication alone**.

This study aims to explore these possibilities through a primarily qualitative analysis, supported by patient-reported scores and external video evaluations, and to contribute to the broader discussion on how dosing strategies — not only substances — shape clinical outcomes in chronic degenerative conditions.

Study Design: This is a prospective, observational, and exploratory study, summarized below and detailed in subsequent sections.

The study followed a qualitative observational design with cross-validation. Clinical evaluations focused on symptom severity using 0–4 scores, particularly during the patient's worst moment (PM) related to gait or tremor symptoms in individuals with Parkinson's disease. Assessments were conducted after the administration of a single dose of a constitutional homeopathic medicine. The Veredas Protocol was employed to guide and monitor treatment, using hourly symptom records via the Veredas mobile application. **Clinical improvement was further validated by short video recordings, with external evaluation conducted by an independent reviewer, showing a 77% agreement with the quantitative self-assessments submitted via the Veredas app.**

The distinction between **Phase 1**, in which patients used only allopathic medications for Parkinson's disease over an average of 60.5 months, and **Phase 2**, in which a constitutional homeopathic medicine was added for just one month, does not lie solely in the time frame. More importantly, it reflects a conceptual shift: from the allopathic dosage logic based on the Effective Dose 50% (DE50), commonly used in pharmaceutical protocols, to the Hahnemannian concept of Effective Dose 100% (DE100), applied during Phase 2.

The theoretical framework of the Veredas Protocol is essential for understanding the study and is provided in detail in the section *Theory and Methodology* (see Annexes and Supplemental Materials, "Paste 2.zip"). The full research structure is presented in *Annex 3*, which includes all phases of the study across nine components. These materials contain recruitment content shared via social media, training materials for four assistants (who supported patients in four online groups), individualized prescriptions issued by each assistant group, and pharmacy coordination. Volunteers were recruited from various regions of Brazil.

The homeopathic medicinal products were authorized by the national agency of sanitary surveillance-ANVISA (Decree No. 79094, published in the Official Gazette in 5/1/77) and by The National Ethics Committee approved the project as indicated by the Brazil Platform on 10/31/2021, under the number CAAE: 52986221.9.0000.5133.

Data Collection and Procedure

At the initial consultation, patients or their caregivers were instructed to complete daily symptom records at home, using a 0–4 scale to assess both mental/emotional symptoms (for constitutional diagnosis) and their primary Parkinson's symptom (either gait or tremor). Parkinson's symptoms were rated using descriptors derived from the Unified Parkinson's Disease Rating Scale (UPDRS), with scores ranging from 0 (no symptom) to 4 (severe), increasing in intensity and frequency. Separate analyses were conducted to calculate mean scores for each of the two symptom categories.

From the beginning, participants were trained to use the scoring system through explanatory meetings and video tutorials under the guidance of four trained research assistants. They learned how to interpret both emotional and motor symptom descriptors. An additional explanatory video on the use of the Veredas App was recorded by the principal investigator (see *Annex 3 – Item 3.4*), guiding patients to identify their most disabling symptom (gait or tremor) for tracking.

On the 30th day of exclusive allopathic Parkinson's treatment (mean duration: 60.5 months), patients received an initial prescription of a constitutional homeopathic medicine (CM), administered as two drops in the morning, following a remote individual consultation with the study physician. Potencies were increased individually every four days, following the Veredas Protocol's sequence of seven doses: CH6, CH9, CH12, CH16, CH20, CH30, CH40, CH50, and CH60.

Approximately 45 different homeopathic constitutional medicines were donated by 13 homeopathic pharmacies from various Brazilian states. The individualized homeopathic treatments were mailed to participants at their home addresses.

Training materials, WhatsApp guidance, and monitoring protocols are detailed in the Supplemental Materials (*Annex 3*).

Throughout the study, patients continued their usual medications as prescribed by their neurologists. The comparison was restricted to scores 3 and 4 reported during the worst moments in Phase 1 (allopathic treatment) and their corresponding values in Phase 2 (with added homeopathic treatment), ensuring clear focus on clinically significant changes — a critical element in qualitative analysis.

Cross-validation was performed by comparing app-based self-assessments with video recordings. During the two-month study period, the Veredas App issued automated alerts for data entry and score validation. After the second month, the

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author independently reviewed the video records, confirming a 77.1% agreement with the app-based scores. This methodological triangulation added credibility to the qualitative findings, mitigating subjectivity — a common critique of qualitative health research.

The use of an app with automated alerts and standardized score descriptors (e.g., "step length = 1/4 of foot") introduced a rare level of methodological consistency in a qualitative study, enhancing alignment with observational validation criteria.

Technical Description of Clinical Markers

To standardize and ensure consistency in qualitative data, five clinical markers were defined to assess patient progress throughout the study. These markers were applied to both the daily spreadsheet entries and the video recordings submitted by patients, enabling a reliable alignment between score variations (0–4) and clinical observations.

Below is a description of the five primary quantitative markers later cross-referenced with qualitative data (evolutionary videos):

Summary 1 – Identifying the Optimal Dose Using the Veredas App

1. **WM (Worst Moment):**
   The moment when the selected symptom (gait or tremor) reaches its peak intensity, scored from 0 to 4 with descriptive states. This may occur multiple times per day and serves as the criterion for taking the next dose of any repeating medication. Identifying the WM ensures that the previous dose has fully dissipated (100% clearance), thus avoiding dose overlap. A reduction in the frequency of WM events during the day is expected to correlate with a reduction in dosage until its complete suspension.
2. **BM (Best Moment):**
   The moment of greatest symptom relief for the selected gait or tremor issue, also scored from 0 to 4 with descriptive parameters. This serves as a clinical indicator of improvement and balance in motor response.
3. **Hs WM (Hours of Worst Moment):**
   The cumulative number of hours per day during which WM events occur. This marker quantifies the duration of symptomatic exacerbation and may appear multiple times in a day. It is used to track reduction in symptom burden across the treatment period.
4. **Hs BM (Hours of Best Moment):**
   The cumulative number of hours per day during which BM events are recorded. As symptom control improves, Hs BM is expected to increase. Six hours per day was used as a reference threshold for positive clinical response.
5. **Mean Score and Coefficient of Cure (Coef):**
   The daily mean score was calculated to evaluate the trend in clinical progression.
6. The **coefficient of cure** was defined as the ratio between BM periods (and Hs BM) and WM periods (and Hs WM), providing a composite measure of symptom improvement and treatment effectiveness.
7. **Texto introdutório para a Table I** Table I summarizes the best clinical outcomes observed for each tested dose across a four-day evaluation period, as identified through the markers described in Summary 1. Each row represents a specific dose and its associated results in terms of motor symptom evolution. These outcomes are interpreted in conjunction with the patient's general clinical context, as the optimal dose is not defined solely by numerical values but also by individual response patterns.

Table – I: Summary 2 – Consolidated Analysis of Dose Response

Index	Confusions	Syntom	Taking day	Drug Dosis	CH	OT	Média	WM	HsWM	BM	HsBM	Coef
2	-None	March	16/09/2024	DNA12 OT Ossos CH14/OT Cerebro +Hipocampo CH45	DNA, ATP	1.89	4	7	0	7	0.27	
3	None	March	24/09/2024	ATP CH16-	DNA, ATP	1.11	4	3	0	13	0.09	
1	None	March	29/09/2024	ATP CH18	DNA, ATP	1.63	4	6	0	10	0.16	
1	Abdom pain	March	06/10/2024	ATP CH16- Abdominal pain	DNA, ATP	1.74	4	6	0	8	0.22	
4	None	March	12/10/2024	DNA CH12	DNA, ATP	1.37	4	6	0	12	0.11	
2	None	March	14/10/2024	Continuation DNA CH12	DNA, ATP	1.58	4	6	0	10	0.16	
3	-None	March	19/10/2024	Continuation DNA CH12	DNA, ATP	1.84	4	7	0	8	0.23	

Drugs: OT – Organotherapic; DNA CH12 – DNA, Homeopathic Blood Patient DNA Dose CH12; ATP – Adenosine Triphosphate, CH 12, 45, 6, 18,16 (test doses); WM – Worst Moment; HsW – Hours of WM; BM – Best Moment; HsB – Hours of BM; Coef. – Healing Coefficient.

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Example of Results Interpretation of Table 1 to check the best dose and the dose test evolution:

As shown in Table 1 - Summary 2 (is the summary of Summary 1)

Best CH Dose: ATP CH16, with an average score of 1.11 on September 24, 2024. This dose resulted in:

Significant increase in Best Moment (BM) hours: From 7 to 13 hours per day (BM = 0).

Reduction in Worst Moment (WM) hours: From 7 to 4 hours per day (WM = 4).

Compared to a previous average of 1.89, with similar variations in other indicators.

Worsening with CH18: On September 29, 2024, CH18 led to deterioration, with an average score of 1.63, worse than the previous CH16 score of 1.11.

Reversal Attempt with CH16: Returning to CH16 on October 6, 2024, did not reverse the worsening, attributed to the emergence of a comorbidity (colon cancer) with average score of 1,74, worsed from 10 hours per day (BM=0) to 8 hours per day(MM=0) and maintaining the same 6 hours per day (WM=4)

Criteria for Determining the Optimal Dose

The best dose was identified by evaluating the five markers, with criteria including:

Highest number of daily hours with BM.

Lowest average scores.

Fewest daily hours with WM.

Example of Results Interpretation from Table I

Example of Dose Response Interpretation – Table I

As shown in Table 1 (Summary 2, which consolidates Summary 1), the optimal dose was identified as **ATP CH16**, administered on **September 24, 2024**, with an **average clinical score of 1.11**. This dose yielded:

- A significant **increase in Best Moment (BM) hours**, rising from 7 to **13 hours/day**, with BM rated as 0;
- A **reduction in Worst Moment (WM) hours**, dropping from 7 to **4 hours/day**, with WM rated as 4;
- Improvement over a previous dose that had produced a higher average score of 1.89, despite similar trends in other indicators.

Worsening with CH18:

On **September 29, 2024**, administration of **CH18** resulted in clinical deterioration, with the average score increasing to **1.63**, reversing prior gains.

Attempted Reversal with CH16:

A return to CH16 on **October 6, 2024**, failed to reverse the decline. The average score rose further to **1.74**, which coincided with the emergence of a comorbidity (diagnosed as colon cancer). BM hours decreased from 10 to 8 (still rated BM = 0), and WM hours remained unchanged at 6 (WM = 4).

Criteria for Determining the Optimal Dose

The best dose was determined by evaluating all five clinical markers, using the following criteria:

- The **highest number of hours per day with Best Moment (BM)**;
- The **lowest average clinical score** across the assessment period;
- The **fewest hours per day with Worst Moment (WM)**.

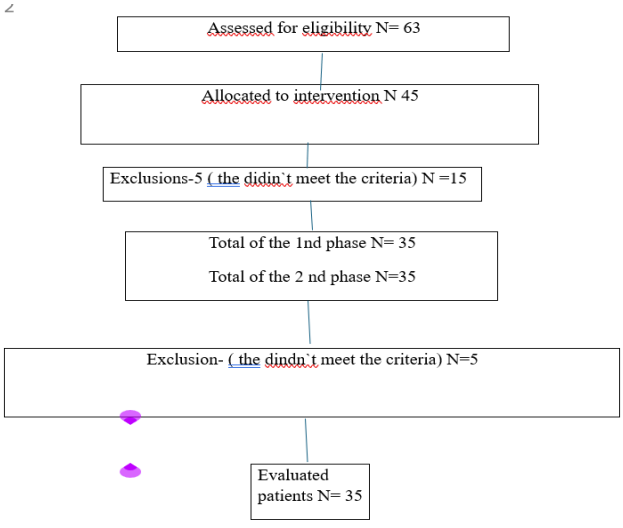
However, clinical judgment remains essential. The emergence of **comorbidities** or other confounding variables may require reassessment of the optimal dose. The Veredas App includes built-in logic to prioritize treatment of such intercurrent conditions before resuming dose progression. Only after managing the comorbidity is it advisable to resume testing higher potencies (e.g., CH18).

This process was conducted **individually for each of the 35 volunteers**, demonstrating the **precision, responsiveness, and practical utility** of the Veredas Protocol in identifying optimal therapeutic doses based on real-time clinical data.

RESULTS

1. Qualitative Study 1 – Participant Selection and Demographics

Figure 1



A detailed flowchart of participant inclusion and exclusion is presented in **Figure 1**.

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Demographic Characteristics

- **Age and Gender:**
  Parkinson's disease was more prevalent among **men aged 51–92** and **women aged 44–90**.
- **Regional Representation (RMBH – Metropolitan Region of Belo Horizonte):**
  The sample corresponded to **5.3% of men** and **11.3% of women** within the regional population of diagnosed individuals.
- **Educational Level:**
  An equal proportion of participants had completed either **primary education** or **higher education** (22% each).
- **Healthcare Access:**
  - **36%** of participants were covered by the public health system (SUS).
  - **32%** had access to private healthcare insurance.
- **Time Since Diagnosis:**
  - **12%** had been diagnosed within the last 5 years.
  - **18%** had been diagnosed between 6 and 10 years prior.
  - **12%** had a disease duration of 18 to 20 years.
- **Comorbidities:**
  Participants presented with an **average of 1.3 comorbidities**, ranging from **0 to 10** per individual.

Veredas App Evaluation – Dose Selection

The study also evaluated the **effectiveness of the Veredas App** in identifying the most appropriate dose among seven tested potencies for each participant.

A qualitative analysis was conducted using **video documentation from 9 of the 35 included volunteers**, focusing on:

- The evolution of symptom intensity across different potencies;
- The app's ability to assist in clinical decision-making regarding optimal dose selection;
- The correlation between app-based records and video-based external assessments.

Table – II: Reduction of Worst Moment Clinical Scores – Phase 1 to Phase 2

ID		FASE 1	FASE 2	FASE 1	FASE 2
		Hours WM- 3 e 4	Hours WM- 3 e 4	Hours BM -0-1-2	Hours BM-0-1-2
1	AMM			12	8
2	DLL	3		2	8
3	EMR	1		12	6
4	FTL	3		9	16
5	GP	12		7	16
6	GMS	5		12	10
7	JGGM	8		4	13
8	JCR			14	16
9	KCG		16	9	17
10	LC	7		2	15
11	LCN	2		14	14
12	MSE	2		2	5
13	MEFS			18	2
14	MRPM	2		5	3
15	NRNR	9		8	4
16	NFB	4		11	5
17	SPVS			8	5
18	TJG	3	10	3	2
19	VLG			14	19
20	CMC			4	5
21	DLP			6	12
22	EMR	1		14	17
23	IPNVS	9		8	12
24	JIP	18	19	18	16
25	JLA	1		9	16
26	MCA			18	7
27	MVBS			13	11
28	MIRS			14	9
29	MGO			13	10
30	NOR			6	16
31	RC			11	13
32	RFS			5	10
33	SPVS			13	2
34	DM	6		4	17
35	JM			13	17
Total-		95	45	335	374

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Interpretation of Phase 1 and Phase 2 Results

Note: Blank cells in the tables do not indicate missing data but rather the absence of severe symptoms (scores 3 or 4) during Phase 2. This absence is interpreted as a clinical indicator of improvement and is discussed in the main text.

From Phase 1 (allopathic treatment only) to Phase 2 (addition of constitutional homeopathic medication), there was a **52.6% reduction in the number of hours with Worst Moment (PM) scores of 3 or 4**, and a **10.4% increase in Best Moment (BM) hours**. This pattern reflects the logic of the Veredas Protocol, which prioritizes **dose administration exclusively during the PM** — that is, at moments of highest symptom intensity.

Importantly, score 4 was an exclusion criterion for study participation, meaning that **score 3 (intense symptom)** was the upper clinical threshold observed. According to protocol guidelines, once PM scores of 3 diminish and PM hours approach zero, the patient no longer presents intense symptoms and is transitioned to testing doses during moderate (score 2) or mild (score 1) symptoms. Thus, while improvement in PM hours may occur rapidly, this does not imply full clinical resolution or treatment discontinuation. Ongoing testing of potencies, consideration of comorbidities, and evaluation of possible confounding factors remain essential, given the **biochemical and energetic interconnection between organs and environmental factors**, which may modulate therapeutic response in both homeopathic and allopathic approaches to Parkinson's disease.

In Phase 1, the number of PM hours ranged from **1 to 18 hours per day**. In Phase 2, although some patients initially experienced increased PM hours (likely due to the surfacing of deeper symptom layers), these events began to shift from **score 3 (intense)** to **score 2 (moderate)** and **score 1 (mild)**. This clinical transition is evidenced by the near disappearance of score 3 in Phase 2.

Specifically, in Phase 1, **17 of the 35 volunteers presented PM scores of 3**. By the end of Phase 2, after just one month of constitutional homeopathic treatment, **only 3 patients still registered score 3**, reflecting an **83.35% improvement** in the number of hours with PM = 3 following the introduction of homeopathy.

Table – III – Reduction of Worst Moment Clinical Scores with Evolutive Videos

Patient	Phase 1 PM	Phase 2 PM	Videos (Before / After)
GMS	3	0	https://drive.google.com/file/d/17YVelOZtxDMZGH7drQNZKs_qX4WynnZ5/view?usp=sharing https://drive.google.com/file/d/1b4pEzjSIotHKyTPGkvH44g5I7JvwAlqE/view?usp=sharing
AMM	2	1	https://drive.google.com/file/d/1JDTwEnR9f0v8Kw630cjy6cqvuwhwp7UR/view?usp=sharing https://drive.google.com/file/d/1Zanp0NjBShcAzAH6llarbfn8XuvqKO5O/view?usp=sharing
DLL	3	1	https://drive.google.com/file/d/1_QUBTddSfHSi2yXdnTZN4yv7LqDVKbGe/view?usp=sharing https://drive.google.com/file/d/1GVAr0q6WoYPJZWKAmSSuDqTM55n7-wY3/view?usp=sharing
EMR	2	1	https://drive.google.com/file/d/1AREN7g1BU0O6tXxkfiXeMQOGb74abdHm/view?usp=sharing https://drive.google.com/file/d/1kuC0SMyqC-jaSoPv9-PSoe9LSwlUvqz7/view?usp=sharing
MEFS	3	2	https://drive.google.com/file/d/1IDxNPCpGELh8svQosjz6jVPk0LfG1LOB/view?usp=sharing https://drive.google.com/file/d/1emvcKlmdnTDUnJmNRWnqhn-xbx3AOHwx/view?usp=sharing
NOR	2	1	https://drive.google.com/file/d/1cVBjiLVeaaLqJt4-qE0EWT_tBeuFKpOa/view?usp=sharing https://drive.google.com/file/d/1Eq7BbJwBhC4Ywi5PQ9asmlKrSqUKUQs_/view?usp=sharing
MIRS	1	1	https://drive.google.com/file/d/1npyKfxp2Oif8qmO3C9ZbLF2VoyVbexSd/view?usp=sharing https://drive.google.com/file/d/1ftHTMj2KCQLderU2AZiT1s9WzmWfPyL1/view?usp=sharing
MSE	1	0	https://drive.google.com/file/d/1ZXRM8tMICBfPAO1h7lVJEf79AqDE4j1W/view?usp=sharing https://drive.google.com/file/d/1ocXEIO5NCZvZTVpouFCHE8aFjxM_-rwQ/view?usp=sharing
MVBS	1	0	https://drive.google.com/file/d/1H2IidLyyBRSAhj_Um-j9tfoL_O6JlrTt/view?usp=sharing https://drive.google.com/file/d/11a-HT2uFwQVpUdNpX4_N3aFg_KJPpdjh/view?usp=sharing
	18	7	

The comparative results of the Worst Moment (WM) videos between Phases 1 and 2 confirmed the improvements observed in Table III. Specifically, there was a 61.1% average reduction in WM scores from Phase 1 (allopathic treatment only) to Phase 2 (addition of constitutional homeopathic treatment). The video assessments for these 9 out of 35 volunteers were independently performed by the principal investigator, rather than by the volunteers themselves. This cross-validation of video scores substantially enhanced the credibility of the results.

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Table – IV: Increase of Best Moment Clinical Scores in Evolutive Videos

F	Fase 1	Fase 2	FASE 1 Video	FASE 2 Video
GMS	2	0	https://drive.google.com/file/d/17YVelOZtxDMZGH7drQNZKs_qX4WynnZ5/view?usp=sharing	https://drive.google.com/file/d/1fA4AE7eUgps0IRWVLosDmOviE4cVQ3eu/view?usp=sharing
AMM	1	1	https://drive.google.com/file/d/1JDTwEnR9f0v8Kw630cjy6cqvuwhwp7UR/view?usp=sharing	https://drive.google.com/file/d/1yiNwVNk0UhueABQl3zAIKqU_SDjtyq6D/view?usp=sharing
DLL	1	1	https://drive.google.com/file/d/1_QUBTddSfHSi2yXdnTZN4yv7LqDVKbGe/view?usp=sharing	https://drive.google.com/file/d/1GVAr0q6WoYPJZWKAmSSuDqTM55n7-wY3/view?usp=sharing
EMR	1	1	https://drive.google.com/file/d/1AREN7g1BU0O6tXxkfiXeMQOGb74abdHm/view?usp=sharing	https://drive.google.com/file/d/1XHC6YodWiTpNDlr9YzDT8xZ8edRaQT4G/view?usp=sharing
MEFS	2	0	https://drive.google.com/file/d/1IDxNPCpGELh8svQosjz6jVPk0LfG1LOB/view?usp=sharing	https://drive.google.com/file/d/1csKDV9pc7_VKlxRVljq7yjL28YI26hsj/view?usp=sharing
NOR	2	0	https://drive.google.com/file/d/1cVBjiLVeaaLqJt4-qE0EWT_tBeuFKpOa/view?usp=sharing	https://drive.google.com/file/d/1v79SJ-8vZz-ly1nnZpHnj3DDS4T4uF6G/view?usp=sharing
MIRS	1	1	https://drive.google.com/file/d/1npyKfxp2Oif8qmO3C9ZbLF2VoyVbexSd/view?usp=sharing	https://drive.google.com/file/d/18ViXNJhzlWUOQSLy1DVtGIv7wn0aeMtj/view?usp=sharing
MSE	0	0	https://drive.google.com/file/d/1ZXRM8tMICBfPAO1h7lVJEf79AqDE4j1W/view?usp=sharing	https://drive.google.com/file/d/1ocXEIO5NCZvZTVpouFCHE8aFjxM_-rwQ/view?usp=sharing
MVBS	1	0	https://drive.google.com/file/d/1H2IidLyyBRSAhj_Um-j9tfoL_O6JlrTt/view?usp=sharing	https://drive.google.com/file/d/1WNhku_312htkX0iVwc28jYZGGXdoI0no/view?usp=sharing
	11	4		

The comparison of Best Moment (BM) clinical video scores between Phases 1 and 2 showed a 36.4% improvement. This result provides strong evidence of clinical recovery based on key markers, achieved after just one month of constitutional homeopathic treatment. The video assessments for these 9 out of 35 volunteers were independently conducted by the principal investigator.

Table – V: Example of Daily Reduction in Allopathic Medication Doses

Date	Confounding	Symptom	CH	OT	Average	WM	WM Hours	BM	BM Hours
11/07/2024	None	Parkinson	12	DNA 12+ ATP CH12	1.63	4	6	0	10
13/07/2024	None	Parkinson	12	No Repeat	1.21	4	6	0	11
18/07/2024	None	Parkinson	12	No Repeat	1.32	4	6	0	11
31/07/2024	lack of energy	Parkinson	12	No Repeat	1.79	4	7	0	10
08/08/2024		Parkinson	12	No Repeat	1.74	4	6	0	10

Video Example – Clinical Evolution

- **Baseline (July 13, 2024):**
  Best Moment (BM = 0): 11 hours/day
- https://youtube.com/shorts/hUFEQ3xyXl8
- (walking)
- Worst Moment (WM = 4): 6 hours/day
  Average clinical score: 1.21 over 17 waking hours
- https://youtube.com/shorts/sooKxV0z2Po
- (being loaded)

This patient—who was also receiving concurrent cancer therapy—gained one additional symptom-free hour daily (BM = 0) and reduced intense symptoms (WM = 4) from six to one hour/17 walking hours. Because the Veredas Protocol directs dose administration only during the worst-symptom period, the improvement allowed a proportional decrease in daily allopathic Parkinson's doses, from six to one.

This is a video that shows the action of the Veredas Protocol by reducing the number of times taken from 10 comp/day of Prolopa 125/50mg to 5 comp/day, along with improvements in gait from score 4 to score 2 in just 2 days.

VIDEO explaining individualized ideal dose in the Veredas Application.
https://youtu.be/7MyH0vFvPhE

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Observed Improvements Across the Cohort

Phase 2 results (Table 2) corroborate this pattern. In a condition typically marked by stability or progressive decline, most patients shifted from severe WM scores (3–4) in Phase 1 to mild scores (0–2) after only one month of homeopathy. Although formal significance testing was not feasible due to the small sample and short observation period, cross-referenced video analyses—independently rated by the principal investigator for 9 of the 35 volunteers—showed visible functional gains in motor performance even when numerical score changes were modest.

These qualitative findings strengthen the evidence that individualized, DE100-guided dosing can rapidly attenuate peak symptom intensity in Parkinson's disease, enabling tapering of conventional medication while improving overall clinical status.

Comparison with Previous Quantitative Studies

The clinical improvements observed in Phase 2 of this qualitative study are consistent with findings from earlier quantitative research, particularly when Organotherapeutics (OT) were added to Constitutional Medication (CM):

Quantitative Study 2 (2021, n = 41)[23]

- Overall symptom improvement: 91% (95% CI: 60–98%)
- Emotional/mental improvement: 85% (95% CI: 53–96%)
- Symptom-specific reductions over 30 days:
    - Difficulty swallowing: –18% (p = 0.000)
    - Tremors: –3% (p = 0.013)
    - Joint pain/locking: –8% (p = 0.000)
    - Speech difficulty: –7% (p = 0.008)
    - Gait/postural instability: –5% (p = 0.005)
    - Cognitive comprehension: –9% (p = 0.015)
    - Emotional symptoms: –10% average (p = 0.000)

Conclusion: Patients showed marked clinical improvement without suppression of symptoms — particularly evidenced by parallel improvements in emotional and cognitive domains.

Quantitative Study 3 (2012, n = 168)[24]

- Population: Parkinson's patients with chronic pain
- Phase 1 (Days 0–90):
    - 60.78% (78/129) achieved ≥50% reduction in McGill pain scores using only CM
- Phase 2 (Days 90–150):
    - Remaining 39.53% (51/129) received two additional CM doses plus one OT dose
    - Result: 49.2% additional pain reduction (p = 0.005)
    - Total improvement: 60.2% (p < 0.001)

Similarities and Differences Between Studies

- Both quantitative studies used an initial phase with CM and introduced OT later.
- The 2021 study extended follow-up to 550 days and aligned treatment adjustments with Worst Moment (WM) scores using the Veredas App.
- In both studies, clinical improvement and WM reduction supported the progressive tapering of allopathic medications.

Other Results

Advances in Homeopathic Prescription Practices

1. The study introduced the prescription of seven different doses (one every four days), instead of the conventional protocol of increasing the dose every 60 days. Identifying the best dose in just 28 days has brought benefits: A single dose above CH30 had an average effect of 60 to 90 days. The criterion of Effective Dose 100 allowed the dose to be repeated only when the previous dose lost efficacy. Treatment time was reduced by up to 15 times (28 days vs. 420 days). Average recommended dose: CH15.
2. Impact on Treatment Duration and Best Dose Identification Patients recorded symptoms for 15.3 hours a day (out of 18 hours awake). Before the study, they used only allopathic medicines for about 60.3 months. After the introduction of constitutional homeopathy, they were followed for only one month.
3. Discussion of Results Monitoring: monthly follow-up for 2 months; patients in stages I to IV of the disease. Randomization: abandoned due to the need to observe the isolated effects of the constitutional drug (CM). In the 3rd month of the default survey in the design planning, it was not possible to analyze test and placebo groups separately because both had already been previously remedied with their constitutional remedies and it would not be possible to evaluate the brain organotherapeutic method additionally because the homeopathic paradigm does not admit its use in isolation from the Constitutional Remedy that treats the patient as a whole. Data reliability: records in spreadsheets showed consistency, with mathematical synthesis made by the Veredas app. Videos: reinforced the reliability of the results by correlating clinical observations with evolutionary images. Identification of the Best Dose: the ideal dose was defined as the one prior to the one that caused worsening of symptoms. Veredas Protocol: proved to be innovative in quickly individualizing the ideal dose, optimizing therapeutic response and avoiding adverse effects.
4. Limitations of the Allopathic Approach UPDRS: although useful for assessing disease progression, it does not consider individualization of doses, which can induce overdose. Scheduling control: lack of detailed control of the Worst (WM) and Best (BM) moments can compromise the reliability of the data and delay therapeutic adjustments. Although it was not the scope of this study, we believe that the conceptual change of the Effective Dose 50 would bring to allopathy the beneficial effects brought by this work in the use of homeopathic medicines with the Hahnemanean Effective Dose 100 criterion.

CONCLUSION

We did not conclude only from the qualitative and quantitative results of the study. We can assume with great probability that the failures in allopathic or homeopathic treatments, which were submitted to the Veredas Protocol, compared to the Protocol of conventional allopathic prescriptions at fixed intervals of doses, are not due to the

medication but to the inadequate protocol of administration of the doses, in both paradigms. This is not only true for cerebrodegenerative diseases, but for any other diagnosis, allopathic or homeopathic.

The Veredas Protocol demonstrated itself as an innovative and efficient strategy for the individualization of homeopathic doses, offering a faster and more precise method for identifying the optimal dose. Its capacity to integrate temporal and variable aspects of Parkinson's symptoms highlights its potential for personalized treatment in complex clinical contexts.

This study opens the door to an urgent conversation aligned with recent and important investigations on dose-response testing methodologies, especially in silico simulations. These advances are even more relevant when compared to the limitations of conventional protocols based on the Effective Dose 50 (ED50), predominantly used by the pharmaceutical industry. By contrast, the Veredas Protocol adopts the conceptual foundation of Effective Dose 100 (DE100), a principle formulated by German physician and chemist Samuel Hahnemann in the 19th century. Remarkably, scientific proposals from that period, such as DE100, are only now beginning to gain recognition in contemporary research.

This work may represent a pioneering step toward re-evaluating the conceptual criterion of dose-response testing. It challenges the prevailing ED50 standard, which may be contributing to a global scenario where over 50% of patients relying on allopathic medicine are at risk of hospitalizations or even death due to serious adverse drug effects. The study thus calls for a renewed scientific discussion on the fundamental assumptions of pharmacological dosing and therapeutic safety.

Conflicts of Interest

None declared.

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ORIGINAL ARTICLE

Role of Procalcitonin and C-reactive Protein as Biomarkers for Early Detection of Neonatal Sepsis

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ABSTRACT

Introduction: *Neonatal sepsis is a major cause of newborn deaths, with early diagnosis hindered by delayed blood culture results. This study aims to assess the diagnostic accuracy of procalcitonin (PCT) and C-reactive protein (CRP) for early detection.* ***Methods & Materials:*** *This cross-sectional observational study was conducted over a six-month period from January to June 2015 at two private tertiary healthcare centers in Dhaka, Bangladesh. A total of 45 neonates aged 1–28 days with suspected sepsis. Serum procalcitonin (PCT) and C-reactive protein (CRP) levels were measured along with other laboratory parameters. Diagnostic accuracy was assessed using sensitivity, specificity, predictive values, and ROC curve analysis. Statistical analysis was performed using SPSS version 25.0.* ***Results:*** *The mean age was 8.2 ± 6.4 days; 62.2% were male. Common clinical features included fever (84.4%) and tachypnea (77.8%). Mean PCT was 2.45 ± 1.82 ng/mL; mean CRP was 24.8 ± 18.4 mg/L. PCT sensitivity and specificity were 89.5% and 78.2% respectively at a 1.5 ng/mL cut-off, while CRP had 82.4% sensitivity and 71.8% specificity at 15 mg/L. Combining both biomarkers increased sensitivity to 94.7% and specificity to 82.6%. ROC curve analysis showed PCT had an AUC of 0.886, CRP 0.798, and combined markers 0.924 ($p < 0.001$). PCT and CRP levels correlated strongly ($r = 0.742$, $p < 0.001$), and both increased with sepsis severity.* ***Conclusion:*** *PCT is a sensitive and specific biomarker for early neonatal sepsis detection, with diagnostic accuracy enhanced by combining with CRP. Routine measurement of both biomarkers can improve early diagnosis and guide timely treatment.*

Keywords: *Neonatal Sepsis, Procalcitonin, C-reactive Protein*

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INTRODUCTION

Neonatal sepsis is a major cause of morbidity and mortality worldwide, especially in developing countries with limited health resources [1]. It is estimated that about 3–10 newborns per 1,000 live births are affected by neonatal sepsis, accounting for a significant proportion of neonatal deaths [2]. Early-onset sepsis occurs within the first 72 hours of life and, if not detected and treated on time, is particularly dangerous due to the rapid progression to septic shock and multiple organ failure. Neonates with respiratory problems or metabolic disorders during the perinatal period are at higher risk of developing sepsis [3]. Blood cultures are still considered the gold standard for diagnosis, but they have several limitations, including low sensitivity, delayed results (requiring 48–72 hours), and potential contamination. These issues result in diagnostic uncertainty and delays in initiating appropriate therapy. In this context, the use of reliable biomarkers for early detection of neonatal sepsis is crucial for the timely initiation of antimicrobial treatment and improved clinical outcomes [4]. Procalcitonin (PCT) and C-reactive protein (CRP) are two biomarkers that have been extensively studied for their diagnostic value in neonatal sepsis. Procalcitonin concentration increases within 2–4 hours after bacterial invasion and peaks at about 6 to 12 hours and has a half-life of about 24 h, correlating with the severity of infection [5]. This makes it a potentially more specific biomarker for bacterial sepsis. C-reactive protein, an acute-phase reactant synthesized by the liver in response to interleukin-6 stimulation, begins to rise after 12–24 hours and peaks within 2–3 days [6]. However, conditions such as delayed growth, perinatal asphyxia, meconium aspiration, and prolonged labor may elevate CRP levels, reducing its

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specificity for sepsis. Several studies have evaluated the diagnostic accuracy of procalcitonin and CRP, both individually and in combination, for the early detection of neonatal sepsis. Procalcitonin may offer higher sensitivity and specificity in the early stages of bacterial infection, while CRP remains valuable for monitoring response to treatment. The combined use of these biomarkers may enhance diagnostic accuracy, allowing for better clinical decision-making and rational antibiotic use, thereby helping to reduce antimicrobial resistance [7]. Considering these factors, the current research aimed to evaluate the role of procalcitonin and CRP as biomarkers for the early detection of neonatal sepsis. The findings are expected to provide evidence that supports timely medical intervention and promotes the use of effective diagnostic tools to improve survival outcomes among neonates, particularly in resource-limited settings.

METHODS & MATERIALS

This cross-sectional observational study was conducted over a six-month period from January to June 2015 at two private tertiary healthcare centers in Dhaka, Bangladesh: Padma General Hospital Ltd. and CURE Specialized Hospital Ltd. A total of 45 neonates aged 1 to 28 days with clinical suspicion of sepsis were enrolled consecutively. Clinical and demographic information was collected, and blood samples were obtained within 2 hours of admission. Serum procalcitonin (PCT) and C-reactive protein (CRP) levels were measured using standard immunoassay methods, with diagnostic cut-offs of 1.5 ng/mL and 15 mg/L, respectively. Additional laboratory parameters included white blood cell count, absolute neutrophil count, platelet count, and serum lactate. Patients were categorized into sepsis, severe sepsis, or septic shock based on clinical and laboratory criteria. Data analysis was performed using SPSS version 25.0, including calculation of sensitivity, specificity, positive and negative predictive values, and ROC curve analysis. Pearson's correlation was used to assess relationships between biomarkers and laboratory findings. Ethical approval was obtained from the Institutional Review Board, and informed consent was secured from the guardians of all participants.

Inclusion criteria:

- Neonates aged ≤28 days.
- Presence of clinical signs suggestive of sepsis (e.g., fever, lethargy, respiratory distress, poor feeding).
- Informed written consent obtained from parents or guardians.

Exclusion criteria:

- Neonates with major congenital anomalies or surgical conditions.
- Prior antibiotic therapy for more than 24 hours before admission.
- Incomplete laboratory data or refusal to participate.

RESULTS

Table I shows the baseline characteristics of the study population (N = 45). The mean age of neonates was 8.2 ± 6.4 days (range: 1–28 days). The majority were male (62.2%). The mean gestational age was 36.8 ± 2.1 weeks, with 71.1% born full-term and 28.9% preterm. The mean birth weight was 2.68 ± 0.52 kg. Regarding nutritional status, 84.4% were well-nourished, and 15.6% were malnourished. [Table I].

Table – I: Distribution of study patients based on their initial characteristics (*n* = 45)

Characteristics	Number (%) / Mean ± SD
Total Sample Size	45
Age Range (days)	1 – 28
Mean Age (days)	8.2 ± 6.4
Gender	
Male	28 (62.2%)
Female	17 (37.8%)
Gestational Age (weeks)	36.8 ± 2.1
Gestational Status	
Full-term	32 (71.1%)
Preterm	13 (28.9%)
Birth Weight (kg)	2.68 ± 0.52
Nutritional Status	
Well-nourished	38 (84.4%)
Malnourished	7 (15.6%)

As presented in Table II, the most common clinical feature was fever (84.4%), followed by tachypnea (77.8%), lethargy (71.1%), and poor feeding (64.4%). Other notable symptoms included tachycardia (55.6%), hypotension (40.0%), grunting (33.3%), and seizures (17.8%). [Table II].

Table – II: Clinical Features and Symptom Frequency Among Study Patients (*n* = 45)

Clinical Feature	Count (n)	Percentage (%)
Fever	38	84.4%
Tachypnea (RR >60/min)	35	77.8%
Lethargy	32	71.1%
Poor feeding	29	64.4%
Tachycardia	25	55.6%
Hypotension (MAP <40 mmHg)	18	40.0%
Grunting	15	33.3%
Seizures	8	17.8%

Table III summarises laboratory parameters. The mean procalcitonin (PCT) level was 2.45 ± 1.82 ng/mL (range: 0.25–8.50), and mean C-reactive protein (CRP) was 24.8 ± 18.4 mg/L (range: 3.2–78.5). Mean white blood cell (WBC) count was 12.4 ± 6.8 $\times 10^3/mm^3$, ANC was 8.2 ± 4.6 $\times 10^3/mm^3$, platelet count was 198 ± 82 $\times 10^3/mm^3$, and lactate level was 3.8 ± 2.1 mmol/L. [Table III].

Table – III: Laboratory Findings of the Study Population (*n* = 45)

Parameter	Mean ± SD	Range
PCT (ng/mL)	2.45 ± 1.82	0.25 – 8.50
CRP (mg/L)	24.8 ± 18.4	3.2 – 78.5
WBC ($\times 10^3/mm^3$)	12.4 ± 6.8	4.2 – 28.9
ANC ($\times 10^3/mm^3$)	8.2 ± 4.6	2.1 – 18.7
Platelets ($\times 10^3/mm^3$)	198 ± 82	85 – 420
Lactate (mmol/L)	3.8 ± 2.1	1.2 – 9.4

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As shown in Table IV, mean PCT, CRP, and WBC levels increased progressively with sepsis severity. In the sepsis group, mean PCT was 1.2 ± 0.8 ng/mL and CRP 12.5 ± 8.2 mg/L. For severe sepsis, PCT was 3.1 ± 1.4 ng/mL, CRP 28.4 ± 12.6 mg/L, and for septic shock, PCT reached 4.8 ± 2.2 ng/mL and CRP 45.2 ± 18.9 mg/L. Platelet counts decreased with severity, lowest in septic shock (148 ± 92 $\times 10^3/mm^3$). [Table IV].

Table – IV: Comparison of Biomarker Levels across Sepsis Severity Groups

Group	PCT (ng/mL)	CRP (mg/L)	WBC ($\times 10^3/mm^3$)	Platelets ($\times 10^3/mm^3$)
Sepsis (n = 24)	1.2 ± 0.8	12.5 ± 8.2	10.2 ± 4.1	220 ± 65
Severe Sepsis (n = 7)	3.1 ± 1.4	28.4 ± 12.6	14.8 ± 7.2	185 ± 78
Septic Shock (n = 8)	4.8 ± 2.2	45.2 ± 18.9	16.2 ± 8.9	148 ± 92

Table – V: Diagnostic Accuracy of PCT, CRP, and Their Combination

Biomarker	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Cut-off
PCT	89.5	78.2	85.3	84.1	1.5 ng/mL
CRP	82.4	71.8	79.6	75.2	15 mg/L
Combined	94.7	82.6	90.0	90.5	Both elevated

Table V summarises the diagnostic accuracy of PCT, CRP, and their combination. PCT demonstrated a sensitivity of 89.5% and specificity of 78.2% at a cut-off of 1.5 ng/mL. CRP showed 82.4% sensitivity and 71.8% specificity at 15 mg/L. The combination of PCT and CRP yielded the highest diagnostic performance with 94.7% sensitivity and 82.6% specificity. [Table V]

As presented in Table VI, PCT had an AUC of 0.886 (95% CI: 0.798–0.945, $p < 0.001$), indicating excellent diagnostic ability. CRP had an AUC of 0.798 (95% CI: 0.695–0.879, $p < 0.001$). The combined biomarkers achieved the highest diagnostic accuracy with an AUC of 0.924 (95% CI: 0.845–0.972, $p < 0.001$). [Table VI].

Table – VI: ROC Curve Analysis of PCT, CRP, and Combined Biomarkers

Biomarker	AUC	95% CI	P-value
PCT	0.886	0.798 – 0.945	<0.001
CRP	0.798	0.695 – 0.879	<0.001
Combined	0.924	0.845 – 0.972	<0.001

Table VII presents a correlation analysis. PCT and CRP showed a strong positive correlation ($r = 0.742$, $p < 0.001$). PCT correlated moderately with WBC ($r = 0.568$, $p < 0.001$). CRP showed moderate correlations with WBC ($r = 0.489$, $p < 0.01$). [Table VII].

Table – VII: Correlation Analysis between Biomarkers and Laboratory Parameters

Correlation Pair	Pearson's r	P-value
PCT vs CRP	0.742	<0.001
PCT vs WBC	0.568	<0.001
CRP vs WBC	0.489	<0.01

DISCUSSION

Neonatal sepsis continues to be a major challenge worldwide. In this study, we assessed the roles of procalcitonin (PCT) and C-reactive protein (CRP) as biomarkers for early detection of neonatal sepsis, and our findings have several important implications. In our study, the mean age of neonates was 8.2 ± 6.4 days, with a male predominance (62.2%). This is quite similar to findings reported by Chiesa et al. (2011), where the mean age was around 7.5 days with 60% male neonates [8]. We found that 71.1% were full-term and 28.9% preterm, which aligns with the distribution reported by Morad et al. (2020) [9]. The mean birth weight here was 2.68 ± 0.52 kg, comparable to the 2.7 kg reported by Abdollahi et al. (2012) [10]. This suggests that our study population is broadly similar to those in previous studies, strengthening the external validity of our results. Fever was the most common presenting symptom in our neonates (84.4%), followed by tachypnea (77.8%), lethargy (71.1%), and poor feeding (64.4%). These findings are consistent with Morad et al. (2020), who also reported respiratory distress, lethargy, and poor feeding as common features [9]. The mean PCT level in our study was 2.45 ± 1.82 ng/mL (range: 0.25–8.50), which is slightly lower than that reported by Morad et al. (2020) (median 10.4 ng/mL), possibly due to the inclusion of more severe cases in their cohort [9]. Mean CRP was 24.8 ± 18.4 mg/L, lower than 48 mg/L reported by Morad et al. (2020) [9]. The mean WBC count was 12.4 ± 6.8 $\times 10^3/mm^3$, similar to Oncel et al. (2012) (15.8 ± 7.3 × $10^3/mm^3$) [11]. Platelet counts averaged 198 ± 82 $\times 10^3/mm^3$, slightly lower than the 220 $\times 10^3/mm^3$ reported by Chiesa et al. (2011), possibly due to sepsis-associated thrombocytopenia in our patients [8]. Lactate levels averaged 3.8 ± 2.1 mmol/L, indicating tissue hypoxia, which is consistent with Abdollahi et al. (2012), who found elevated lactate in septic neonates [10]. We found that PCT levels increased with severity, being 1.2 ± 0.8 ng/mL in sepsis, 3.1 ± 1.4 ng/mL in severe sepsis, and 4.8 ± 2.2 ng/mL in septic shock. This trend is consistent with Chiesa et al. (2011) and Eschborn & Weitkamp (2019), who reported PCT levels rising from 1.0 ng/mL in sepsis to >3 ng/mL in severe sepsis [8,12]. Similarly, CRP levels rose with severity, from 12.5 ± 8.2 mg/L in sepsis to 45.2 ± 18.9 mg/L in septic shock, aligning with Xu et al. (2016) meta-analysis showing pooled CRP elevation in

sepsis [13]. Platelet counts decreased with worsening sepsis (220, 185, and 148 $\times 10^3/mm^3$ respectively), consistent with thrombocytopenia as a severity marker described by Morad et al. (2020) [9]. In our study, PCT had a sensitivity of 89.5% and specificity of 78.2% at a cut-off of 1.5 ng/mL, which is similar to Altunhan et al. (2011), who reported PCT sensitivity of 83% and specificity of 89% [14]. CRP showed a sensitivity of 82.4% and specificity of 71.8% at 15 mg/L, another study by Akter et al (2018), who reported 35.1% sensitivity and 78.9% specificity [15]. Interestingly, the combination of PCT and CRP improved diagnostic performance, with 94.7% sensitivity and 82.6% specificity, which is supported by Eschborn & Weitkamp (2019), Pravin Charles et al. (2018), and Ruan et al. (2018) who found that combined biomarkers yield higher diagnostic accuracy [12,16,17]. The AUC for PCT was 0.886 (95% CI: 0.798–0.945, p<0.001), indicating excellent diagnostic utility, similar to Morad et al. (2020) (0.991) [9]. CRP had an AUC of 0.798 (95% CI: 0.695–0.879, p<0.001), comparable to Xu et al. (2016) (0.846) [13]. The combined AUC was highest at 0.924 (95% CI: 0.845–0.972, p<0.001), suggesting a combined approach is optimal, as shown by Eschborn & Weitkamp (2019)[12]. We observed a strong positive correlation between PCT and CRP ($r = 0.742$, $p < 0.001$), similar to Chiesa et al. (2011) [8]. PCT also showed moderate correlation with WBC ($r = 0.568$, $p < 0.001$) and lactate ($r = 0.634$, $p < 0.001$), suggesting its role in reflecting systemic inflammatory response and tissue hypoxia, as supported by Abdollahi et al. (2012) [10]. CRP correlated moderately with WBC ($r = 0.489$, $p < 0.01$) and lactate ($r = 0.521$, $p < 0.001$), but these correlations were weaker compared to PCT.

Limitations of the Study:

This study has a small sample size and a single-center design, which may limit the generalizability of the findings.

CONCLUSION

PCT demonstrated high sensitivity and specificity for the early diagnosis of neonatal sepsis, with levels increasing with disease severity. CRP remains a useful complementary marker, and using both together improves diagnostic accuracy. Implementing this combined approach could facilitate early intervention, ultimately improving neonatal outcomes.

RECOMMENDATON

Based on our study findings, we recommend that procalcitonin (PCT) be used routinely for the early detection of neonatal sepsis, as it showed high sensitivity and specificity with a cut-off value of 1.5 ng/mL. However, since CRP also remains a useful marker, combining both PCT and CRP can improve diagnostic accuracy even further. Using these two biomarkers together in daily NICU practice could help doctors make faster and more confident decisions, leading to earlier treatment and better outcomes for newborns with suspected sepsis.

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ORIGINAL ARTICLE

Megaprosthesis Reconstruction of Distal Femur-Our Experience at District Level Tertiary Care Hospital and Clinics

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ABSTRACT

Background: *Distal femoral megaprosthesis is a modular endoprosthetic implant designed to replace extensive segments of the lower femur, typically following tumor resection, non-reconstructable fractures, fracture nonunion, or failed total knee arthroplasty with significant bone loss. It serves a limb-salvage function, restoring structural integrity and joint mobility while enabling early rehabilitation. Despite its increasing use, outcomes following distal femoral megaprosthesis in district-level tertiary care settings remain underreported.* ***Aim of the study:*** *The present study aimed to evaluate the functional and clinical outcomes of distal femoral reconstruction using a megaprosthesis in patients with oncologic and non-oncologic indications, focusing on postoperative mobility, joint function, pain relief, and complication rates.* ***Methods:*** *A retrospective analysis was conducted on patients who underwent distal femoral megaprosthesis between 2016 and 2024 and completed a standardized postoperative rehabilitation protocol. Surgical management involved resection of the distal femur followed by implantation of a modular megaprosthesis with a hinged total knee replacement. Rehabilitation emphasized early mobilization, progressive weight-bearing, joint motion restoration, muscle strengthening, and gait re-education. Functional outcomes were assessed using the Musculoskeletal Tumor Society (MSTS) score, Oxford Knee Score (OKS), knee range of motion (ROM), and ambulatory status. Follow-up evaluations were performed at 45 days, 3, 6, and 12 months postoperatively, and annually thereafter.* ***Result:*** *Sixteen patients (10 males, 6 females; mean age 44.1 years) were included. Etiologies comprised accidental trauma (37.5%), tumors (31.3%), and trivial trauma (31.2%), with osteoporosis present in 62.5% of cases. The mean hospital stay was 12.2 days. Patients achieved standing at 4.1 days and assisted ambulation at 4.5 days post-surgery. At a mean follow-up of 23 months, the mean MSTS score improved from 10.4 preoperatively to 19.3 postoperatively. Median Knee Society Score increased from 20 to 80, and mean OKS was 38.5. Postoperative knee ROM ranged between 94° and 108°. Ten patients (62.5%) achieved independent ambulation, while six used a cane. Complications were minimal, including one wound dehiscence, one superficial infection, and one deep infection; all resolved without prosthesis removal. Implant survival at last follow-up was 100%. Early mobilization correlated with improved MSTS scores (standing: $R = -0.609$; $p = 0.012$; assisted walking: $R = -0.623$; $p = 0.010$).* ***Conclusion:*** *Distal femoral megaprosthesis is a reliable option for extensive bone loss, enabling early mobilization, functional restoration, and low complication rates, with structured rehabilitation crucial for optimal recovery.*

Keywords: *Distal femur, Megaprosthesis, Limb salvage, Nonunion, Tumor resection, Functional outcome, MSTS score, Knee reconstruction, Rehabilitation*

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INTRODUCTION

Malignant bone tumors, though rare, pose significant clinical challenges due to their aggressive nature and the complex reconstructive needs following surgical resection[1]. Osteosarcoma, the most common primary malignant bone tumor, accounts for approximately 35% of cases, with a substantial proportion affecting the distal femur[2]. Globally, the incidence of primary malignant bone tumors is estimated

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at 0.2% of all malignancies, highlighting their rarity and the necessity for specialized management strategies[3]. These tumors predominantly occur in adolescents and young adults, with the distal femur being the most frequent site of involvement. This region is of particular clinical significance, as it plays a critical role not only in weight-bearing and mobility but also in maintaining overall knee function, making its involvement a key consideration in both diagnosis and treatment planning[4]. The management of distal femoral bone tumors necessitates a comprehensive multidisciplinary approach, combining meticulous surgical resection with advanced reconstructive techniques. This integrated strategy aims not only to achieve optimal oncological safety by minimizing the risk of local recurrence but also to restore limb function, preserve mobility, and maintain the patient's overall quality of life[5]. Historically, amputation was regarded as the standard treatment for distal femoral bone tumors; however, advances in surgical techniques, prosthetic design, and perioperative care have revolutionized management, making limb salvage procedures increasingly feasible. These innovations have not only improved functional outcomes and quality of life for patients but also expanded the scope of oncologically safe, limb-preserving options available to surgeons[6]. Among the available reconstructive options, megaprosthetic reconstruction has emerged as a reliable and widely adopted approach for managing extensive bone defects. This technique not only preserves limb length and joint stability but also significantly improves patients' postoperative mobility and overall quality of life, making it a preferred option in modern orthopedic oncology[7]. Megaprostheses are custom-designed implants capable of replacing large segments of bone and joint structures, providing durable and functional reconstruction after tumor resection[8]. Multiple studies have documented the efficacy of distal femoral megaprostheses, reporting favorable outcomes in terms of limb function, long-term implant survival, and manageable complication rates. The introduction of modular and custom-made prostheses has further enhanced surgical flexibility, allowing surgeons to tailor reconstructions according to defect size, patient anatomy, and anticipated functional demands[8,9]. Additionally, postoperative rehabilitation protocols combined with megaprosthetic reconstruction have shown promising results in restoring patients' daily activities and reducing long-term morbidity[10]. Particularly at district-level tertiary care hospitals, implementing such advanced reconstructive procedures presents unique challenges and opportunities. These institutions often serve as primary centers for specialized orthopedic care, catering to a diverse patient population with varying socioeconomic backgrounds and limited access to advanced facilities[11]. Sharing institutional experience from these settings provides valuable insights into the feasibility, outcomes, and cost-effectiveness of megaprosthetic reconstruction in resource-constrained environments, contributing to global knowledge while addressing local healthcare challenges[12]. The aim of this study was to evaluate the clinical outcomes and challenges of megaprosthesis reconstruction of the distal femur in patients treated at a district-level tertiary care hospital and clinics.

METHODS & MATERIALS

This multicenter retrospective study was conducted in Satkhira Medical College Hospital and affiliated clinics in Bangladesh. The study spanned from June 2022 to January 2025 and included patients who underwent massive bone resection of the distal femur followed by megaprosthetic reconstruction of the distal femur and knee joint. All procedures were performed in accordance with the ethical standards of the 1964 Declaration of Helsinki and its later amendments [13]. A total of 16 patients were enrolled, comprising 10 males and 6 females, with an age range of 20–70 years. Data were systematically collected from institutional records, pre-operative assessments, and postoperative follow-up evaluations.

Inclusion Criteria

- Patients undergoing massive bone resection followed by implantation of a modular megaprosthesis of the distal femur and knee joint.
- Patients diagnosed with primary or secondary bone tumors, periprosthetic fractures, or fracture non-union.
- Patients managed with the standard rehabilitation protocol during and after hospitalization.

Exclusion Criteria

- Pre-operative diagnosis of advanced tumor.
- Pre-operative neurological deficits, adverse effects of chemotherapy, or systemic diseases that could impede rehabilitation.
- Intra-operative sacrifice of the extensor apparatus as a whole to achieve wide resection margins.
- Post-operative mechanical failures or local recurrences requiring further surgical intervention.
- Follow-up shorter than 12 months.

Data Collection

Pre-operative imaging including X-rays, CT scans, and MRI was performed for all patients to establish diagnostic confirmation and assist in surgical planning. Pre-operative functional status was evaluated using the Musculoskeletal Tumor Society (MSTS) score. Postoperatively, patients were followed up through serial office visits, clinical examinations, and X-ray imaging in order to assess both clinical and radiological outcomes. Outcome parameters included implant status, peri- and postoperative complications, and knee range of motion (ROM) at each follow-up. Functional outcomes were assessed using the Knee Society Score (KSS) and the MSTS scoring system. The KSS is a validated scoring tool that evaluates pain, range of motion, stability, alignment, and function, with a maximum score of 100 points. The MSTS system, on the other hand, measures pain, function, emotional acceptance, walking ability, support, and gait, with a maximum score of 30 points. Ethical approval was obtained from the Ethical Review Committee of Satkhira Medical College Hospital and concerned clinics.

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Surgical Technique

All procedures were performed through an anterolateral approach to the distal femur. Following resection of the affected bone and canal preparation, a modular megaprosthesis was implanted. Fixation was achieved with polymethylmethacrylate (PMMA) bone cement, with cement restrictors to optimize mantle formation; additional stabilization with plates, screws, or cerclage wires was used when required. Soft tissue reconstruction of ligaments and tendons was carried out to restore joint stability, and wounds were closed in layers with suction drains.

Postoperative Management

Antibiotic prophylaxis with intravenous Vancomycin (1 g) and Tobramycin (100 mg) every 12 hours was given from the night before surgery until drain removal. The operated limb was immobilized with an articulated knee brace allowing controlled flexion–extension while reducing varus–valgus stress, maintained full-time for 30 days. Rehabilitation was initiated under brace protection, and all intraoperative and postoperative complications were documented.

Statistical Analysis

Both descriptive and analytical statistics were used. Statistical analysis was performed with Stata SE 13 (StataCorp LLC, College Station, TX, USA). Continuous variables were expressed as mean ± standard deviation (SD), and categorical variables as frequencies and percentages. A p-value ≤ 0.05 was considered statistically significant for all endpoints.

RESULT

Table 1 showed the demographic characteristics of the study population (n=16). The mean age was 44.1 years (range 20–70). Males comprised 62.5% and females 37.5%. The mean BMI was 29.36 kg/m^2 (range 24.3–35.5). The left side was more often involved (56.3%) than the right (43.7%). Accidental trauma (37.5%) was slightly more frequent than tumor (31.3%) and trivial trauma (31.2%). By ASA physical status, most patients were Grade I (56.2%), followed by Grade III (31.3%) and Grade II (12.5%) (Table 2). The mean resected femur length was 13.6 cm, with an average hospital stay of 12.2 days. Patients stood after a mean of 4.1 days and began assisted walking after 4.5 days (Table 3). Figure 1 demonstrated a steady reduction in VAS pain scores, from 4.5 at 45 days to 3.5 at 3 months, 2.8 at 6 months, and 2.3 at 12 months. Figure 2 illustrated functional improvement, with mean scores rising from 29 at 45 days to 32 at 3 months, 34 at 6 months, 36 at 12 months, and 37 at the final 23-month follow-up. The mean pain score was 86.3±22.8, with 2% at the floor and 62.7% at the ceiling. Function scores averaged 85.5±22.3, with 62.7% at ceiling. The overall MSTS scale averaged 84.3±23.8, with 2% at floor and 56.9% at ceiling (Table 4). Table 5 outlined functional outcomes at the last follow-up (mean 23 months, range 12–43 months). The mean MSTS score improved markedly from 10.4 (range 5–15) preoperatively to 19.3 (range 17–25) postoperatively. In the first postoperative week, patients initiated partial weight-bearing and basic postural passages, gait re-education, and hygiene education. By the second week, progressive partial weight-bearing and proprioceptive exercises were introduced, alongside improved muscle tone and joint motion. After the first month, full functional restoration focused on muscle strengthening, joint mobility, stair climbing, and behavioral adaptation, consolidating independence and return to daily activities (Table 6). Figure 3 showed the preoperative Clinical and Radiological Views with Peroperative and Postoperative X-ray Findings. Wound dehiscence occurred in 1 patient (6.2%) and was successfully managed with debridement and negative pressure wound therapy (NPWT). Prosthesis survival was 100% at the last follow-up, with all implants reported as well-positioned and osteointegrated (Table 7).

Table – I: Demographic characteristics of the study population (*n*=16)

Variables	Frequency (n)	Percentage (%)
Age (years), Mean	44.1 (20–70)	
Gender		
Male	10	62.5
Female	6	37.5
Mean BMI (kg/m^2)	29.36 (24.3–35.5)	

Table – II: Baseline characteristics of the study population (*n*=16)

Variables	Frequency (n)	Percentage (%)
Side involved		
Left	9	56.3
Right	7	43.7
Etiology		
Accidental trauma	6	37.5
Tumor	5	31.3
Trivial trauma	5	31.2
ASA physical status score		
Grade I	9	56.2
Grade II	2	12.5
Grade III	5	31.3
Osteoporosis		
Present	10	62.5
Absent	6	37.5
Preoperative mobility (walked with walking aids)	16	100

Table – III: Surgical and hospitalization details of participants (*n*=16)

Variable	Mean (range)
Resected femur length (cm)	13.6 (10–20)
Hospital stay (days)	12.2 (2–22)
Time to standing (days)	4.1 (1–7)
Time to assisted walking (days)	4.5 (1–10)
First walking aid used	
Crutches, n (%)	11 (68.7)
Walking frame, n (%)	5 (31.3)

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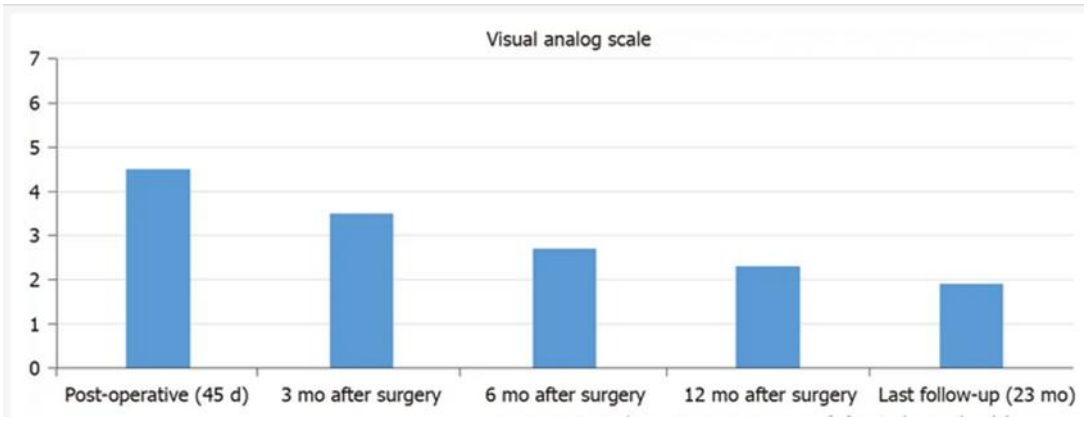

Figure – 1: Postoperative Pain Reduction Measured by Visual Analog Scale (VAS) Over Follow-up Period.

Figure – 2: Improvement in Functional Outcome Assessed by Oxford Knee Score Over Follow-up Period.

Table – IV: MSTS lower extremity

Scale	Missing (%)	Mean	SD	Lowest	Highest	Range	% at floor	% at ceiling
Pain (0–100)	0	86.3	22.8	0	100	100	2	62.7
Function (0–100)	0	85.5	22.3	20	100	80	0	62.7
Emotional (0–100)	0	89	23.1	0	100	100	3.9	72.5
Hand position (0–100)	0	89.8	16.2	40	100	60	0	64.7
Manual dexterity (0–100)	0	91.4	16.1	20	100	80	0	70.6
Scale	0	84.3	23.8	0	100	100	2	56.9

Table – V: Functional outcomes at last follow-up (mean 23 months, range 12–43) of patients (*n*=16)

Outcome Measure	Preoperative	Postoperative
MSTS score (mean, range)	10.4 (5–15)	19.3 (17–25)
Knee Society Score (KSS, median)	20	80
Oxford Knee Score (OKS, mean)	–	38.5 (30–45)
Knee range of motion (ROM)	–	94°–108°
Independent ambulation, n (%)	–	10 (62.5)
Ambulation with cane, n (%)	–	6 (37.5)

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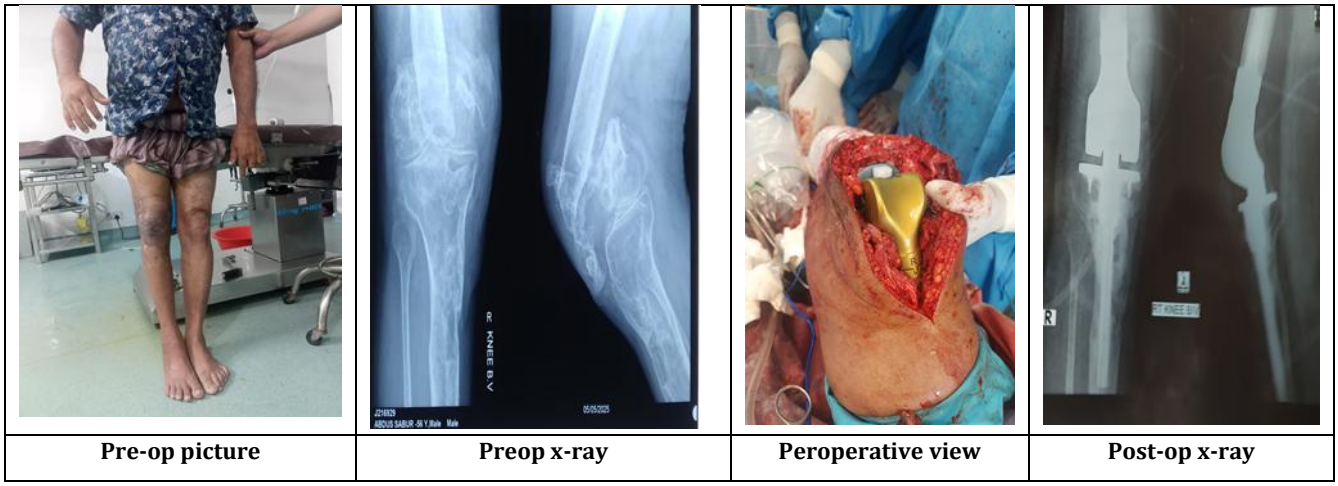
Table – VI: Rehabilitation stages: Distal femoral replacement with megaprosthesis.

	First Week after Surgery	Second Week after Surgery	Third–Fourth Week after Surgery	After the First Month after Surgery
Weight-bearing on operated leg	Partial	Progressive partial	Full	Full
Restoration and maintenance of muscle tone and trophism	+	++	++	+++
Restoration and maintenance of joint motion	++	++	++	+++
Postural passages	+++	+++	++	+
Gait re-education	+++	+++	+++	++
Stair climbing re-education	+	++	++	+++
Proprioceptive exercises	+	++	++	+++
Education about hygienic and behavioral rules	+++	+++	+++	+



Pre-op picture	Preop x-ray	Peroperative view	Post-op x-ray

Figure – 3: Preoperative Clinical and Radiological Views with Peroperative and Postoperative X-ray Findings

Table – VII: Complications and prosthesis survival among study subject (*n*=16)

Complication	n (%)	Outcome
Wound dehiscence	1 (6.2)	Resolved with debridement and NPWT
Superficial wound infection after fall	1 (6.2)	Resolved with suturing and antibiotics
Deep infection	1 (6.2)	Resolved with debridement
Prosthesis survival at last follow-up	100.00	All well-positioned and osteointegrated

DISCUSSION

Megaprosthetic implants have emerged as a reliable solution for reconstructing the distal femur and knee following tumor resection or in cases of fracture non-union[14]. Initially developed within oncologic orthopedic surgery, these implants address primary or metastatic bone lesions necessitating extensive bone excisions[14-16]. While their use is well-documented in tumor-related reconstructions, literature on distal femur fractures remains limited. Several studies have demonstrated favorable postoperative functional outcomes with distal femur megaprostheses, alongside acceptable complication rates given the complexity of the procedure[15,17-18]. Importantly, principles from total knee arthroplasty, such as early mobilization and structured rehabilitation, are applicable to patients undergoing distal femur megaprosthesis, as these procedures combine joint replacement with extensive femoral reconstruction. In the present study, we managed sixteen patients with displaced supracondylar fractures, non-union, or tumors using total knee replacement with custom-made megaprosthetic implants. In the present study, patients were systematically evaluated at 45 days, 3 months, 6 months, and 12 months postoperatively, followed by annual assessments, with a median follow-up of 23 months. Postoperative functional outcomes demonstrated knee flexion ranging from 94° to 108.3°, slightly lower than the 120° (range, 85–140°) reported by Abou-Nouar et al[19]. The mean active extensor lag observed in our cohort was 5° (range, 0–20°), consistent with prior studies reporting a mean postoperative knee motion of approximately 100°[20]. Functional outcomes were further assessed using the Musculoskeletal Tumor Society (MSTS) scoring system, the most widely adopted tool for objective evaluation of limb-salvage procedures. In the present series, approximately 75% of patients achieved scores classified as “good” to “excellent,” with a mean MSTS score of 22.2. These results align with the systematic review by Abou-Nouar et al., which reported mean MSTS scores ranging from

21.8 to 27.3 following distal femoral megaprosthesis reconstruction[19]. Favorable outcomes of distal femoral endoprosthesis have also been reported in non-oncologic and geriatric populations. Scoccianti et al., in a series of 18 elderly patients with acute distal femoral fractures treated with endoprostheses, reported positive functional recovery[21], while Saidi et al. described satisfactory outcomes in 17 patients with comminuted periarticular fractures[22]. However, the management of distal femoral nonunion or tumors presents additional challenges, including fibrosis, knee stiffness, and difficult surgical exposure. Scoccianti et al., in a series of 10 patients with distal femoral nonunion treated with megaprosthesis, emphasized these technical complexities[23]. Berend and Lombardi reported on 39 distal femoral replacements performed for non-tumor indications, demonstrating an implant survivorship of 87% at a mean follow-up of 46 months[24]. Similarly, Rosen and Strauss observed that 71% of patients returned to their preoperative ambulation levels, with no revisions recorded during a short-term follow-up of 11 months in 24 distal femoral endoprostheses[25]. These studies reinforce the utility of endoprosthetic reconstruction as a reliable, single-stage intervention in elderly patients, yielding favorable functional outcomes. In the present study, the overall complication rate was 29.1%, which is comparable to previous reports in geriatric populations undergoing distal femoral endoprosthesis. Bettin et al. documented a 39% complication rate, including an implant-related complication rate of 11%, highlighting that although complications are not uncommon, functional outcomes remain largely satisfactory[26]. Collectively, these findings substantiate the role of distal femoral endoprosthesis as a safe and effective option in elderly patients and complex distal femoral pathology, particularly where single-stage reconstruction is indicated. Deep surgical site infection requiring debridement occurred in one patient (4.1%). Elderly patients are inherently at increased risk of infection due to factors such as multiple surgical interventions, extensive soft tissue exposure, and co-morbidities. In the present case, the affected patient was diabetic; however, the infection resolved completely following prompt surgical debridement. Kaplan-Meier analysis demonstrated a predicted implant survivorship of 97% at 1 year, exceeding the rates reported by Mechas et al., and an estimated 5-year survivorship of 83% compared with their 68%[27]. This improvement is likely attributable to advancements in prosthesis design, fixation techniques, and modularity, which may enhance both durability and functional outcomes in distal femoral endoprosthetic reconstruction.

Limitations of the study:

This study has several limitations, including its retrospective design, single-centre data, and relatively short follow-up period, which restrict the generalizability of the findings and reduced the statistical significance of some associations. Greater reliability could be achieved through prospective, multicentric studies with larger populations. Another limitation is the absence of structured evaluation of postoperative rehabilitation. Proper rehabilitation—focused on early mobilization and progressive weight-bearing—is crucial for optimizing functional outcomes, facilitating return to daily activities, and ensuring long-term success of megaprosthetic implants in surviving patients.

CONCLUSION AND RECOMMENDATIONS

Megaprosthesis represents a viable treatment option for patients with distal femoral fractures—whether acute, periprosthetic, or due to nonunion—as well as for those with distal femoral tumors. These implants allow for immediate weight-bearing, reduced hospital stay, and rapid recovery of knee function. This is especially beneficial in elderly patients suffering from severe osteoporosis and pre-existing osteoarthritis. Continued innovation and refinement in prosthetic technology and surgical techniques are anticipated to further improve outcomes in the coming years.

Optimal outcomes in megaprosthesis surgery require:

- Careful patient selection
- Meticulous surgical technique
- Specialist surgical expertise
- Diligent postoperative care

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Ethical approval: *The study was approved by the Institutional Ethics Committee.*

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ORIGINAL ARTICLE

Clinical Profile and Outcome of Dengue for Current Scenario, Khulna, Bangladesh

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ABSTRACT

Background: *Dengue fever is an acute febrile illness spread by the bite of Aedes mosquitoes infected with one of the dengue viruses (DENV), a member of the Flaviviridae family, with four distinct but closely related serotypes (DENV-1 to 4). It is a major health burden particularly in tropical and subtropical areas of the world. Primarily transmitted by the female Aedes aegypti mosquito and to a lesser extent, Adeses albopictus. Symptoms range from fever, nausea, and rash to severe conditions like Dengue hemorrhagic fever (DHF) and Dengue Shock Syndrome (DSS), which involves hemorrhage and organ failure. In endemic countries such as Bangladesh dengue has transitioned from sporadic outbreaks to a sustained seasonal pattern with recent increased case numbers and fatalities. Understanding epidemiology, risk factors and disease burden is essential for prevention and control measures. Early diagnosis and monitoring are crucial to reduce morbidity and mortality.* ***Aim of the study:*** *This study aims to assess the common clinical profile and their outcome in patients admitted in Khulna medical college hospital of Bangladesh.* ***Methods:*** *This six-month cross-sectional study at Khulna Medical College hospital, Khulna aimed to evaluate the clinical profile and outcomes of 550 dengue-confirmed patients. Inclusion criteria included an oral temperature of 100.4°F or higher, fever for less than seven days, and specific symptoms like headache, joint pain, or vomiting. Exclusion criteria were other viral fevers or specific diseases. All patients were confirmed dengue cases based on NS1 antigen positivity. Data collection involved detailed clinical monitoring and examinations. Data were analyzed using SPSS (version 26.0).* ***Result:*** *The study included 550 dengue patients, mostly aged 20-40 years (50%), with a mean age of 27.15±14.089 years. Males comprised 60.45% of cases. Urban residents made up 70%. The mean monthly income was BDT 38,529. Fever was the most common symptom (93.18%), followed by nausea/vomiting (60.91%) and headache (45.91%). Common complications included breathlessness (41.36%), pleural effusion (39.09%), and abdominal ascites (29.55%). Hospital stays averaged 4.8±2 days, with 94.55% recovering and 5.45% dying. ICU stays averaged 2.2±2 days, with 58.64% staying three days or less.* ***Conclusion:*** *This study on dengue in Khulna, Bangladesh, found that most patients were adults (20-40 years) with a mean age of 27.15 years. Males were more affected, with fever as the primary symptom. Common complications included breathlessness and pleural effusion. The high recovery rate was 94.55%, with a 5.45% mortality rate.*

Keywords: *Dengue, Laboratory parameters and Viral infection.*

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INTRODUCTION

Dengue, a virus transmitted by mosquitoes, is the most prevalent arthropod-borne viral disease globally, representing a major global health threat. It is also referred to by other names, including break-bone fever or 7-day fever[1]. The primary vector responsible for spreading the dengue virus is the *Aedes aegypti* mosquito. The virus is transmitted to humans by the female *Aedes mosquito* through its bites, typically after the mosquito has fed on the blood of an infected individual. These mosquitoes breed in stagnant water, such as

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in water tanks, puddles, old tyres, and various containers[2]. *Aedes* mosquitoes, primarily including the female vectors *Aedes aegypti* and *A albopictus*, transmit the virus and are common in tropical and subtropical parts of the world[1]. The most vulnerable countries include Bangladesh, India, Pakistan, and Sri Lanka[3,4]. Prior to 2000, dengue outbreaks in Bangladesh were infrequent, with an epidemic resulting in 5,551 cases and 93 deaths. However, following the first recorded dengue outbreak in Bangladesh in 2000, the number of hospitalized patients has surged, surpassing 3,000 cases on six different occasions, with a peak of 10,148 cases in 2018[5]. Between January 01 and December 31, 2022, there were 62,382 dengue cases, including the highest number of 281 related deaths in Bangladesh's history of dengue fever reported by the Ministry of Health & Family Welfare (MOHFW)[6]. The signs and symptoms of dengue vary from non-specific febrile disease to classic dengue fever with haemorrhage and shock (Dengue Shock Syndrome)[7]. The initial symptoms of dengue typically include fever, nausea, vomiting, skin rash, and body aches. Classic dengue fever is characterized by a sudden onset of high fever (up to 40°C), intense headache, nausea, vomiting, severe joint and muscle pain, retro-orbital pain, and a centrifugal maculopapular rash. In contrast, severe dengue symptoms usually appear 1–2 days after the fever subsides and include abdominal tenderness and pain, vomiting at least three times a day, nosebleeds, blood in vomit (hematemesis), black stools (melena), fatigue, and restlessness[8]. Most cases of dengue are self-limiting; however, if not treated and handled in the early stage of this disease, it can become a life-threatening condition[7]. Severe dengue causes internal hemorrhage and organ failure[9]. Secondary dengue infections, advanced age, elevated hematocrit levels, low platelet counts, and prolonged activated partial thromboplastin time (APTT) have been identified as potential risk factors for developing severe dengue fever. These factors necessitate immediate hospitalization for affected patients[10-12]. Due to the wide range of clinical symptoms, diagnosing dengue accurately can be difficult. However, simple clinical and laboratory monitoring of affected patients helps lower morbidity and mortality rates. Severe dengue (SD) cases can be identified through clinical profiles, laboratory tests, and warning signs, allowing for early intervention and potentially saving lives. The outcomes of dengue patients admitted to critical care units have been less frequently studied, and the prognostic factors influencing the clinical outcome of critically ill dengue patients remain uncertain[13]. This study aims to assess the common clinical profile and their outcome in patients in the Khulna district of Bangladesh.

METHODS & MATERIALS

This cross-sectional observational study was conducted at the Department of Medicine, Khulna Medical College (KMC), Khulna, Bangladesh, over six months from June 2023 to July 2024. The primary aim was to evaluate the clinical profile and outcomes of dengue patients during the current outbreak in Bangladesh. A total of 550 dengue-confirmed patients were enrolled and analyzed.

Inclusion criteria:

- Patients with an oral temperature of 100.4°F or higher and fever for less than seven days.
- Patients report at least one specific symptom, such as headache, joint pain, backache, abdominal pain, vomiting, fatigue, anorexia, or diarrhea.

Exclusion criteria:

- Patients with other viral fevers.
- Patients with any other identified specific disease, febrile illness, or bleeding disorder.

All patients had confirmed dengue based on NS1 (non-structural protein) antigen positivity. The hospitals were conveniently selected for data collection and designated as dengue-specialized centres during the outbreak. Admitted patients were closely monitored, with important clinical and laboratory details recorded regularly on a standard case report form. Clinical examinations included vital signs, skin rashes, pleural effusion, breathlessness, ascites, hepatomegaly, and splenomegaly. Patients were selected based on laboratory confirmation of NS1 Ag or Anti-dengue IgM. Data were entered into Microsoft Excel and analyzed using SPSS (version 26.0). Descriptive statistics summarized demographic data and clinical profiles. Continuous variables, like age and laboratory values, were presented as mean±standard deviation (SD) or median (interquartile range). Categorical variables, such as gender and severity of dengue, were expressed as frequencies and percentages.

RESULTS

The study included a total of 550 patients with confirmed DENV infection. The majority of patients (56.36%) were between 20–40 years of age, followed by 26.36% in the 10–19 year age group, while 17.27% were above 40 years. The mean age of the cohort was 27.15±14.089 years. Males accounted for 60.55% of cases, compared to 39.45% females. Employment status was almost evenly distributed, with 50.36% employed and 49.64% unemployed. Most patients (70.00%) resided in urban areas, while 30.00% were from semi-urban or rural settings. Regarding monthly household income, 37.82% reported earnings between BDT 20,001–40,000, 33.09% earned ≤20,000, and 29.09% ≥40,000, with a mean monthly income of BDT 38,529±30,186 (Table 1). Clinical features revealed an average body temperature of 100.3±2.3°F. Fever was the most common presenting symptom, observed in 93.09% of patients. Other frequent symptoms included nausea/vomiting (60.91%), headache (45.82%), abdominal pain (29.45%), myalgia (26.73%), skin rash (24.91%), and itching (21.27%). Less common manifestations were diarrhea (19.45%), retro-orbital pain (4.91%), conjunctival suffusion (2.73%), and miscellaneous features in 6.73% of cases (Table 2). With respect to complications, breathlessness (41.27%), pleural effusion (38.91%), and ascites (29.45%) were the most prevalent. Bleeding manifestations were noted in 10.91% of cases, while multiple organ failure occurred in 9.09%. Other complications included hepatomegaly (7.64%), seizures (3.09%), and splenomegaly (1.27%) (Table 3). Table 4 summarizes patient

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outcomes. The mean duration of hospitalization was 4.8±2 days, with 62.73% of patients admitted for 3–6 days, 24.18% for ≤3 days, and 13.09% for more than six days. ICU stay averaged 2.2±2 days, with the majority (58.55%) staying ≤3 days. Overall, recovery was favorable, with 94.55% of patients discharged after improvement, while mortality was documented in 5.45% of cases.

Table – I: Socio-demographic characteristics of the patients with DENV infection (*n*=550)

Variables	Frequency (n)	Percentage (%)
Age (in years)		
10-19	145	26.36
20-40	310	56.36
>40	95	17.27
Mean ± SD	27.15 ± 14.089	
Gender		
Male	333	60.55
Female	217	39.45
Occupation		
Employed	277	50.36
Unemployed	273	49.64
Residence		
Semi-Urban/Rural	165	30.00
Urban	385	70.00
Monthly Income (BDT)		
≤20,000	182	33.09
20,001–40,000	208	37.82
≥40,000	160	29.09
Mean ± SD	38529 ± 30186	

Table – II: Clinical Features of patients with DENV infection (*n*=550)

Clinical Features	Frequency (n)	Percentage (%)
Temperature (Mean ± SD)	100.3 ◦F± 2.3 ◦F	
Fever	512	93.09
Abdominal Pain	162	29.45
Diarrhea	107	19.45
Skin Rash	137	24.91
Itching	117	21.27
Myalgia	147	26.73
Nausea/Vomiting	335	60.91
Headache	252	45.82
Conjunctival suffusion	15	2.73
Retro-Orbital Pain	27	4.91
Others	37	6.73

Table – III: Complications experienced by patients with DENV infection (*n*=550)

Complications	Frequency (n)	Percentage (%)
Bleeding	60	10.91
Pleural Effusion	214	38.91
Breathlessness	227	41.27
Ascites	162	29.45
Hepatomegaly	42	7.64
Splenomegaly	7	1.27
Seizures	17	3.09
Multiple Organ Failure	50	9.09

Table – IV: Outcome of Dengue infection in studied patient (*n*=550)

Variables	Frequency (n)	Percentage (%)
Duration of hospitalization (in days)		
≤3	133	24.18
03-6	345	62.73
>6	72	13.09
Mean±SD	4.8±2	
ICU stay (in days)		
≤3	322	58.55
03-6	205	37.27
≥6	23	4.18
Mean ±SD	2.2±2	
Recovery	520	94.55
Death	30	5.45

DISCUSSION

Over the last few years, dengue has emerged as a rapidly growing public health threat, contributing significantly to global morbidity and mortality. Its rising incidence has been closely linked to rapid and unplanned urbanization, poor sanitation, and environmental conditions that favor mosquito breeding. In Bangladesh, dengue transmission typically peaks during the monsoon (around 50%) and post-monsoon (49%) seasons, particularly from July to October, reflecting seasonal dynamics of vector activity[14]. Given its increasing burden, our study explored the socio-demographic characteristics, clinical features, complications, and outcomes of dengue patients in Khulna. In the present study, the majority of dengue cases (56.36%) occurred in adults aged 20–40 years, with a mean age of 27.15 years. This finding aligns with reports by El-Gilany in Saudi Arabia, where most cases were in the 16–44 years age group[15], and Rahman et al. in Bangladesh, who documented the highest incidence among 18–33 years[16]. Both highlight the higher susceptibility of young adults, likely due to greater outdoor exposure and occupational mobility. Conversely, younger children under 10 years were less affected (12.73%), a trend also observed in Nepal, Nigeria, and Cameroon[17–19]. A lower prevalence among children may be attributed to parental care, limited outdoor exposure, and, in our study, the fact that participants were largely recruited from private facilities, suggesting middle- to higher-income families residing in relatively clean environments. A male predominance was evident, with 60.55% of patients being male, consistent with previous studies from India and Bangladesh, which reported higher infection rates among men[20,21]. This may be related to increased outdoor activity, occupational exposure, and sociocultural factors influencing healthcare access. Regarding clinical presentation, fever was the most frequent symptom (93.09%), in agreement with studies conducted in Saudi Arabia, Pakistan, and India[15,22,23]. Nausea and vomiting (60.91%), headache (45.82%), abdominal pain (29.45%), myalgia (26.73%), and skin rash (24.91%) were also commonly reported. These findings are broadly comparable to those of Badreddine et al., who found abdominal pain and vomiting as predominant features[24], and El-Gilany, who reported headache (74.6%) and myalgia (67.6%) at higher

rates[15]. The frequency of skin rash in our study (24.91%) is consistent with reports from Saudi Arabia and India[15,23]. Ocular manifestations such as conjunctival suffusion (2.73%) and retro-orbital pain (4.91%) were relatively rare compared to other published data[15,25]. Complications in our study were dominated by respiratory manifestations, with breathlessness (41.27%) and pleural effusion (38.91%) being most common, followed by ascites (29.45%). These rates were notably higher than those reported by Godbole in India, where pleural effusion and ascites were observed in only 11% of cases[26]. Bleeding manifestations were detected in 10.91% of patients, slightly higher than some earlier reports, while multiple organ failure was observed in 9.09%. Hepatomegaly (7.64%), seizures (3.09%), and splenomegaly (1.27%) were less frequent but clinically significant. Other studies have highlighted a broad spectrum of severe complications, including acute respiratory distress syndrome (ARDS), encephalitis, myocarditis, disseminated intravascular coagulation (DIC), and acute kidney injury (AKI), underscoring the variable clinical course of dengue[27–29]. In terms of outcomes, the average hospital stay was 4.8±2 days, with most patients (62.73%) hospitalized for 3–6 days. ICU admissions were generally brief, with a mean stay of 2.2±2 days and the majority (58.55%) requiring three days or less. Overall, the prognosis was favorable, with a recovery rate of 94.55%, while mortality was recorded in 5.45% of cases. These figures are comparable to other studies from the region, which have similarly reported high recovery rates but highlighted the persistent risk of fatal outcomes in severe dengue[30]. Taken together, our findings reinforce that dengue predominantly affects young adults, manifests with typical febrile and gastrointestinal symptoms, and frequently leads to respiratory complications such as pleural effusion and breathlessness. While most patients recover with supportive care, the observed mortality emphasizes the need for early recognition of warning signs and timely management to reduce severe outcomes.

Limitations of the study:

The study's cross-sectional nature limits the ability to establish causality. The sample size of 550 patients, while adequate, may only partially represent the broader population affected by dengue in different regions of Bangladesh. Additionally, the study was conducted in a single medical college, potentially introducing selection bias as it may not capture cases treated in other healthcare settings. The reliance on self-reported symptoms could lead to reporting bias. Lastly, the study's six-month duration may not account for seasonal variations in dengue incidence, potentially affecting the generalizability of the findings.

CONCLUSION AND RECOMMENDATIONS

This study on the clinical profile and outcomes of dengue patients in Khulna, Bangladesh, found that the majority of cases involved adults aged 20-40 years, with a mean age of 27.15 years. Males were more affected than females. Most patients were urban residents, with fever being the predominant symptom, followed by nausea/vomiting and headache. Common complications included breathlessness and pleural effusion. The average hospitalization duration was 4.8 days, with a high recovery rate of 94.55% and a mortality rate of 5.45%. These findings highlight the critical need for early diagnosis and effective management to reduce dengue morbidity and mortality.

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ORIGINAL ARTICLE

Clinical and Etiological Patterns of Urinary Tract Infections in Children

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ABSTRACT

Background: *Urinary tract infections (UTIs) are among the most common bacterial infections in children, associated with diagnostic challenges, recurrence, and the risk of long-term renal complications. Rising antimicrobial resistance further complicates management.* ***Aim of the study:*** *To evaluate the clinical presentations and etiological spectrum of pediatric UTIs and assess their antimicrobial susceptibility patterns in a Bangladeshi tertiary care setting.* ***Methods:*** *A cross-sectional descriptive study was conducted over 12 months on 105 children aged 0–15 years with clinically suspected UTIs and significant bacteriuria. Demographic, clinical, and laboratory data were recorded, and urine cultures were processed using standard microbiological methods. Antimicrobial susceptibility was determined by the Kirby–Bauer disk diffusion method following CLSI guidelines.* ***Result:*** *The highest prevalence was in infants under one year (24.76% males, 18.10% females). Fever with irritability (69.52%) was the most common symptom, followed by vomiting (62.86%) and dysuria with frequency (60.95%). Escherichia coli (65.71%) was the predominant uropathogen, followed by Klebsiella pneumoniae (12.38%). Most isolates showed high sensitivity to carbapenems (85–99%) and piperacillin–tazobactam (85–96%), moderate sensitivity to aminoglycosides and ciprofloxacin, and low sensitivity to third-generation cephalosporins and cotrimoxazole.* ***Conclusion:*** *Pediatric UTIs in this cohort were most common in infancy, with E. coli as the leading pathogen. High resistance to commonly used antibiotics underscores the importance of culture-based diagnosis and local antimicrobial surveillance to guide empirical therapy.*

Keywords: *Pediatric urinary tract infection, Escherichia coli, antimicrobial resistance, uropathogens, Bangladesh, antibiotic susceptibility.*

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INTRODUCTION

A urinary tract infection (UTI) is an infection affecting any part of the urinary tract, most commonly caused by bacterial invasion of the bladder (cystitis) or kidneys (pyelonephritis). UTIs represent one of the most common bacterial infections in children, presenting a significant concern in pediatric healthcare[1]. Globally, in 2021, the prevalence of UTIs was estimated to reach approximately 3.5 million cases, corresponding to an age-standardized prevalence rate (ASPR) of about 3.76 per 100,000 population[2]. In Bangladesh, a community-based study conducted at a diagnostic clinic found that among 120 pediatric patients evaluated, 63.3% were girls and 36.7% were boys, with UTIs occurring more frequently in females[3]. Pediatric UTIs are clinically significant due to their diagnostic challenges, potential for recurrence, and risk of long-term complications such as renal scarring, hypertension, and impaired renal function. Children with UTIs often display non-specific symptoms as fever, abdominal discomfort, or poor feeding in infants that can delay diagnosis and treatment[4]. By the age of six, the cumulative incidence is notably higher in girls than in boys, highlighting clear gender- and age-related patterns in pediatric UTI susceptibility[5]. Each year, UTIs contribute to a notable proportion of febrile illnesses in children and result in a substantial number of outpatient consultations as well as emergency department visits in pediatric populations[6]. Emerging antimicrobial resistance presents a growing challenge in pediatric UTI management. Extended-spectrum beta-lactamase (ESBL)–producing organisms and other multidrug-resistant (MDR) bacteria are increasingly common among pediatric uropathogens[7]. In Bangladesh, studies have revealed high rates of MDR uropathogens in community-acquired UTIs, with resistant strains including E. coli and Klebsiella showing resistance to multiple antibiotic classes[8]. This trend

complicates empiric therapy, increases treatment failures, and underscores the necessity for localized antimicrobial stewardship and updated treatment guidelines[9]. Furthermore, epidemiological data reveal gender and age variations in pediatric UTIs. During the first year of life, boys and girls are affected at approximately similar rates; however, beyond infancy, girls experience a notably higher incidence[10]. These differences are largely attributed to anatomical and behavioral factors, such as the shorter female urethra, which facilitates bacterial entry[11]. Additional predisposing factors include vesicoureteral reflux, constipation, bladder–bowel dysfunction, and previous antibiotic exposure. Recurrence is also a common issue, with a considerable proportion of children developing another episode within a year of the initial infection[12]. Given the considerable clinical, epidemiological, and public health implications of pediatric UTIs including high prevalence, rising antimicrobial resistance, frequent recurrence, and potential for renal sequelae it is imperative to examine the clinical and etiological patterns of UTIs in children within the Bangladeshi context[13]. The aim of this study is to elucidate the clinical presentations and etiological spectrum of pediatric UTIs in Bangladesh to inform more effective diagnosis and treatment strategies.

METHODS & MATERIALS

This was a cross-sectional descriptive study conducted at the Department of Infectious Disease & Community Pediatrics, Bangladesh Shishu Hospital & Institute, Dhaka, Bangladesh. over a 12-month period from July 2023 to June 2024. A total of 100 consecutive pediatric patients (aged 0–15 years) with clinically suspected urinary tract infection (UTI) who attended the outpatient clinic or were admitted to the pediatric wards were enrolled.

Inclusion criteria:

- Children aged 0–15 years.
- Clinical features suggestive of UTI.
- Significant bacteriuria, defined as $\geq 10^5$ CFU/mL of a single organism in a properly collected urine sample, in the presence of symptoms.

Exclusion criteria:

- Repeat samples from a patient already included in the study.
- Urine samples showing evidence of perineal contamination.
- Children with incomplete clinical or laboratory records.

Ethical Considerations

The study protocol was approved by the Institutional Review Board. Written informed consent was obtained from parents or legal guardians; assent was taken from older children as appropriate. Confidentiality of patient data was maintained throughout.

Specimen collection and transport

Urine specimens were obtained according to the child's age and ability to cooperate: clean-catch midstream urine for toilet-trained children, sterile catheter specimen for infants or non-toilet-trained children when necessary, and suprapubic aspiration only when clinically indicated. All samples were collected in sterile containers, labelled, and transported to the microbiology laboratory within 2 hours; if delay was expected, specimens were refrigerated at 4°C and processed within 24 hours.

Microbiological processing and identification

Semi-quantitative urine culture was performed by streaking 0.001 mL of well-mixed urine onto CLED (cysteine-lactose-electrolyte-deficient) and MacConkey agar plates and incubating aerobically at 35–37°C for 18–24 hours. Colony counts were expressed as colony forming units per mL (CFU/mL). Significant bacteriuria was defined as $\geq 10^5$ CFU/mL for midstream (clean-catch) specimens, $\geq 10^4$ CFU/mL for catheter specimens, and any growth on suprapubic aspirates [14]. Isolates were identified to species level using standard biochemical tests and, when available, an automated identification system or API strips.

Antimicrobial susceptibility testing

Antimicrobial susceptibility was performed using the Kirby–Bauer disk diffusion method on Mueller–Hinton agar and interpreted according to Clinical and Laboratory Standards Institute (CLSI) guidelines. The antibiotic panel included: amikacin, gentamicin, cefotaxime/ceftriaxone, ciprofloxacin, nitrofurantoin, piperacillin–tazobactam, imipenem/meropenem, and cotrimoxazole.

Data collection

A structured case record form was used to collect demographic information (age, sex), clinical features, and any known congenital urinary tract anomalies were retrieved from hospital records and entered into a predesigned proforma. Physical examination findings and basic laboratory investigations were recorded.

Statistical analysis

Data entry was performed using Microsoft Excel, and statistical analysis was done using SPSS version 26.0. Descriptive statistics were used: frequencies and percentages for categorical variables.

RESULT

The highest proportion of cases occurred in infants under one year of age, comprising 24.76% of males and 18.10% of females. Among children aged 1–5 years, 16.19% were males and 19.05% were females. In the 6–10-year age group, the prevalence was 9.52% in males and 6.67% in females (Table 1). Fever with irritability was most common presenting symptom (69.52%), followed by vomiting (62.86%), dysuria with frequency (60.95%), abdominal pain (51.43%), chills and rigors (29.52%), with diarrhea (4.76%), nocturnal enuresis (2.86%), and haematuria (0.95%) being less frequent (Table 2). The distribution of uropathogens showed *E. coli* as the

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predominant isolate, accounting for 65.71% of cases, after *Klebsiella pneumoniae* (12.38%). Other organisms included *Pseudomonas aeruginosa* (5.71%), *Enterococcus faecalis* (3.81%), *Morganella morganii* (3.81%), and *Proteus mirabilis* (3.81%). Less common isolates were *Acinetobacter baumannii* (1.90%), *Enterobacter cloacae* (1.90%), and *Enterobacter aerogenes* (0.95%) (Figure 1). The antibiotic sensitivity analysis revealed that most uropathogens showed high susceptibility to carbapenems (Imipenem/Meropenem: 85–99%) and Piperacillin–Tazobactam (85–96%), followed by Amikacin (70–90%) and Nitrofurantoin (20–85%, highest in *E. coli* at 85%). Moderate sensitivity was observed for Gentamicin (45–80%) and Ciprofloxacin (30–70%), while lower sensitivity was noted for Cefotaxime (25–48%) and Cotrimoxazole (15–40%) across most isolates. *E. coli* and *Klebsiella pneumoniae* showed the highest prevalence, with *Pseudomonas aeruginosa* exhibiting strong resistance to most oral agents but high sensitivity to carbapenems and Piperacillin–Tazobactam (Table 3).

Table – I: Demographic characteristics of the study population (*n*=105)

Age (years)	Male		Female	
	n	%	n	%
<1	26	24.76	19	18.10
1-5	17	16.19	20	19.05
6-10	10	9.52	7	6.67
11-15	3	2.86	3	2.86

Table – II: Clinical presentation of pediatric UTI cases (*n*=105)

Symptoms	Frequency (n)	Percentage (%)
Fever with irritability	73	69.52
Abdominal pain	54	51.43
Vomiting	66	62.86
Dysuria with frequency of micturition	64	60.95
Chills and rigors	31	29.52
Diarrhea	5	4.76
Nocturnal enuresis	3	2.86
Haematuria	1	0.95

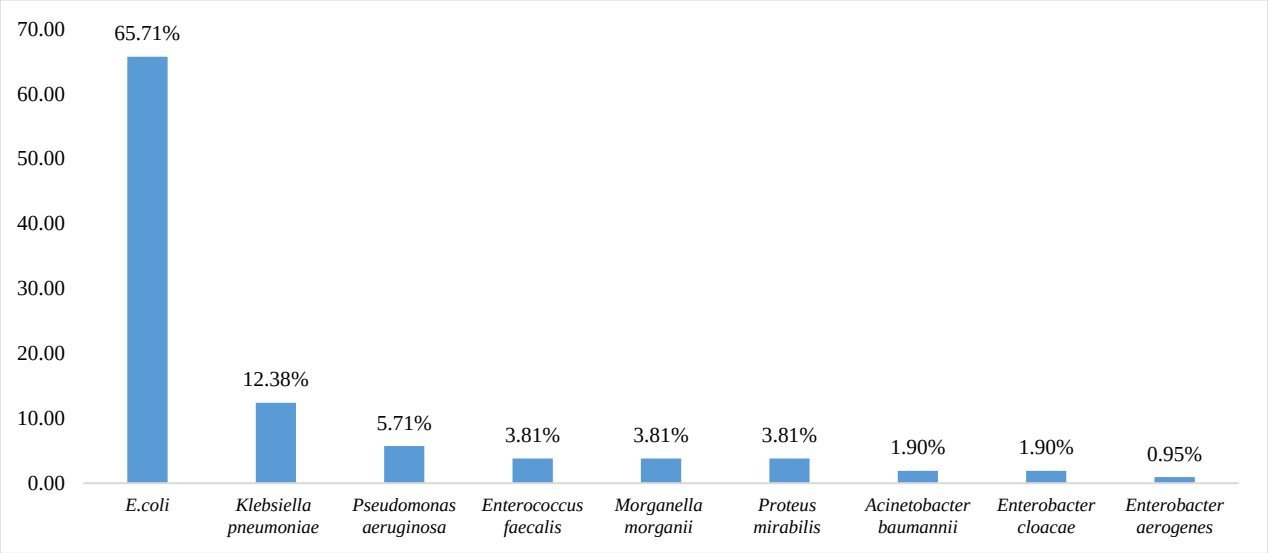

Figure – 1: Etiological agents isolated from urine culture (*n*=105)

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Table – III: Antibiotic Sensitivity Pattern of Uropathogens (*n*=105)

Organism	Amikacin	Gentamicin	Cefotaxime	Ciprofloxacin	Nitrofurantoin	Piperacillin–Tazobactam	Imipenem/Meropenem	Cotrimoxazole
E. coli	88%	80%	45%	65%	85%	95%	98%	38%
Klebsiella pneumoniae	85%	72%	40%	60%	70%	93%	97%	35%
Pseudomonas aeruginosa	90%	75%	35%	68%	20%	96%	99%	15%
Enterococcus faecalis	50%	45%	25%	30%	80%	60%	85%	40%
Morganella morganii	82%	70%	42%	65%	55%	90%	95%	30%
Proteus mirabilis	87%	74%	48%	70%	40%	92%	97%	32%
Acinetobacter baumannii	70%	60%	30%	55%	25%	85%	90%	20%
Enterobacter cloacae	78%	68%	38%	60%	35%	88%	94%	28%
Enterobacter aerogenes	75%	65%	35%	58%	32%	86%	93%	25%

DISCUSSION

Urinary tract infections (UTIs) are among the most common bacterial infections in children, contributing to significant morbidity if not promptly diagnosed and treated. The clinical presentation of pediatric UTIs can vary widely, often overlapping with other childhood illnesses, which may delay diagnosis. Understanding the clinical features and underlying etiological agents is essential for guiding effective management and preventing long-term complications such as renal scarring. This study aimed to evaluate the clinical presentations and identify the etiological agents of urinary tract infections in children, in order to guide timely diagnosis, appropriate treatment, and preventive strategies. In our study, the age group most affected was children under one year, which is consistent with findings from studies conducted in India[15,16]. The least affected group was those aged 11–15 years. Males predominated in the first year of life, aligning with observations by other studies[17-19]. This may be due to the higher susceptibility of uncircumcised infant boys, as microorganisms can accumulate beneath the prepuce. The male-to-female ratio in our study was 1.2:1 during infancy and 1:1 between 11 and 15 years of age. Among children older than one year, a female predominance has been reported, with ratios ranging from 6:1 to 1.33:1 depending on sample size and age distribution[20]. Taneja et al. and Qureshi et al. found the 1–5 year age group to be most commonly affected, with a male predominance[21,22]. In pediatric patients, UTIs often lack the classic signs and symptoms typically observed in adults. Physical examination findings are also less reliable, as costovertebral angle and suprapubic tenderness are not dependable indicators in children. The present study found that fever accompanied by irritability was the most common presenting symptom, followed by abdominal pain. Among children aged 2 to 5 years, abdominal pain and fever were identified as the predominant clinical manifestations[23]. In our study, *Escherichia coli* was the most common uropathogen in pediatric UTIs (65.7%), followed by *Klebsiella pneumoniae* (12.4%), with other isolates including *Pseudomonas aeruginosa* (5.7%), *Enterococcus faecalis*, *Morganella morganii*, and *Proteus mirabilis* (each 3.8%). This distribution is consistent with previous studies, where *E. coli* and *Klebsiella* were the most common uropathogen, while *Pseudomonas* and other pathogens were less frequent and often associated with complicated or hospital-acquired cases[23,24]. Such findings highlight the need for empiric therapy targeting *E. coli* and *Klebsiella*, guided by local antimicrobial resistance data. In this study, *Escherichia coli*—the predominant uropathogen—demonstrated high susceptibility to amikacin (88%), nitrofurantoin (85%), piperacillin–tazobactam (95%), and carbapenems (98%), contrasted by markedly lower susceptibility to cefotaxime (45%) and cotrimoxazole (38%). This resistance profile is in line with prior pediatric UTI research showing a rising trend toward ESBL-mediated β-lactam resistance and reduced efficacy of trimethoprim–sulfamethoxazole, while aminoglycosides, nitrofurantoin, and β-lactam/β-lactamase inhibitor combinations retain activity[25]. In pediatric ESBL-positive isolates, nitrofurantoin has shown high effectiveness, including susceptibility rates of 95.2 % for *E. coli*, reinforcing its empirical utility [26]. *Pseudomonas aeruginosa* in our cohort displayed high sensitivity to amikacin (90 %), piperacillin–tazobactam (96 %), and carbapenems (99 %), with expected low nitrofurantoin susceptibility, consistent with its intrinsic resistance profile[25].

Limitations of the study:

- Lack of molecular analysis to detect resistance genes.
- Possible selection bias as only hospital-attending cases were included, potentially excluding community-managed cases.
- No imaging studies included to correlate anatomical abnormalities with infection risk.

CONCLUSION

This study highlights that pediatric UTIs are most prevalent in early childhood, particularly infancy, and are predominantly caused by *E. coli*. The observed high resistance to commonly prescribed oral antibiotics such as third-generation

cephalosporins and cotrimoxazole raises concern for empirical treatment failures. Nitrofurantoin, aminoglycosides, piperacillin–tazobactam, and carbapenems demonstrated better activity and may be considered in empirical regimens where appropriate. These findings emphasize the need for periodic local antimicrobial resistance surveillance, targeted antibiotic stewardship, and public health initiatives to prevent recurrent infections and reduce resistance trends.

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Ethical approval: *The study was approved by the Institutional Ethics Committee.*

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ORIGINAL ARTICLE

Clinical Characteristics and Outcomes in Pediatric Patients at outdoor Experiences with Measles

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ABSTRACT

Background: *Measles remains a significant cause of pediatric morbidity and mortality worldwide, especially in low-resource settings with suboptimal vaccination coverage. Outdoor patients often represent severe disease with high risks of complications.* ***Aim of the study:*** *To evaluate the clinical characteristics, demographic profile, immunization status, and outcomes of pediatric outdoor patients with measles, with a focus on identifying factors associated with adverse outcomes.* ***Methods:*** *A descriptive cross-sectional study was conducted involving 55 pediatric outdoor patients with clinically and/or laboratory-confirmed measles. Data on demographic variables, nutritional and immunization status, clinical presentation, complications, and outcomes were collected and analyzed.* ***Result****: The majority of patients were under 5 years of age (61.82%), with a slight female predominance (52.73%) and predominantly from rural (67.27%) and lower socioeconomic backgrounds (69.09%). Immunization coverage was high (80.00%), with 61.82% reporting known contact with measles cases. Tachypnea (50.91%) and gastrointestinal symptoms (27.27%) were common clinical features. Malnutrition and anemia were present in 14.54% and 34.55% of patients, respectively. Vaccinated children demonstrated significantly better outcomes, with a lower mortality rate (1.82%) compared to unvaccinated children (3.64%).* ***Conclusion:*** *Low immunization coverage, young age, malnutrition, and rural residency are associated with increased severity and poorer outcomes in pediatric measles. Strengthening vaccination programs and addressing socioeconomic barriers are essential to reduce measles-related morbidity and mortality in vulnerable populations.*

Keywords: *Measles, Pediatric, Immunization, Clinical Characteristics, Malnutrition, Outcomes*

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INTRODUCTION

Measles is an acute, highly contagious viral disease caused by the measles virus, clinically characterized by fever, cough, coryza, conjunctivitis, and a generalized maculopapular rash[1]. It is transmitted primarily via respiratory droplets and airborne spread, and due to its high basic reproduction number, measles can rapidly cause outbreaks in susceptible populations[2]. Globally, the burden of measles has resurged in recent years, with an estimated 15 million cases reported worldwide in 2023[3]. In Bangladesh, the challenge remains significant, with 4,181 measles cases documented in 2019, many originating from outbreaks in refugee settlements and underserved communities[4]. Although measles is preventable through a safe and effective vaccine, it continues to pose a significant public health threat where immunization coverage is inadequate[5]. The virus spreads explosively when herd immunity falls below the critical threshold, leading to high attack rates in unvaccinated groups[6]. Children under five years of age are especially vulnerable to severe complications such as pneumonia, diarrhea, otitis media, and encephalitis, which can cause long-term disability or death. Malnutrition and immunosuppression further increase the risk of severe outcomes[7]. In recent years, global immunization progress has been undermined by multiple factors, including conflict, mass displacement, inadequate health infrastructure, misinformation, and the COVID-19 pandemic's disruption of routine vaccination services[8]. Many regions, particularly in low- and middle-income countries, have struggled to recover vaccination coverage to pre-pandemic levels. The persistence of immunity gaps has created an environment ripe for recurrent outbreaks, which in turn increase pediatric hospitalizations and mortality rates[9]. In Bangladesh, large-

scale immunization campaigns under the Expanded Program on Immunization (EPI) have greatly reduced measles-related morbidity and mortality[10]. However, challenges persist, including population displacement from neighboring countries, overcrowded urban settlements, rural healthcare access barriers, and occasional lapses in vaccine distribution systems[11]. Refugee camps remain high-risk environments due to overcrowding, malnutrition, and limited health services. In addition, underreporting and inconsistent surveillance limit the accurate assessment of measles burden, particularly in hospitalized pediatric cases[12]. Hospital-based research plays a crucial role in filling these knowledge gaps by documenting the clinical spectrum, complication rates, hospital stay durations, and mortality outcomes among measles patients[13]. Such information can guide the refinement of treatment protocols, strengthen public health planning, and ensure that vaccination and case management strategies are targeted and evidence-based[14]. Given the continuing circulation of the virus and the country's unique socio-demographic challenges, updated and context-specific data are essential. Understanding the patterns of clinical presentation and outcomes among hospitalized children with measles can help optimize resource allocation, improve patient care, and reduce the risk of severe complications or death[15]. This study aims to evaluate the clinical characteristics and outcomes of pediatric outdoor patients with measles in Bangladesh, providing evidence to inform patient care strategies and strengthen public health interventions.

METHODS & MATERIALS

This retrospective observational study was carried out in the Department of Infectious Disease & Community Pediatrics, Bangladesh Shishu Hospital & Institute, Dhaka, Bangladesh. The study was conducted from January 2023 to December 2023. The study included 55 pediatric outdoor patients with measles over the study period, as confirmed by clinical assessment.

Inclusion Criteria

- Children aged <15 years with a clinical diagnosis of measles according to WHO criteria.
- Cases must be identified during outdoor (outpatient) visits.
- Presence of fever, generalized rash starting from the face and spreading downward, plus at least one of the following:
    - Cough
    - Coryza (runny nose)
    - Conjunctivitis

Exclusion Criteria

- Children with documented chronic illnesses (e.g., congenital heart disease, chronic lung disease, chronic liver disease).
- Immunodeficiency disorders (e.g., HIV, primary immunodeficiency).
- Presence of other febrile rash illnesses not confirmed as measles.
- Incomplete hospital records preventing full data collection.

Ethical Considerations

Ethical approval was obtained from the hospital's institutional review board. Patient confidentiality was maintained by anonymizing data, and no identifiable information was included in the analysis.

Clinical and Diagnostic Criteria

Pneumonia was diagnosed using WHO criteria: fast breathing (≥50 breaths/min for children 2–12 months, ≥40 breaths/min for children 12 months–5 years) or chest indrawing, with radiographic confirmation of pulmonary infiltrates when indicated. Encephalitis was diagnosed in the presence of altered consciousness, convulsions, neurological deficits, or irritability, supported by cerebrospinal fluid lymphocytic pleocytosis when lumbar puncture was indicated. Hepatomegaly cases underwent liver function tests. Chest radiographs and cerebrospinal fluid analysis were performed as clinically warranted.

Treatment Protocol

All children received vitamin A supplementation — 100,000 IU/day for those aged 6 months to 1 year, and 200,000 IU/day for children older than 1 year — in accordance with WHO guidelines. Supportive and complication-specific treatments were provided as needed.

Data Collection

Patient records were reviewed to extract information on age, sex, place of residence, socioeconomic status, presenting symptoms, complications, vaccination status and doses received, recent exposure to a confirmed measles case (within 3 weeks), nutritional status (weight-for-age based on National Center for Health Statistics growth charts). All children were examined to monitor disease progression and detect complications.

Data Analysis

Data were entered into Microsoft Excel and analyzed using SPSS version 26.0. Categorical variables were expressed as frequencies and percentages. The primary outcomes measured were recovery and death depending on vaccination status.

RESULT

The age distribution revealed that the majority of cases were between 1 to 5 years (41.82%), followed by 6 to 10 years (32.73%), with infants under one year accounting for 20.00%. Children aged 11 to 12 years constituted the smallest group (5.45%). The gender distribution was relatively balanced, with a slight female predominance (52.73%) compared to males (47.27%). Most patients (67.27%) originated from rural areas, and a substantial proportion belonged to the lower socioeconomic class (69.09%) (Table 1). Regarding baseline

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characteristics, 34.55% of patients were anemic, while severe and moderate acute malnutrition were observed in 7.27% each. Immunization coverage was notably high, about 80.00% having received any measles vaccination, whereas 20.00% were unvaccinated. Contact history with measles cases was positive in 61.82% of patients (Table 2). Clinically, tachypnea was the predominant presenting feature, affecting over half of the cohort (50.91%), followed by gastrointestinal symptoms, including diarrhea and vomiting (27.27%). Less common signs included Koplik's spots (7.27%), stridor (3.64%), convulsions (3.64%), and hepatosplenomegaly in a minority (Table 3). Pneumonia without dehydration was the most prevalent complication, affecting 40.00% of patients. This was followed by diarrhea with dehydration, observed in 38.18% of cases, and pneumonia with dehydration, which accounted for 12.73%. Notably, encephalitis, a severe neurological complication, was documented in 9.09% of patients (Figure 1). Out of all patients, 31 (56.36%) were vaccinated, 19 (34.55%) were not vaccinated, and the vaccination status of 5 patients (9.09%) was unknown (Table 4). Vaccination coverage varied significantly by age group, with the highest vaccination rate seen in children aged 1–5 years (69.57%), followed by those aged 11–12 years (66.67%), 6–10 years (55.56%), and lowest among infants under one year (27.27%) (Table 5).

Table – I: Demographic characteristics of the study population (*n*=55)

Variables	Frequency (n)	Percentage (%)
Age (year)		
<1	11	20.00
1- 5	23	41.82
6- 10	18	32.73
11-12	3	5.45
Gender		
Male	26	47.27
Female	29	52.73
Location		
Urban	18	32.73
Rural	37	67.27
Socioeconomic status		
Lower-class	38	69.09
Middle-class	15	27.27
Upper-class	2	3.64

Table – II: Baseline characteristics of the study population (*n*=55)

Variables	Frequency (n)	Percentage (%)
Nutritional status		
Severe Malnutrition	4	7.27
Moderate Acute Malnutrition	4	7.27
Anemia	19	34.55
Immunization status		
Immunized	44	80.00
Not-immunized	11	20.00
Contact history		
Contact	34	61.82
Non-contact	17	30.91
Unknown	4	7.27

Table – III: Clinical features of the study population (*n*=55)

Clinical features	Frequency (n)	Percentage (%)
Tachypnea	28	50.91
Diarrhea and vomiting	15	27.27
Koplik's spots	4	7.27
Stridor	2	3.64
Convulsions	2	3.64
Hepatomegaly	1	1.82
Splenomegaly	2	3.64
Cervical lymphadenopathy	1	1.82
Disturbance in level of con	1	1.82

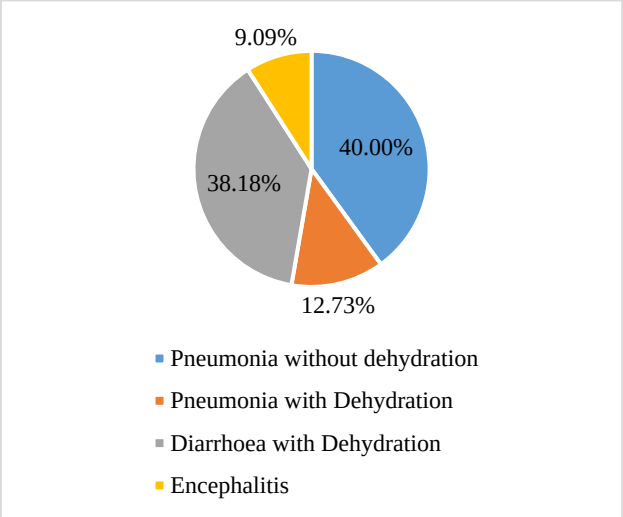

Figure – 1: Complications shown in the study population (*n*=55)

Table – IV: Vaccinated status among patients (*n*=55)

Vaccination status	Frequency (n)	Percentage (%)
Vaccinated	31	56.36
Not vaccinated	19	34.55
Unknown	5	9.09

Table – 5: Vaccinated status based on age (*n*=55)

Vaccinated	Frequency (n)	Percentage (%)
<1 year (n=11)	3	27.27
1-5 years (n=23)	16	69.57
6-10 (n=18)	10	55.56
11-12 years (n=3)	2	66.67

DISCUSSION

Measles remains a formidable public health concern, particularly in low- and middle-income countries, where gaps in immunization coverage, limited healthcare access, and underlying malnutrition collectively fuel recurrent outbreaks and severe disease presentations. Although measles is preventable through an effective and low-cost vaccine, its persistence reflects systemic weaknesses in public health and

community engagement. Pediatric cases often present with severe complications, prolonged stays, and high mortality, particularly in socioeconomically disadvantaged or rural settings, underscoring the need for targeted interventions to reduce disease burden. In the present study, the majority of measles cases were observed in children aged 1–5 years (41.82%), followed by those aged 6–10 years (32.73%) and infants under 1 year (20%). This age distribution aligns closely with findings reported from Chandigarh[16], West Bengal[17], and Pakistan[18]. In the present study a slight female predominance was observed (52.73%), which contrasts with earlier reports of male predominance; Satpathy et al.[17] described a male predominance and Hirfanoglu[19] reported a male:female ratio of 2:1. The predominance of rural residence (67.3%) and lower socioeconomic status (69.1%) among hospitalized cases aligns with prior reports demonstrating that measles disproportionately affects children from underserved communities, where healthcare access and immunization services may be limited[20-21]. National data also indicate that children from the poorest socioeconomic quintile face more than twice the risk of measles-related mortality compared to wealthier peers, highlighting the influence of socioeconomic factors on outcomes[22]. Nutritional deficiencies were significant in our cohort, with 14.54% exhibiting moderate to severe malnutrition and 34.55% anemia. These rates are consistent with Black et al. (2013) and Kassebaum et al. (2014), who demonstrated that malnutrition and anemia are prevalent comorbidities that exacerbate disease severity by impairing host immunity[23-24]. Notably, our malnutrition prevalence was somewhat lower than reported in similar settings by Rahat et al. (2020), potentially reflecting differences in local nutritional programs or sampling frames[25]. Immunization status emerged as a critical determinant of clinical outcomes in our cohort. Notably, 80% of children were vaccinated. A study at Sheikh Zayed Hospital in Rahim Yar Khan, Pakistan, showed that 56% of hospitalized measles patients were from rural areas, with 58% unvaccinated despite an 80% national immunization rate, underscoring rural population vulnerability[26]. Clinically, tachypnea was the predominant symptom (50.91%), consistent with Gershon et al. (2018) and Rudan et al. (2008), who identify respiratory distress as a hallmark of severe pediatric infections[27-28]. The relatively low detection of Koplik's spots (7.27%) contrasts with classical descriptions but may be attributable to delayed presentation or clinical under-recognition, a phenomenon reported by Moss (2017)[29]. Comparable observations have been reported in other cohorts, including hospitalized children with measles, where the prevalence ranged from 23–30%[30]. A national survey in Japan similarly documented Koplik's spots in 23.7% of measles and suspected cases, with positivity influenced by timing of examination and concurrent viral infections[31]. Pneumonia without dehydration (40.0%) and diarrhea with dehydration (38.18%) were the predominant complications in our cohort. Encephalitis occurred in 9.09% of patients, indicating a measurable risk of severe neurological sequelae. These results align with previous reports; Anis-ur-Rehman described pneumonia in 16–77% of hospitalized cases, diarrhoea as the second most frequent complication, and encephalitis-associated mortality up to 57.1%[32].

CONCLUSION AND RECOMMENDATIONS

Measles remains a significant cause of morbidity and mortality among hospitalized pediatric patients, especially in settings with low vaccination coverage and high rates of malnutrition. This study highlights that young age, rural residence, and poor immunization status are key factors associated with severe clinical presentations and adverse outcomes. Respiratory and gastrointestinal complications were common, with unvaccinated children experiencing higher mortality. Therefore, strengthening routine immunization, improving healthcare access, and addressing nutritional deficiencies are essential to reduce measles burden. These findings reinforce the urgent need for comprehensive public health strategies to protect vulnerable children and move closer to measles eradication.

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Ethical approval: *The study was approved by the Institutional Ethics Committee.*

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ORIGINAL ARTICLE

Estimation of Serum Troponin-I in ST Elevated MI Patient and Prediction of their in-Hospital Outcome

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ABSTRACT

Background: *Troponin-I is a highly sensitive biomarker for myocardial injury and may predict in-hospital outcomes in ST-elevation myocardial infarction (STEMI) patients. This study aimed to estimate serum troponin-I levels in STEMI patients and evaluate their prognostic significance for in-hospital outcomes.* ***Methods & materials:*** *This cross-sectional observational study included 100 STEMI patients admitted to Sir Salimullah Medical College & Mitford Hospital, Dhaka, Bangladesh. Serum troponin-I levels were measured at admission and patients were categorized into three groups: <0.034 ng/mL, 0.034–0.12 ng/mL, and ≥0.12 ng/mL. In-hospital outcomes including arrhythmia, cardiogenic shock, heart failure, hospital stay duration, and mortality were recorded.* ***Results:*** *The mean age was 52.5 ± 13.1 years, with males comprising 59% of patients. Hypertension (63%), smoking (47%), and diabetes mellitus (42%) were the most common risk factors. Arrhythmia rates increased from 0% (<0.034 ng/mL) to 46.1% (≥0.12 ng/mL); cardiogenic shock rose from 3.7% to 23.0%; and heart failure rose from 0% to 30.7%. Hospital stays >7 days were observed in 76.9% of patients with troponin-I ≥0.12 ng/mL. Mortality was highest (38.5%) in this group, compared to 0% in the lowest troponin category.* ***Conclusion:*** *Elevated admission troponin-I levels are associated with increased in-hospital complications, prolonged hospitalization, and mortality among STEMI patients. Troponin-I measurement serves as a valuable tool for early risk stratification in acute STEMI management.*

Keywords: *Troponin-I, ST-elevation myocardial infarction (STEMI), In-hospital outcomes, Risk stratification*

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INTRODUCTION

Coronary artery disease (CAD) continues to be the leading cause of mortality globally, representing a critical public health challenge. According to the World Health Organization (WHO), cardiovascular diseases (CVDs), predominantly ischemic heart disease, accounted for approximately 17.9 million deaths globally in 2019, representing 32% of all deaths worldwide. Remarkably, over three-quarters of these deaths occur in low- and middle-income countries (LMICs), underscoring the stark health inequities that exist between different global regions [1]. This disparity persists despite substantial advancements in therapeutic interventions and preventive cardiology measures, highlighting the urgent need for targeted research and interventions, especially in resource-limited settings [2]. Acute coronary syndrome (ACS), a manifestation of coronary artery disease, encompasses a clinical spectrum ranging from unstable angina through non-ST elevation myocardial infarction (NSTEMI) to ST-elevation myocardial infarction (STEMI). STEMI, characterized by complete thrombotic occlusion of a coronary artery, remains associated with particularly high morbidity and early mortality rates if not promptly addressed with appropriate reperfusion strategies [3]. Indeed, untreated STEMI can result in up to 30% mortality within the initial hours to days following onset [4]. In contrast, NSTEMI and unstable angina typically involve partial coronary obstruction, resulting in comparatively lower immediate risk but substantial longer-term morbidity and mortality [5]. The rapid identification and stratification of patients based on their clinical severity and associated risk factors thus become critical steps in improving

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patient outcomes. In recent decades, cardiac biomarkers have emerged as crucial diagnostic and prognostic tools in ACS. Among these biomarkers, the cardiac troponins; regulatory proteins consisting of T, I, and C subunits have demonstrated superior specificity and sensitivity for myocardial injury compared to previously used markers such as creatine kinase-MB (CK-MB). Troponin-I, in particular, is highly specific to cardiac muscle injury, with diagnostic sensitivity that surpasses CK-MB significantly, making it a gold-standard marker in diagnosing myocardial infarction [6,7]. The kinetics of troponin-I also underscore its clinical utility; it typically becomes detectable in serum 4 to 12 hours after myocardial injury, peaks between 14 to 36 hours, and remains elevated for approximately 5 to 7 days, providing a robust window for diagnosis and prognostication in ACS patients [8]. Beyond its diagnostic role, troponin-I plays a significant role in risk stratification and prognostication among patients with ACS. Landmark clinical trials, including the Fragmin and Fast Revascularization during Instability in Coronary artery disease (FRISC-II) and the Global Use of Strategies to Open Occluded Coronary Arteries (GUSTO-III), have firmly established the prognostic importance of troponin measurements. Elevated troponin levels at admission correlate strongly with adverse outcomes such as increased mortality, arrhythmias, cardiogenic shock, and heart failure, both at 30-day and 6-month follow-up periods [9,10]. Clinically validated cut-offs of troponin levels have therefore been implemented in practice to classify patients into low, intermediate, and high-risk categories, guiding timely clinical decisions, aggressive interventions, and resource allocations [11]. In Bangladesh, cardiovascular diseases have increasingly emerged as leading contributors to morbidity and mortality. According to data from the INTERHEART study, Bangladesh reported the highest prevalence of key risk factors for CVD in the South Asian region, including hypertension (14.3%), smoking (59.9%), and low fruit and vegetable intake (8.6%) [12]. Rapid urbanization, combined with significant lifestyle changes such as increasing sedentary behavior, dietary shifts, and escalating prevalence of obesity, diabetes mellitus, and dyslipidemia, has exacerbated the burden of CAD in the country [13]. Moreover, despite this growing burden, Bangladesh still lacks comprehensive, large-scale, population-based studies focusing specifically on ACS outcomes. Most existing studies tend to be hospital-based, single-center analyses with limited generalizability, highlighting a critical knowledge gap that impedes the formulation of effective national health policies and preventive strategies [14]. Recognizing these gaps, this current research aims to examine the predictive value of serum troponin-I measurement at admission for in-hospital outcomes among STEMI patients in Bangladesh. It is hypothesized that higher levels of troponin-I at admission will correlate significantly with increased risk of arrhythmias, cardiogenic shock, heart failure, prolonged hospitalization, and mortality. By addressing the prognostic implications of serum troponin-I in a Bangladeshi cohort, this study seeks to contribute vital evidence to the existing literature, potentially influencing clinical practices and guiding future research and policy initiatives in the context of ACS management in Bangladesh.

METHODS AND MATERIALS

This cross-sectional observational study was conducted in the Department of Medicine and Cardiology at Sir Salimullah Medical College & Mitford Hospital, Dhaka, Bangladesh, over a period of six months from June 12, 2018, to December 11, 2018. The study population included adult patients aged 30 to 70 years admitted with ST-elevation myocardial infarction (STEMI) confirmed by clinical evaluation and electrocardiographic (ECG) evidence. Patients were selected using purposive sampling after applying inclusion and exclusion criteria. Patients with non-STEMI, previous cardiac events including old MI, history of coronary artery bypass grafting (CABG) or percutaneous coronary intervention (PCI), valvular heart disease, cardiomyopathy, malignancy, chronic pulmonary diseases such as bronchitis, asthma, old pulmonary tuberculosis, chronic kidney disease, and those aged below 30 or above 70 years were excluded. A total of 100 patients were enrolled. After obtaining informed written consent, detailed medical history and complete physical examination were performed for each patient, recording cardiovascular risk factors such as hypertension, diabetes mellitus, smoking status, dyslipidemia, obesity, and family history of premature coronary artery disease. Body mass index (BMI) and blood pressure were measured. Venous blood samples were collected at admission for routine investigations including fasting blood glucose, serum creatinine, lipid profile, and serum troponin-I estimation. Serum troponin-I concentration was determined using an immunometric assay (Vitros Troponin-I ES Reagent Pack; Johnson & Johnson, USA) performed on the Vitros ECI Cube System. Samples were collected in plastic tubes without anticoagulant, centrifuged at 4000 rpm for 10 minutes, and processed within standard laboratory protocols. The assay used a cut-off value of ≥0.12 ng/mL to diagnose acute myocardial infarction, with risk stratification categories defined as <0.034 ng/mL (low risk), 0.034–0.12 ng/mL (average risk), and ≥0.12 ng/mL (high risk). All patients were monitored during hospital stay for outcomes including duration of hospitalization, development of arrhythmia, cardiogenic shock, heart failure, or in-hospital mortality. Data were collected using a structured case record form and entered into Microsoft Excel, then analysed with SPSS version 20.0 (IBM Corp., Armonk, NY, USA). Quantitative data were expressed as mean and standard deviation, while qualitative data were presented as frequencies and percentages. Comparisons were performed using Chi-square test for categorical variables and Student's t-test for continuous variables. A p-value <0.05 was considered statistically significant. The study protocol was reviewed and approved by the Institutional Review Board of Sir Salimullah Medical College & Mitford Hospital, and all procedures were performed in accordance with the Declaration of Helsinki.

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RESULTS

Table I shows the baseline demographic and clinical characteristics of the study population. The mean age of patients was 52.5 ± 13.1 years, ranging from 29 to 68 years. The majority of patients were aged between 41 and 50 years (34%), followed by 51–60 years (27%). Males comprised 59% of the study population, while females accounted for 41%. Regarding occupation, 29% were involved in business, 26% were day labourers, 25% were housewives, and 20% were service holders. [Table I]

Table – I: Baseline Demographic and Clinical Characteristics of Patients (*n* = 100)

Characteristic	n	%
Age Group (years)		
≤30	5	5.0
31–40	21	21.0
41–50	34	34.0
51–60	27	27.0
>60	13	13.0
Mean ± SD	52.5 ± 13.1	
Range (years)	29–68	
Sex		
Male	59	59.0
Female	41	41.0
Occupation		
Business	29	29.0
Service	20	20.0
Day laborer	26	26.0
Housewife	25	25.0

Table II presents the distribution of cardiovascular risk factors among STEMI patients. Hypertension was the most common risk factor, present in 63% of patients. Diabetes mellitus was noted in 42% of patients, while 47% were smokers. Dyslipidemia was present in 22% of the study population, and 27% had a family history of coronary artery disease. [Table II]

Table – II: Cardiovascular Risk Factors among STEMI Patients

Risk Factor	Yes n (%)	No n (%)
Hypertension	63 (63.0)	37 (37.0)
Diabetes Mellitus	42 (42.0)	58 (58.0)
Smoking	47 (47.0)	53 (53.0)
Dyslipidemia	22 (22.0)	78 (78.0)
Family History of CAD	27 (27.0)	73 (73.0)

Table III shows the distribution of serum troponin-I levels among STEMI patients. The majority of patients (60%) had troponin-I levels between 0.034 and 0.12 ng/mL, while 27% had levels below 0.034 ng/mL. A total of 13% of patients had troponin-I levels equal to or greater than 0.12 ng/mL. The mean troponin-I level in the study population was 0.1 ± 0.05 ng/mL. [Table III]

Table – III: Serum Troponin-I Levels in STEMI Patients

Troponin-I Level (ng/mL)	n	%
<0.034	27	27.0
0.034–0.12	60	60.0
≥0.12	13	13.0
Mean ± SD	0.1 ± 0.05	

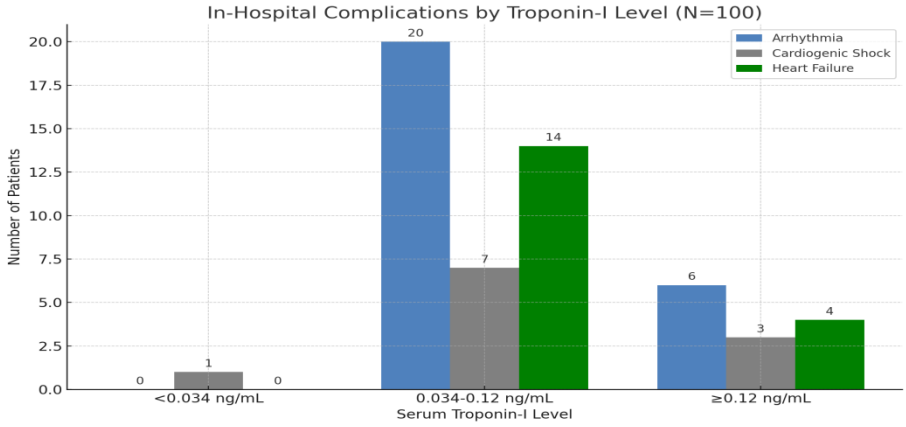

Figure – 1: In-Hospital Complications by Troponin-I Level

Figure 1 illustrates the distribution of in-hospital complications according to serum troponin-I levels. Patients with troponin-I levels between 0.034 and 0.12 ng/mL had the highest frequency of arrhythmia (20 patients), cardiogenic shock (7 patients), and heart failure (14 patients). In the group with troponin-I levels ≥0.12 ng/mL, 6 patients developed arrhythmia, 3 experienced cardiogenic shock, and 4 developed heart failure. Minimal complications were observed among patients with troponin-I levels <0.034 ng/mL.

Table IV shows the distribution of in-hospital outcomes according to serum troponin-I levels. Arrhythmia occurred in 33.3% of patients with troponin-I levels between 0.034 and 0.12 ng/mL and in 46.1% of those with levels ≥0.12 ng/mL, while no cases were reported in the <0.034 ng/mL group. Cardiogenic shock was observed in 3.7% of patients with troponin-I <0.034 ng/mL, 11.6% in the 0.034–0.12 ng/mL group, and 23.0% in the ≥0.12 ng/mL group. Heart failure occurred in 23.3% of patients with troponin-I levels between

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0.034 and 0.12 ng/mL and in 30.7% of those with levels ≥0.12 ng/mL, with no cases in the <0.034 ng/mL group. Regarding hospital stay, all patients with troponin-I <0.034 ng/mL were discharged within 3–5 days, while the majority in the ≥0.12 ng/mL group stayed >7 days (76.9%). Overall, 45% of patients had no complications during hospitalization. [Table IV]

Table – IV: In-Hospital Outcomes by Serum Troponin-I Levels

Outcome	<0.034 ng/mL (n=27)	0.034–0.12 ng/mL (n=60)	≥0.12 ng/mL (n=13)	Total (N=100)
Arrhythmia	0 (0%)	20 (33.3%)	6 (46.1%)	26 (26.0%)
Cardiogenic shock	1 (3.7%)	7 (11.6%)	3 (23.0%)	11 (11.0%)
Heart failure	0 (0%)	14 (23.3%)	4 (30.7%)	18 (18.0%)
Hospital stay: 3–5 days	27 (100.0%)	17 (28.3%)	0 (0%)	44 (44.0%)
Hospital stay: 5–7 days	0 (0%)	39 (65.0%)	3 (23.0%)	42 (42.0%)
Hospital stay: >7 days	0 (0%)	4 (6.7%)	10 (76.9%)	14 (14.0%)
No complication	26 (96.2%)	19 (31.6%)	0 (0%)	45 (45.0%)

Table V presents recovery and mortality rates according to serum troponin-I levels. All patients with troponin-I levels <0.034 ng/mL recovered without any deaths. In the 0.034–0.12 ng/mL group, 96.6% recovered while 3.4% died. Among patients with troponin-I levels ≥0.12 ng/mL, 61.5% recovered and 38.5% died. Overall, the total mortality rate in the study population was 7%. [Table V]

Table – V: Recovery and Mortality Rates by Troponin-I Group

Troponin-I Level	Recovered n (%)	Death n (%)
<0.034 ng/mL	27 (100.0)	0 (0.0)
0.034–0.12 ng/mL	58 (96.6)	2 (3.4)
≥0.12 ng/mL	8 (61.5)	5 (38.5)
Total	93 (93.0)	7 (7.0)

Note. Recovery defined as discharge without death;

DISCUSSION

The present study evaluated the predictive value of serum troponin-I levels measured at admission in determining the in-hospital outcomes among STEMI patients in Bangladesh. Key findings of this study revealed a middle-aged cohort (mean age 52.5 ± 13.1 years), predominantly male (59%), and characterized by diverse occupational backgrounds, including businesspersons (29%), day labourers (26%), housewives (25%), and service holders (20%). This demographic profile aligns closely with other regional studies. Akhtar et al. reported a similar mean age of 52.6 ± 10.8 years and higher male predominance (88.7%) in their Bangladesh-based STEMI registry [15]. Similarly, Azad et al. (2020) found the mean age in a Dhaka STEMI cohort to be 53.25 ± 9.65 years, with males comprising 75% of their sample [16]. The cardiovascular risk profile identified in our study was notably high, with hypertension (63%), smoking (47%), and diabetes mellitus (42%) being most prevalent. This observation is consistent with other regional literature; Rabbani et al. reported hypertension in 56% and smoking in 49% of their Bangladeshi cohort, while Roy et al. noted even higher prevalence rates of smoking (59.5%) and hypertension (61.9%) among STEMI patients [17,18]. The prevalence of diabetes mellitus in our study aligns closely with Roy et al. (35.7%) and Hossen et al., emphasizing the substantial cardio metabolic risk burden among Bangladeshi STEMI patients [18,19]. Serum troponin-I levels provided clear risk stratification in the current study. Most patients (60%) had intermediate troponin-I levels (0.034–0.12 ng/mL), while 13% exhibited high troponin-I levels (≥0.12 ng/mL). The significance of troponin-I levels in stratifying STEMI patients was also documented by Daniel et al. and Bularga et al., who highlighted troponin as a critical biomarker for predicting acute complications [20,21]. Our findings indicate that complications, including arrhythmia, cardiogenic shock, and heart failure, increased significantly with rising troponin-I levels. Arrhythmia prevalence climbed sharply from 0% in the lowest troponin group to 46.1% in the highest group. Cardiogenic shock and heart failure showed similar stepwise escalations (3.7% to 23.0% and 0% to 30.7%, respectively). These findings are consistent with Tambarta et al. and Polyzogopoulou et al., who found similarly strong correlations between elevated troponin-I levels and adverse cardiac outcomes such as cardiogenic shock and heart failure [22,23]. Moreover, hospital stay duration mirrored the troponin-I level stratification. Patients with low troponin levels (<0.034 ng/mL) uniformly had shorter hospital stays (3–5 days), whereas prolonged hospitalizations (>7 days) were predominantly observed among patients with troponin levels ≥0.12 ng/mL (76.9%). Similar observations were reported by Wanamaker et al. and Thielmann et al., who demonstrated prolonged hospitalization associated with higher admission troponin levels, reflecting the severity of myocardial injury and subsequent complications [24,25].

Recovery and mortality rates further emphasized the prognostic utility of troponin-I. Patients in the lowest troponin group exhibited complete recovery with no mortality, whereas those in the highest troponin group had markedly elevated mortality (38.5%). These results align closely with findings by Wanamaker et al., who demonstrated a significantly higher mortality rate (19.5%) among patients with elevated troponin levels [24]. Similarly, Cediel et al. confirmed that elevated troponin levels at admission independently predicted increased in-hospital and long-term mortality, underscoring troponin-I as a robust predictor of patient outcomes [26]. Overall, the current study reinforces the clinical importance of admission troponin-I measurement as a predictive biomarker for risk stratification, enabling clinicians to identify high-risk patients early and prioritize targeted interventions. The observed relationships between elevated

troponin-I levels, prolonged hospitalization, increased complication rates, and heightened mortality suggest a compelling case for routine use of troponin-I testing in resource-limited settings such as Bangladesh. Future large-scale multicenter studies are recommended to further validate these findings and inform national guidelines on STEMI management.

Limitations of the Study:

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

In conclusion, this study demonstrated that serum troponin-I levels measured at admission are strong predictors of in-hospital outcomes among STEMI patients in Bangladesh. Higher troponin-I levels were associated with significantly increased rates of arrhythmia, cardiogenic shock, heart failure, prolonged hospital stays, and mortality. Patients with troponin-I levels ≥0.12 ng/mL experienced the highest complication and mortality rates, whereas those with levels <0.034 ng/mL had no mortality and minimal complications. These findings underscore the utility of serum troponin-I as an effective biomarker for early risk stratification in STEMI, enabling clinicians to identify high-risk patients promptly and tailor management strategies accordingly. Routine assessment of troponin-I levels at admission, particularly in resource-limited settings, may enhance prognostication and optimize clinical outcomes. Further large-scale, multicenter studies are recommended to validate these findings and integrate troponin-based risk stratification into national STEMI management guidelines.

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ORIGINAL ARTICLE

Association of Use of Drugs with Bone Mineral Density in Postmenopausal Women with Diabetes Mellitus

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ABSTRACT

Background: *Postmenopausal osteoporosis is a significant public health concern, characterized by reduced bone mineral density (BMD) and an increased risk of fragility fractures. In women with type 2 diabetes mellitus (T2DM), the interplay between metabolic dysregulation, microvascular complications, and pharmacological treatments may further influence bone health. This study aims to evaluate the association between the use of antidiabetic medications and bone mineral density in postmenopausal women with type 2 diabetes mellitus.* ***Methods & Materials:*** *This cross-sectional study was conducted in the Medicine Department of Sir Salimullah Medical College and Mitford Hospital, from July 2023 to June 2024. A total of 120 cases were included in this study according to the selection criteria. Data were processed and analyzed by SPSS 22.0. A p-value of <0.05 was considered statistically significant.* ***Result:*** *Among the 120 postmenopausal women studied, those with diabetes were older, had a longer duration since menopause, and showed a significantly higher prevalence of osteoporosis (63.3% vs. 40.0%) compared to non-diabetics. In the diabetic group, the mean duration of diabetes was 10.53 ± 5.09 years, with over half having poor glycemic control (HbA1c > 7%), and treatment was almost equally divided between oral agents alone and oral agents plus insulin. However, no significant differences in bone mineral density were observed between the two treatment groups.* ***Conclusion:*** *This study demonstrates that postmenopausal women with diabetes mellitus have a significantly higher prevalence of osteoporosis compared to their non-diabetic counterparts, a difference likely influenced by longer duration since menopause and suboptimal glycemic control. However, no significant association was observed between bone mineral density and the type of antidiabetic treatment (oral agents alone vs. oral agents plus insulin).*

Keywords: *Bone Mineral Density, Use of Drug, Postmenopausal Women, Diabetes Mellitus*

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INTRODUCTION

Postmenopausal women with type 2 diabetes mellitus (T2DM) face a distinctive skeletal phenotype marked by heightened fracture risk despite often normal—or even higher—bone mineral density (BMD) compared with non-diabetic peers. This "diabetic bone paradox" is attributed to qualitative deficits in bone material properties (e.g., increased cortical porosity, collagen glycation, microvascular compromise) and low bone turnover that are not fully captured by areal BMD on dual-energy X-ray absorptiometry (DXA) [1,2]. In this context, the pharmacotherapies commonly prescribed to manage hyperglycaemia may independently modify bone metabolism, BMD, and fracture risk, making medication exposure an important, potentially modifiable determinant of skeletal health in postmenopausal women with diabetes [1]. Among antidiabetic agents, thiazolidinediones (TZDs) have the most consistent adverse skeletal signal. Multiple syntheses of randomized and observational data demonstrate an increased risk of fractures—particularly in women—accompanied by measurable bone loss with TZD use [3,4]. Mechanistically, peroxisome-proliferator–activated receptor-γ activation promotes adipogenesis at the expense of osteoblastogenesis, suppressing bone formation and potentially accelerating postmenopausal bone loss. Given that many postmenopausal women with T2DM also carry cardiovascular and hepatic comorbidities, characterizing TZD-associated changes in BMD provides clinically actionable information for risk stratification.Sodium–glucose cotransporter-2 (SGLT2)

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inhibitors initially raised concern after a canagliflozin safety signal in CANVAS suggested higher fracture rates; however, pooled evidence across the class now indicates a largely neutral effect on fracture risk, with heterogeneity by molecule and population [5]. Dedicated analyses of canagliflozin have not consistently shown clinically meaningful BMD deterioration, though careful attention to volume depletion and fall risk remains prudent in older women [6]. By contrast, dipeptidyl peptidase-4 (DPP-4) inhibitors appear skeletal-neutral in meta-analyses, neither increasing fractures nor showing a strong effect on BMD, suggesting suitability in patients where bone safety is a priority [7]. The evidence for glucagon-like peptide-1 receptor agonists (GLP-1 RAs) is likewise generally neutral concerning fracture risk; some comparative analyses report no significant increase versus other agents, and any direct effects on BMD remain small or inconsistent in randomized data [8]. Insulin therapy presents a more complex picture. Although insulin has anabolic effects on bone in experimental systems, clinical studies indicate a modestly increased fracture risk among insulin users—likely mediated by hypoglycaemia-related falls, comorbidity burden, and confounding by indication—rather than a direct detrimental impact on bone mass [9]. For postmenopausal women, this underscores the importance of fall-prevention strategies and cautious titration where fracture risk is high. Metformin, the anchor first-line agent for T2DM, has been associated with osteoblast-supportive pathways in preclinical models; however, contemporary meta-analyses of clinical studies do not demonstrate a robust protective effect on fracture risk, and effects on BMD appear minimal overall [10].

METHODS AND MATERIALS

This cross-sectional study was carried out in the Department of Medicine of Sir Salimullah Medical College and Mitford Hospital, over 12 months from July 2023 to June 2024, involving 120 postmenopausal women—60 with type 2 diabetes mellitus (case group) and 60 age-matched non-diabetic women (control group). Postmenopause was defined as the absence of menstruation for at least 12 consecutive months, and type 2 diabetes mellitus was diagnosed according to the American Diabetes Association (ADA) criteria, with diabetic participants receiving either oral antidiabetic drugs (OAD) alone or OAD in combination with insulin for at least one year. Women with secondary causes of osteoporosis (e.g., endocrine disorders, chronic kidney disease), those on medications affecting bone metabolism (such as corticosteroids, bisphosphonates, or hormone replacement therapy), with surgical or premature menopause (<40 years), chronic inflammatory diseases, or malignancies were excluded. Data were collected using a structured proforma, recording socio-demographic information, age at menarche, age at menopause, duration since menopause, and for the diabetic group, duration of diabetes, glycemic control (assessed by HbA1c), and treatment modality. Anthropometric measurements were obtained to calculate body mass index (BMI). Bone mineral density (BMD) at the femoral neck and lumbar spine was measured for all participants using dual-energy X-ray absorptiometry (DXA), and T-scores and Z-scores were recorded. Statistical analyses were performed using appropriate software, with continuous variables expressed as mean ± standard deviation and categorical variables as frequency and percentage; comparisons between groups were made using unpaired t-tests and chi-square tests, and a p-value <0.05 was considered statistically significant.

RESULTS

The table shows the demographic profile of the study subjects. Mean age of the patients was 65.83 ± 8.75 years and 62.17 ± 7.67 years in diabetic and non diabetic post menopausal patients. There was no significant difference in the age of menarche and age at menopause. But the duration since menopause was significantly higher in diabetic patients than in non-diabetic patients. There was also no significant difference in BMI between the groups. [Table I].

Table – I: Demographic profile of the study subjects (*n*=120)

	Diabetic (n=60) n (%)	Non diabetic (n=60) n (%)	p-value
Age (years)			
50 – 59	8 (13.3)	19 (31.7)	
60 – 69	32 (53.3)	32 (53.3)	
≥70	20 (33.3)	9 (15.0)	
Mean ± SD	65.83 ± 8.75	62.17 ± 7.67	0.016
Age of menarche (years)	14.78 ± 0.69	14.63 ± 0.64	0.219
Age at menopause (years)	46.90 ± 3.39	46.95 ± 3.04	0.932
Duration since menopause (years)	19.70 ± 7.82	15.15 ± 8.27	0.002
Body Mass Index (kg/m^2)	24.60 ± 4.87	25.26 ± 3.40	0.397

Data were expressed as frequency, percentage, and mean (± Standard Deviation).
An unpaired t-test was done to measure the level of significance.

In the case group (n=60), the mean duration of diabetes mellitus was 10.53 ± 5.09 years, with the highest proportion (38.3%) having diabetes for 6–10 years, followed by 26.7% for 11–15 years, 20.0% for 1–5 years, and 15.0% for more than 15 years. Regarding glycemic control, 58.3% had suboptimal control (HbA1c > 7), while 41.7% maintained HbA1c ≤ 7. In terms of treatment, slightly more than half (51.7%) were on oral antidiabetic drugs (OAD) alone, whereas 48.3% were receiving a combination of OAD and insulin therapy. [Table II]

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Table – II: Diabetic variables of the case group (*n*=60)

	Frequency (n)	Percentage (%)
Duration of DM (years)		
1 – 5	12	20.0
6 – 10	23	38.3
11 – 15	16	26.7
>15	9	15.0
Mean±SD	10.53 ± 5.09	
Glycemic status		
HbA1c ≤ 7	25	41.7
HbA1c > 7	36	58.3
Type of treatment		
OAD	31	51.7
OAD + insulin	29	48.3

Data were expressed as frequency, percentage, and mean (± Standard Deviation).

Nearly half of both diabetic and non-diabetic participants (46.7% in each group) had been menopausal for 11–20 years. A shorter postmenopausal duration of 1–10 years was significantly more common in the non-diabetic group (33.3%) compared to the diabetic group (11.7%) (p = 0.008). Conversely, longer durations since menopause (21–30 years and >30 years) were more frequent among diabetic subjects (31.7% and 10.0%, respectively) than among non-diabetics (18.3% and 1.7%, respectively). [Table III]

Table – III: Duration since menopause of the study subjects (*n*=60)

Duration since menopause (years)	Diabetic (n=60)	Non diabetic (n=60)	p-value
1 – 10	7 (11.7)	20 (33.3)	0.008
11 – 20	28 (46.7)	28 (46.7)	
21 – 30	19 (31.7)	11 (18.3)	
>30	6 (10.0)	1 (1.7)	

Data were expressed as frequency and percentage.
An unpaired t-test was done to measure the level of significance

The table shows osteoporosis in diabetic and non diabetic post menopause patients. Osteoporosis was found to be significantly higher in diabetic patients than in non-diabetic patients. [Table IV]

Table – IV: Osteoporosis in Diabetic and Non diabetic patients (*n*=120)

	Diabetic (n=60) n (%)	Non diabetic (n=60) n (%)	p-value
Osteoporosis	38 (63.3)	24 (40.0)	0.033
Osteopenia	20 (33.3)	31 (51.7)	
Normal	2 (3.3)	5 (8.3)	

Data were expressed as frequency and percentage.
A chi-square test was done to measure the level of significance

Table V shows the association of drugs with bone mineral density in postmenopausal women with diabetes mellitus. There was no association of bone mineral density with the drug in postmenopausal women with diabetes mellitus. [Table V]

Table – V: Association of use of drug with bone mineral density in postmenopausal women with diabetes mellitus (*n*=60)

	Drug		p-value
	OAD (n=31) [Mean±SD]	OAD+insulin (n=29) [Mean±SD]	
T-score			
Femoral neck	-2.51 ± 0.96	-2.94 ± 1.17	0.129
Lumbar spine	-3.12 ± 1.50	-3.54 ± 1.52	0.287
Z-Score			
Femoral neck	-0.96 ± 0.81	-1.37 ± 1.16	0.116
Lumbar spine	-1.53 ± 1.06	-1.70 ± 1.45	0.594

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DISCUSSION

In this case–control study of postmenopausal women, osteoporosis was significantly more prevalent among participants with diabetes than among non-diabetic peers (63.3% vs 40.0%), and the diabetic group had a longer time since menopause. These observations are biologically and epidemiologically plausible. Bone loss accelerates across the menopausal transition and continues thereafter; thus, a greater duration since menopause—as seen in the diabetic cohort—would be expected to correspond with lower BMD and higher odds of osteoporosis, even after accounting for similar ages at menopause between groups [10,11]. Population studies likewise show that fracture risk is elevated in diabetes, and this excess risk is imperfectly captured by BMD alone—people with type 2 diabetes (T2D) often fracture at higher T-scores than non-diabetic individuals, reflecting diabetes-related deterioration in bone material properties and increased propensity to falls [1,2]. Our finding of a higher proportion of osteoporosis among women with diabetes, therefore, aligns with meta-analytic evidence indicating a substantial burden of osteoporosis in T2D globally [12]. At the same time, literature on BMD levels in T2D is mixed, with several cohorts (particularly those with higher BMI) reporting normal or even higher areal BMD in T2D despite greater fracture risk, the so-called "diabetic bone paradox" [2]. Recent syntheses continue to underscore this heterogeneity across skeletal sites and populations [13]. In our sample, diabetics showed more osteoporosis by DXA classification at the femoral neck and lumbar spine. Differences from studies reporting preserved or higher BMD may relate to our cohort's longer postmenopausal duration, the relatively older age structure of the diabetic group, and the high proportion with suboptimal glycemic status (58.3% with HbA1c >7%), all factors that have been linked to accelerated cortical loss, deficits in bone quality, and increased falls risk [1,2,10]. Ethnic and body-composition differences, skeletal site, and DXA measurement artifacts (e.g., spinal degenerative changes) may also contribute to between-study variability [1,2]. With respect to antihyperglycemic therapy, we observed no significant differences in T- or Z-scores between women treated with oral agents alone and those receiving a combination of oral agents plus insulin. This "null" association at the level of BMD is consistent with several lines of evidence. First, initiation of insulin in mid- to late-life diabetes has been associated with hip BMD decline in some longitudinal cohorts, but the magnitude is modest and may be confounded by disease severity and weight change; importantly, fracture excess with insulin appears to be driven at least partly by hypoglycemia and falls rather than large BMD decrements [14]. Second, for many contemporary non-TZD agents, randomized and real-world meta-analyses have generally shown neutral effects on fractures and BMD: DPP-4 inhibitors do not increase fracture risk, GLP-1 receptor agonists appear overall neutral with a possible signal for hip-fracture reduction in some analyses, and SGLT2 inhibitors have not shown clinically meaningful adverse effects on BMD [8,10,15]. In contrast, thiazolidinediones (TZDs) reliably increase fracture risk—particularly in postmenopausal women—through effects on osteoblastogenesis and bone resorption [10].

Limitations of The Study:

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

This study demonstrates that postmenopausal women with diabetes mellitus have a significantly higher prevalence of osteoporosis compared to their non-diabetic counterparts, a difference likely influenced by longer duration since menopause and suboptimal glycemic control. However, no significant association was observed between bone mineral density and the type of antidiabetic treatment (oral agents alone vs. oral agents plus insulin).

RECOMMENDATION

It is recommended that postmenopausal women with diabetes undergo routine bone health assessment, including timely BMD measurement, and be offered targeted osteoporosis prevention and management strategies—such as lifestyle modification, adequate calcium and vitamin D intake, and pharmacological therapy when indicated—regardless of their antidiabetic treatment regimen.

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ORIGINAL ARTICLE

Reconstruction Techniques Following Resection of Auricular Skin Cancers - A Comparative Analysis

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ABSTRACT

Background: *Ear skin cancers present specific reconstructive challenges due to the ear's three-dimensional nature and functional requirements. The reconstructive technique significantly affects both oncologic and cosmetic outcomes. The objective of this study is to compare various reconstructive techniques following excision of skin cancer from the ear in terms of complications, function, and recurrence rate.* ***Methods & Materials:*** *This is a retrospective study of 80 patients who underwent surgical excision of histopathologically confirmed auricular skin malignancies and reconstruction. Patients were categorized based on the reconstructive techniques: primary closure, skin graft, local flap, regional flap, and composite graft. Complications at follow-up, oncological outcome, functional/cosmetic result by surgeon's assessment, and patient satisfaction by visual analogue scale were endpoints measured. Data were analyzed in SPSS (version 26) using descriptive statistics, chi-square tests for associations, and Kaplan–Meier with log-rank tests for recurrence-free survival across reconstruction techniques.* ***Results:*** *The most common malignancy was basal cell carcinoma (50%), followed by squamous cell carcinoma (40%) and melanoma (10%). Local flaps were employed most commonly (30%), and skin grafts and primary closure were used equally (25% each). Primary closure resulted in the fewest complications (10%) and the most cosmetic satisfaction (90%), and skin grafts resulted in more complications (40%) and poorer cosmetic outcomes (60%). Kaplan-Meier analysis identified substantially improved recurrence-free survival with primary closure and local flaps compared to graft-based methods ($p < 0.001$).* ***Conclusion:*** *Local flaps and primary closure are associated with improved aesthetic and oncologic outcomes and fewer complications compared with graft-based reconstruction techniques for auricular skin cancer defects.*

Keywords: *Auricular reconstruction, Skin cancer, Local flaps, Recurrence-free survival*

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INTRODUCTION

Auricular skin cancers are a significant category of cutaneous malignancies, accounting for approximately 8–10% of all head and neck skin cancers [1]. The outer ear is an abnormally exposed area since it is continuously exposed to ultraviolet (UV) radiation, which is the key factor in the pathogenesis of most auricular malignancies. In addition, the complex three-dimensional auricular structure and limited tissue mobility create special difficulties for oncological resection as well as subsequent reconstruction [2]. Compared to other facial regions, auricular defects are prominent due to its focal location, and suboptimal reconstruction can not only lead to a compromise of function but also have critical aesthetic and psychosocial consequences. For the majority of patients, the ear is the center of facial harmony, and postoperative deformities may result in anxiety, social isolation, and reduced quality of life [3]. Most common auricular malignancies include basal cell carcinoma, squamous cell carcinoma, and melanoma, and basal cell carcinoma is the most common [4]. These tumors are most commonly found in sun-exposed regions such as the helix, antihelix, and scaphoid fossa where the skin is extremely thin and supported by minimal subcutaneous tissue [5]. Total oncological excision with histologically evident margins continues to be the standard of successful treatment. Yet, this usually leads to extensive tissue loss that requires prompt reconstructive treatment in order to re-establish function as well as form. Over the decades, many reconstructive techniques have been proposed to close auricular defects, ranging from the most uncomplicated of primary closure to intricate composite grafts and microvascular free tissue transfer [6]. The choice of technique would then depend on numerous variables like defect size,

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depth, anatomical subunit involved, patient age, comorbidities, and the surgeon's level of experience [7]. Primary closure, though limited to small defects, is preferred because of its technical ease and improved color match [8]. In large or irregular defects, local flaps such as advancement, rotation, or transposition flaps are utilized extensively, offering superior tissue similarity in terms of color, thickness, and contour [9]. Local flaps, like postauricular and temporoparietal fascia flaps, provide more versatility but may result in donor site morbidity and longer operation time [10]. Split-thickness and full-thickness skin grafts remain useful for covering extensive surface areas, albeit their cosmetic results marred by imprecise matching of texture or coloration [11].

In spite of this broad armamentarium of reconstructive techniques, few high-quality comparative studies exist to support evidence-based decision-making. Most of the literature consists of small case series or isolated reports of a single technique, making it difficult to develop clear guidelines. Surgeons are thus frequently forced to rely on personal experience rather than standard evidence when planning auricular reconstruction. To address this deficiency, the present study intends to make a comprehensive comparative review of the reconstruction techniques following resection of auricular skin cancer based on complications, functional outcome, aesthetic satisfaction, and oncologic safety.

METHODS AND MATERIALS

This was a retrospective comparative study conducted on patients who underwent surgical excision of auricular skin cancers followed by reconstruction at Rajshahi Medical College, Rajshahi, Bangladesh from January, 2024 to December, 2024. Patients with histologically confirmed auricular malignancies were included in the study. A total of 80 patients with histologically confirmed auricular malignancies were included, and both males and females across all age groups were eligible, provided that complete clinical, surgical, and follow-up records were available. Patients with recurrent auricular tumours at presentation, incomplete documentation, or a history of prior auricular reconstruction were excluded from the analysis. Clinical records were carefully reviewed to collect demographic data, tumour location, histopathological diagnosis, and details of the reconstruction techniques applied. Postoperative outcomes assessed included complications such as infection, flap or graft necrosis, hematoma, and wound dehiscence, while oncological outcomes were evaluated in terms of local recurrence and the need for revision surgery. Functional and cosmetic results were determined based on surgeon-assessed cosmetic outcomes and patient-reported satisfaction measured using a visual analogue scale (VAS). Ethical approval was obtained by institutional requirements, and the study was conducted in compliance with the principles of the Declaration of Helsinki. Informed written consent for surgical treatment for research and publication was obtained from all patients.

Statistical Analysis

Data were entered and analyzed using SPSS (version 26). Categorical variables were expressed as frequencies and percentages. Associations between tumor location and reconstruction techniques, as well as between reconstruction techniques and complications, were assessed using the chi-square test (χ^2 test). A p-value of <0.05 was considered statistically significant.Comparative functional and oncological outcomes across reconstruction methods were also analyzed with chi-square tests. Kaplan–Meier survival analysis was performed to assess recurrence-free survival, and differences across techniques were evaluated using the log-rank test. Survival curves were generated to visually compare long-term oncological outcomes between reconstruction techniques.

RESULTS

Table I reflects the baseline demographic and clinical characteristics of the 80 patients on whom analysis was performed. The distribution of age reveals a preponderance of middle-aged individuals, 50% belonging to the age group of 40-59 years, followed by 30% ≥60 years and 20% <40 years. Male dominance (60% to 40% female) is in keeping with epidemiological patterns for skin carcinomas. The site of the tumor was most commonly the helix (30%), then concha (25%) and antihelix (20%), while the least common was the tragus (10%). [Table I]

Table – I: Basic Characteristics of the Study Population (*n* = 80)

Variable	Category	Frequency (n)	Percentage (%)
Age Group	<40 years	16	20%
	40–59 years	40	50%
	≥60 years	24	30%
Sex	Male	48	60%
	Female	32	40%
Tumor Location	Helix	24	30%
	Antihelix	16	20%
	Lobule	12	15%
	Concha	20	25%
	Tragus	8	10%

Table II presents the histopathologic breakdown of the 80 auricular skin cancers in the cohort. Basal cell carcinoma was the most frequent malignancy and accounted for 50% (n=40) of cases, followed by squamous cell carcinoma in 40% (n=32) of cases, and melanoma accounting for 10% (n=8) of cases. The moderately high frequency of squamous cell carcinoma (40%) compared to other body regions may result from the visibility and susceptibility of the ear to chronic actinic injury. [Table II]

Table – II: Histopathological Distribution of Auricular Skin Cancers (*n* = 80)

Histopathology	Frequency (n)	Percentage (%)
Basal Cell Carcinoma	40	50%
Squamous Cell Carcinoma	32	40%
Melanoma	8	10%

Table III demonstrates the application of reconstruction techniques used following excision of auricular skin cancer. Local flaps constituted the most frequent technique (30%,

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n=24), followed by primary closure and skin grafting, each accounting for 25% (n=20) of patients. Regional flaps were employed for 15% (n=12) of the patients, and composite grafts were the least common at 5% (n=4). Equal application of primary closure and skin grafts (25% each) reflects that size and location of the defect are important factors in determining the technique of choice, with primary closure in the minor defects and skin grafting in the major defects where local tissue becomes thin. [Table III].

Table – III: Reconstruction Techniques Used Following Resection (*n* = 80)

Reconstruction Technique	Frequency (n)	Percentage (%)
Primary Closure	20	25%
Skin Graft	20	25%
Local Flap	24	30%
Regional Flap	12	15%
Composite Graft	4	5%

Table IV shows significant correlations between tumor location and choice of reconstruction technique (p = 0.03). The helix, being the most frequent location, had preferential utilization of local flaps (15% of total cases), reflecting local tissue availability for reconstruction and the challenging curvature for which tissue of similar nature was required. The antihelix showed a trend in favor of local flaps (12.5% of the total). The tragus too favored skin grafts (5% of the total cases), possibly due to the fact that it is small and there isn't much tissue to spare around it. The area of the concha saw more diverse reconstructive techniques, where local flaps (15%) and regional flaps (3.8%) were commonly utilized, possibly due to the fact that it is deeper and requires differently to be repaired. [Table IV]

Table – IV: Association Between Tumor Location and Reconstruction Technique (*n* = 80)

Tumor Location	Primary Closure n (%)	Skin Graft n (%)	Local Flap n (%)	Regional Flap n (%)	Composite Graft n (%)	χ^2, df, P- value
Helix	4 (5%)	2 (2.5%)	12 (15%)	2 (2.5%)	0 (0%)	$\chi^2 = 16.28$, df = 8, p = 0.03
Antihelix	2 (2.5%)	2 (2.5%)	10 (12.5%)	2 (2.5%)	0 (0%)	
Lobule	1 (1.2%)	2 (2.5%)	8 (10%)	1 (1.2%)	0 (0%)	
Concha	2 (2.5%)	2 (2.5%)	12 (15%)	3 (3.8%)	1 (1.2%)	
Tragus	0 (0%)	4 (5%)	1 (1.2%)	0 (0%)	0 (0%)	
Total	9 (11.2%)	12 (15%)	43 (53.7%)	8 (10%)	1 (1.2%)	

Table V provides a lucid comparison of postoperative outcomes between different reconstruction techniques, indicating statistically significant differences (p = 0.014). Primary closure was best in terms of complication with 90% of the patients having no complications and with only a 10% overall complication rate with the majority being minor infection (5%) and hematoma (5%). Local flaps had the second-best outcome with 75% complication-free outcomes and 25% overall rate of complications. Put this in perspective with skin grafts having the highest rate of complications at 40%, which appeared with infections (15%), graft necrosis (10%), hematoma (10%), and wound dehiscence (5%). Regional flaps recorded a 33.3% rate of complications, while composite grafts registered a 50% rate of complications with the minimal number of cases. [Table V].

Table – V: Comparison of Outcomes across Different Reconstruction Techniques (*n* = 80)

Reconstruction Technique	No Complication n (%)	Any Complication n (%)	Infection n (%)	Flap Necrosis n (%)	Hematoma n (%)	Wound Dehiscence n (%)	χ^2, df, P-value
Primary Closure (n=20)	18 (90.0)	2 (10.0)	1 (5.0)	0 (0.0)	1 (5.0)	0 (0.0)	χ^2 = 12.47, df = 4, p = 0.014
Skin Graft (n=20)	12 (60.0)	8 (40.0)	3 (15.0)	2 (10.0)	2 (10.0)	1 (5.0)	
Local Flap (n=24)	18 (75.0)	6 (25.0)	2 (8.3)	2 (8.3)	1 (4.2)	1 (4.2)	
Regional Flap (n=12)	8 (66.7)	4 (33.3)	2 (16.7)	1 (8.3)	1 (8.3)	0 (0.0)	
Composite Graft (n=4)	2 (50.0)	2 (50.0)	1 (25.0)	1 (25.0)	0 (0.0)	0 (0.0)	
Total	58 (72.5)	22 (27.5)	9 (11.2)	6 (7.5)	5 (6.2)	2 (2.5)	

Table VI contrasts oncological and functional outcomes among reconstruction techniques, with significant differences in cosmetic outcomes (p = 0.009). Best results were seen in primary closure with 90% satisfactory cosmetic outcomes and 85% satisfaction of the patient (VAS ≥7), and with the lowest incidence of local recurrence (5%). Local flaps performed equally to 83.3% good cosmetic outcomes, 79.2% patient satisfaction, and an 8.3% rate of local recurrence. Skin grafts provided poorer outcomes with 60% good cosmetic outcome, 55% patient satisfaction, and a 15% rate of local recurrence. Regional flaps produced average outcomes (75% good cosmetic outcomes, 66.7% satisfaction), while composite grafts provided the poorest outcomes in all areas. [Table VI].

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Table – VI: Comparative Oncological and Functional Outcomes Across Reconstruction Techniques (*n* = 80)

Reconstruction Technique	Local Recurrence n (%)	Revision Surgery n (%)	Good Cosmetic Outcome n (%)	Patient Satisfaction (VAS ≥7) n (%)	χ^2, df, P- P-value
Primary Closure (n=20)	1 (5.0)	1 (5.0)	18 (90.0)	17 (85.0)	χ^2 = 14.82, df = 4, p = 0.009 (for cosmetic outcomes)
Skin Graft (n=20)	3 (15.0)	4 (20.0)	12 (60.0)	11 (55.0)	
Local Flap (n=24)	2 (8.3)	2 (8.3)	20 (83.3)	19 (79.2)	
Regional Flap (n=12)	1 (8.3)	1 (8.3)	9 (75.0)	8 (66.7)	
Composite Graft (n=4)	1 (25.0)	1 (25.0)	2 (50.0)	2 (50.0)	
Total	8 (10.0)	9 (11.2)	61 (76.2)	57 (71.2)	

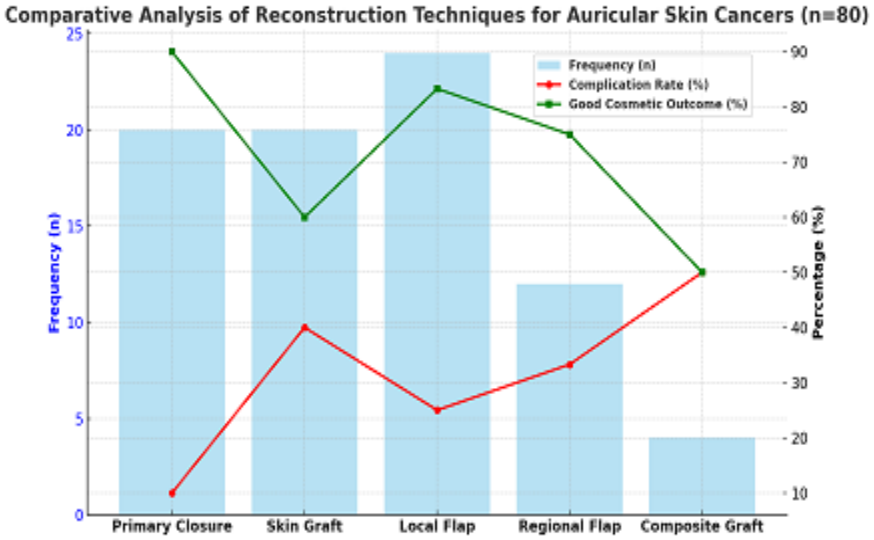

Figure 1 shows the comparative analysis of Reconstructive Techniques for Auricular Skin Cancers. The graph shows that local flaps were the most frequently used, offering a good balance of low complications (25%) and high cosmetic outcomes (83.3%). Primary closure had the best overall results with the lowest complication rate (10%) and highest cosmetic satisfaction (90%). In contrast, skin grafts and composite grafts showed higher complication rates (40–50%) and poorer cosmetic outcomes (50–60%), while regional flaps performed moderately. Overall, primary closure and local flaps emerged as the most favourable reconstruction techniques.

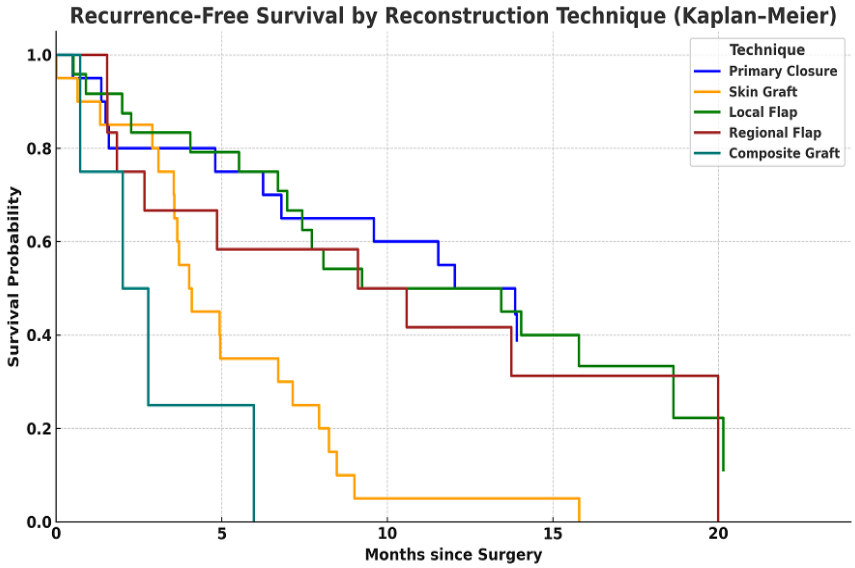

Figure 2 Shows Kaplan-Meier Recurrence-Free Survival Curves by Reconstruction Technique Following Auricular Skin Cancer Resection. The Kaplan–Meier survival curves demonstrate clear differences in recurrence-free survival across reconstruction techniques over a 24-month follow-up. Primary closure achieved the most favourable outcomes, maintaining the highest survival probability with minimal recurrence. Local flaps also performed strongly, showing sustained recurrence-free survival comparable to primary closure and confirming their reliability for covering auricular

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defects. Regional flaps provided moderate outcomes, with a gradual decline in survival over time. In contrast, skin grafts and composite grafts demonstrated the poorest recurrence-free survival, with earlier and more frequent recurrences observed during follow-up. The overall log-rank test confirmed a statistically significant difference among techniques (χ^2 = 25.8, df = 4, p < 0.001), highlighting that primary closure and local flaps are superior options in terms of oncological safety, while graft-based methods are associated with worse long-term outcomes.

DISCUSSION

This study demonstrates the comparative series of 80 patients with significant differences in the various reconstruction modalities following auricular skin cancer removal. The findings indicate primary closure and local flaps are superior to grafting procedures regarding complications, cosmesis, and oncologic safety. The results have important implications for surgical planning and patient counseling in auricular reconstruction. The incidence of basal cell carcinoma (50%) and squamous cell carcinoma (40%) among our cohort aligns with Wunderlich et al. for cutaneous malignancies in sun-exposed areas [12]. The gender predominance and age distribution are predicted demographics for auricular skin cancers and serve to emphasize the importance of sun protection and regular dermatological check-ups in at-risk populations [13]. The preferential involvement of the helix and antihelix regions is consistent with prominent position and maximal sun exposure, as noted by Gibson et al. that the primary closure provided the lowest complication rate (10%) and highest patient satisfaction (85%) justifies its continued preference for appropriate defects [14]. The excellent outcome is likely the result of an absence of tension, optimal tissue matching, and preservation of normal anatomy [15]. Primary closure is limited, however, to small defects in which there is adequate tissue mobility without ear contour compromise or distortion [16]. The local flaps emerged as the most frequent technique (30%) and with good results of 83.3% good cosmetic results and low complication rates (25%). This is explained by the fact that they are ideal for the reconstruction of moderately sized defects with tissue whose characteristics are similar to the surrounding ear [17]. The improved blood supply of the local flaps compared to grafts results in healing with fewer complications [18]. Our results strengthen the continued emphasis on local flap reconstruction as a reliable option for auricular defects. The significantly higher complication rates observed with skin grafts (40%) and composite grafts (50%) highlight the intrinsic challenge in graft-based reconstruction of the auricular region. The complicated three-dimensional anatomy of the ear and the lack of recipient bed vascularity can be attributing factors for graft-related complications like necrosis and poor aesthetic outcomes [19]. In addition, color and texture mismatch intrinsic to grafting procedures typically results in poor cosmetic results, as in our 60% good cosmetic result rate for skin grafts [20]. The Kaplan-Meier survival analysis with primary closure and local flaps demonstrating improved recurrence-free survival (p < 0.001) is a result of particular importance. This suggests that beyond the cosmetic factor, these procedures can have better oncological results. Improved surveillance and better healing of well-vascularized local tissue may result in earlier detection of recurrences and better long-term oncological control [21]. The higher rates of recurrence observed with graft-based operations need to be considered in surgical planning and may necessitate more intensive follow-up protocols.

Regional flaps, while showing intermediate outcomes in our series, still remain valuable for larger defects when local tissue is insufficient. The donor site morbidity and increased operative complexity, however, must be weighed against perceived benefits [22]. Planning should consider patient factors such as age, comorbidities, and aesthetic expectations, along with defect characteristics. The significant association between tumor location and reconstruction modality selection in our series (p = 0.03) demonstrates the influence of anatomic considerations on surgical planning. Preferential use of local flaps for helix and antihelix defects, and skin grafting for tragal defects, aligns with the differing local tissue availability and reconstructive requirements of these auricular subunits. This confirms a site-specific approach to reconstruction modality selection over a one size fits all philosophy.

Limitations of the Study:

Small series sizes within some of the reconstruction groups, particularly composite grafts, limit statistical power for detecting differences. The single-institution nature of the study has the potential to restrict generalizability across different surgical practices and patient groups.

CONCLUSION

Primary closure and local flaps are the optimal reconstruction procedures for auricular skin cancer defects, offering superior oncologic control, reduced complication rates, and greater aesthetic outcomes compared to grafting-based reconstructive procedures. Reconstruction choice must be individualized based on defect size, location, and anatomic landmarks as well as the patient's unique circumstances. These findings support ongoing use of tissue-sparing techniques whenever feasible, emphasizing the importance of careful patient selection and planning in achieving optimal outcomes.

RECOMMENDATION

Multicenter studies with more patients and standardized outcome measures in the future studies are needed to validate these findings. Investigation into novel reconstruction techniques, including tissue engineering and regenerative techniques, is warranted. Development of valid scoring systems for measuring outcomes of auricular reconstruction would permit more objective comparison of techniques and institutions.

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ORIGINAL ARTICLE

Pediatric Acute Glomerulonephritis: Correlation of Clinical Presentation with early complications and histopathology

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ABSTRACT

Background: *Acute glomerulonephritis (AGN) is a major cause of illness in children. It is present in different ways and can lead to complications that affect long-term health. This study examines how clinical presentation, complications, and histopathology in children with acute glomerulonephritis correlate to improve risk assessment and treatment.* ***Methods & Materials:*** *This observational study involved 50 patients aged between 1 to 18 years who were diagnosed with AGN and admitted to a tertiary care hospital. We collected detailed clinical, biochemical, and histopathological data using structured forms. Renal biopsies were done on 18 patients. We used SPSS version 26 for statistical analysis and applied Pearson's correlation coefficient to check associations among clinical presentations, complications, and histopathological features.* ***Results:*** *The average age of the patients was 8.24±3.2 years, with a predominance of males (70%). Common symptoms included facial puffiness (96%), oliguria (98%), hypertension (98%), and hematuria (90%). Early complications occurred in 60% of the patients, while 40% had no complications. Hypertension and oliguria showed strong links to acute kidney injury (AKI), ICU admission, and heart failure. Histopathological findings indicated that endocapillary hypercellularity correlated strongly with clinical severity. The average hospital stay was 10.2±5.2 days, and 94% of the patients improved by the time of discharge.* ***Conclusion:*** *Clinical factors, especially oliguria, hypertension, and anuria, are reliable indicators of early complications and histological severity in pediatric AGN. These findings support using clinical markers for risk assessment and early intervention, which could improve patient outcomes and decrease the need for invasive diagnostic tests.*

Keywords: *Pediatric acute glomerulonephritis, Clinical-pathology, acute glomerulonephritis complications, Histopathology.*

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INTRODUCTION

Acute glomerulonephritis (AGN) is one of the most significant renal diseases in children worldwide, characterized by immune-mediated damage to the glomerular basement membrane, mesangium, or capillary endothelium [1]. It manifests with hematuria, proteinuria, and azotemia, typically accompanied by the classic triad of edema, hypertension, and oliguria [2]. Post-streptococcal glomerulonephritis is the most common form of AGN in children, particularly in developing countries where streptococcal infections are prevalent [3]. The clinical presentation of pediatric AGN is very diverse, ranging from asymptomatic microscopic hematuria to rapidly progressive glomerulonephritis with acute kidney injury requiring dialysis [4]. Acute post-streptococcal glomerulonephritis, as seen in research, usually presents with gross hematuria, mild edema, oliguria, hypertension, and some renal insufficiency, with school-aged children most commonly affected [5]. The pathophysiology is immune complex deposition with complement activation and an inflammatory cascade resulting in glomerular injury and dysfunction [6]. Early recognition and appropriate management of AGN complications are necessary to prevent long-term sequelae. Generalized edema, hypertension, and hematuria have been the most common presenting symptoms in recent publications, while persistent hypertension, renal impairment, and proteinuria can signal a more severe clinical course that may require renal biopsy [7]. Evolution to complications such as acute kidney injury, hypertensive

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encephalopathy, and heart failure significantly influences patient outcomes and needs intensive care management [8]. Histopathology remains the gold standard for making a definitive diagnosis and identifying the types of glomerulonephritis. Immunofluorescence typically shows characteristic patterns, e.g., poststreptococcal glomerulonephritis with irregular, coarse granular deposits of polyclonal IgG and C3 along glomerular capillary walls [9]. Renal biopsy is not always feasible in children due to the risks and technical challenges involved, and thus correlation with clinical presentation and histopathological findings is particularly helpful [10]. Correlation of the clinical presentation with the initial complications and histopathology can significantly improve the management options for the patients. While the majority of the patients recover completely, there remains a 3-6% risk of chronic kidney disease development, which calls for the identification of predictive factors for poor outcomes [11]. The aim of this study is to assess the correlation between clinical presentation, early complications, and histopathology in children presenting with acute glomerulonephritis to improve risk stratification and direct therapeutic interventions in this high-risk population.

METHODS & MATERIALS

This observational study was conducted at the pediatric nephrology department of Bangladesh Shishu Hospital & Institute from October 2024 to March 2025. Fifty patients aged 1 to 18 years diagnosed with acute glomerulonephritis (AGN) were admitted to a tertiary care hospital and included in the study. Structured data collection form was used to gather detailed information, including demographic characteristics, immune status, and history of recent infections. Clinical features at presentation-including hematuria, proteinuria, oliguria, oedema, facial puffiness, hypertension, and systemic complications meticulously documented. Renal biopsy and histopathological examinations were performed among patients with RPGN, persistent hypertension more than 10days, nephrotic range proteinuria beyond 2 weeks and AKI persisting more than 10 days. Patient outcomes were evaluated based on the resolution of symptoms, renal function recovery, complications, ICU requirement, and hospital stay duration.

Data were compiled, checked, and analyzed using IBM SPSS Statistics version 26. Descriptive statistics were used to summarise the baseline characteristics, clinical features, biochemical parameters, and histopathological findings. Continuous variables were expressed as mean ± standard deviation (SD), and categorical variables were presented as frequencies and percentages. Pearson's correlation coefficient was applied to assess the strength and direction of association between clinical presentations and early complications, as well as histopathological features. A *p*-value of less than 0.05 was considered statistically significant.

RESULTS

Table I provides the demographic and baseline characteristics of the study population. Most patients (70%) were aged between 5 and 10 years, and there was a strong male majority (70%). A rural residence was more common (64%), and many patients came from a lower-middle-class socioeconomic background (54%). The average BMI was 15.8±3.2 kg/m^2, and all patients were immunocompetent. [Table I].

Table – I: Distribution of study population based on basic characteristics (*n*=50)

Basic characteristics	N/ Mean±SD	Percentage (%)
Age		
<1 yr	0	0
1-3 yr	1	2
> 3-5 yrs	4	8
> 5-10 yrs	35	70
>10-18 yrs	10	20
Gender		
Male	35	70
Female	15	30
Residence		
Rural	32	64
Urban	18	36
Socioeconomic condition		
Poor	15	30
Middle class	7	14
Upper Mid Class	1	2
Lower Middle class	27	54
BMI		
Mean±SD	15.8 ± 3.2 Minimum 11.01 kg/m^2 Maximum 25.20 kg/m^2	
Immune status	50	100
Mean±SD	8.24 ± 3.2 with Min 3 days Max 15 days	
Duration of illness		
≤ 7 days	32	64
≤ 7 days	18	36

Clinical symptoms at presentation in Table II showed a typical nephritic syndrome pattern. Almost all patients had hypertension (98%) and oliguria (98%), while facial swelling was noted in 96% of cases. Hematuria was present in 90% of patients, and proteinuria was found in 78%. Systemic complications included encephalopathy (18%), convulsions (20%), heart failure (10%), and pneumonia (14%). Only 2% of patients had anuria, and ascites was seen in 14% of cases, indicating a range of disease severity at presentation. A history of sore throat was found in 54% of cases. Skin infections were noted in 28% of patients, with fever associated in 42% of cases. [Table II].

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Table – II: Distribution of study population based on clinical presentation at admission (*n* = 50)

Clinical presentation at admission	Number	Percentage (%)
Gross Hematuria	45	90
Proteinuria	39	78
Oliguria	49	98
Anuria	1	2
Oedema	22	44
Facial Puffiness	48	96
Ascites	7	14
Hypertension	49	98
Pneumonia	7	14
Encephalopathy	9	18
Heart Failure	5	10
Convulsion	10	20
H/O sore throat	27	54
H/O skin infection	14	28
Associated fever	21	42

Laboratory tests in Table III showed significant kidney involvement and systemic effects. Moderate proteinuria (0.5-2.0 mg/mg) was the most common finding (56%), whereas severe proteinuria was rare (4%). Serum albumin was moderately low in 56% of patients. Complement C3 levels were reduced for all the patients (100%), and C4 level was raised in 4% patinets. Most patients (70%) had elevated serum creatinine levels above 0.9 mg/dL, with 96% meeting stage 3 CKD by GFR criteria. ASO titers were elevated (≥200 IU/ml) in 98% of patients, while ANA and anti-dsDNA were negative in all cases, supporting a post-infectious cause. [Table III].

Table – III: Distribution of study population based on Biochemical parameters (*n*=50)

Biochemical Parameter	N	Percentage (%)
Urine Culture Positive	10	20
Urine Protein Present	45	90
Urine RBC	48	64
Urine Pus cell Present	16	32
Urine Hyaline Cast	1	2
Urine RBC Cast	2	4
Spot PCR (mg/mg) Nephrotic Range Proteinuria	2	4
S. Albumin (g/L) Reduced	35	70
S. Cholesterol (mmol/L) Raised	8	16
S. C3 Level (gm/L) Reduced	50	100
S. C4 Level (gm/L) Raised	2	4
GFR Level (ml/1.73m^2) Reduced	48	96
S. Creatinine Level (mg/dL) Raised	35	70
Blood Urea(mmol/L) Raised	25	50
ASO titre (IU/ml) Raised	42	84
ANA Negative	50	100
Anti DsDNA Negative	50	100
Sodium (mmol/L)		
Hyponatremia	3	6
Hypernatremia	6	12
Potassium (mmol/L)		
Hypokalemia	0	0
Hyperkalemia	7	14
Chloride (mmol/L)		
Hypochloremia	6	12
Hyperchloremia	15	30

Histopathological examination was done on 18 patients (36%), showing widespread glomerular enlargement and increased matrix, which is demonstrated in Table IV. Endocapillary hypercellularity was most common (61.11%), and mesangial hypercellularity occurred in 27.78% of cases. Crescentic changes were seen in 5.55% of patients. Immunofluorescence analysis showed variable intensity of immune deposits, with IgM being the most prominent (72% with 2+ or 3+ staining), followed by IgA (72%) and C3 (66%). The most common diagnosis was infection-associated glomerulonephritis (50%), with crescentic forms indicating more severe disease patterns. [Table IV].

Table – IV: Distribution of study population based on Renal Histopathology (*n*=18)

Renal Histopathology	N	Percentage (%)
Glomerular Size		
Enlarge glomeruli	18	100
Cellularity		
Endocapillary hypercellularity	11	61.11
Mesangial Hypercellularity	1	5.55
Endocapillary & Mesangial Hyper Cellularity	5	27.78
Endocapillary hypercellularity With the Presence of crescents	1	5.55
Matrix Increased	18	100
GBM		
Irregularly thick	2	11.11
Mildly thick	2	11.11
Not thick	14	77.78
IgG		
Trace	3	16.67
1+	10	55.55
2+	5	27.78
IgM		
Trace	2	11.11
1+	3	16.67
2+	9	50
3+	4	22.22
IgA		
Trace	1	5.55
1+	4	22.22
2+	7	38.89
3+	6	33.33
C3		
Trace	3	16.67
1+	5	27.78
2+	7	38.89
3+	1	5.55

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Diagnosis		
Infection associated with GN	9	50
Infection-associated proliferative GN	3	16.67
Proliferative Crescentic GN	1	5.55
Infection associated with Crescentic GN	1	5.55
Post-infectious Proliferative GN	4	22.22

Table V shows that the treatment is varied based on disease severity and complications. All patients needed furosemide for fluid management, while 82% required calcium channel blockers for hypertension. Corticosteroids were given to 50% of patients (14% received intravenous methylprednisolone, 36% took oral prednisolone). Mycophenolate mofetil was used in 16% of cases with severe disease. Hemodialysis was necessary for 12% of patients with acute kidney injury, while no patients required peritoneal dialysis. Antibiotics were prescribed to 42% of patients for concurrent or suspected bacterial infections. [Table V].

Table – V: Distribution of study population based on Treatment (*n*=50)

Treatment	N	Percentage (%)
Hemodialysis	6	12
Methylpednisolon	7	14
Oral Pednisolon	18	36
MMF	8	16
Frusemide	50	100
Calcium channel blocker	41	82
Antibiotic	21	42

Clinical outcomes, which are shown in Table VI, were generally positive, with 94% of patients showing improvement at discharge. Early complications occurred in 60% of patients, with acute kidney injury being common (10% isolated and 6% with other complications). Other major complications included septicemia (8%), respiratory issues (8%), and rapidly progressing glomerulonephritis (10%). ICU admission was necessary for 26% of cases. [Table VI].

Table – VI: Distribution of study population based on Complications (*n*=50)

Outcome	N/Mean±SD	Percentage (%)
Complication		
AKI	2	4
AKI with other complications	3	6
CRBSI	1	2
Encephalopathy	5	10
Heart Failure	3	6
Complications in the respiratory tract	3	6
RPGN	2	4
RPGN with other complications	4	8
Septicemia	20	40
UTI	13	2
No complications		
ICU Needed		

Table VII represents the distribution of outcomes among the study population (N = 50). Most participants, 94%, showed improvement. A small number, 6%, were discharged with ongoing hypertension (HTN). Recovery times varied: hypertension resolved in 9.9±5.1 days, swelling in 6.7±4.3 days, and gross hematuria in 7.4±5.0 days. The average hospital stay was 10.2±5.2 days, and only 6% were discharged with ongoing hypertension. [Table VII].

Table – VII: Distribution of the Study population based on Outcome (*n*=50)

Outcome	N	Percentage (%)
Improved	47	94
Discharged with persistent HTN	3	6
Duration to resolve HTN Mean±SD		9.9 ± 5.1 Min 4 days Max 30 days
Duration to resolve Oedema Mean±SD		6.7 ± 4.3 Min 2 days Max 28 days
Duration to resolve gross hematuria Mean±SD		7.4 ± 5.0 Min 3 days Max 21 days
Duration to improve renal function		9.9 ± 5.5 Min 3 days Max 30 days
Mean Hospital Stay		10.2 ± 5.2 Min 4 days Max 30 days

The correlation analysis in Table VIII shows strong statistical links between certain clinical features and complications. Hypertension had the strongest association with acute kidney injury (r=0.55, p=0.002), heart failure (r=0.39, p=0.03), and ICU admission (r=0.50, p=0.01). Oliguria also had a strong correlation with AKI (r=0.52, p=0.005), encephalopathy (r=0.44, p=0.01), and ICU requirement (r=0.56, p=0.002). Although rare (2%), anuria had the highest correlation coefficients with serious complications, particularly AKI (r=0.61, p=0.001) and ICU admission (r=0.58, p=0.002). Proteinuria and facial puffiness showed moderate correlations with neurological complications. [Table VIII].

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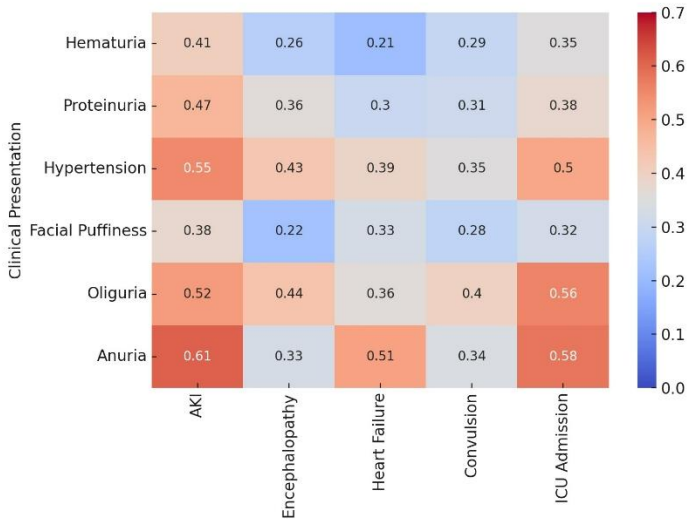
Table – VIII: Correlation between Clinical Presentations and Early Complications

Clinical Presentation	AKI	Encephalopathy	Heart Failure	Convulsion	ICU Admission
Hematuria	r = 0.41, p = 0.03	r = 0.26, p = 0.09	r = 0.21, p = 0.16	r = 0.29, p = 0.08	r = 0.35, p = 0.05
Proteinuria	r = 0.47, p = 0.01	r = 0.36, p = 0.04	r = 0.30, p = 0.07	r = 0.31, p = 0.06	r = 0.38, p = 0.03
Hypertension	r = 0.55, p = 0.002	r = 0.43, p = 0.02	r = 0.39, p = 0.03	r = 0.35, p = 0.04	r = 0.50, p = 0.01
Facial Puffiness	r = 0.38, p = 0.03	r = 0.22, p = 0.13	r = 0.33, p = 0.05	r = 0.28, p = 0.10	r = 0.32, p = 0.07
Oliguria	r = 0.52, p = 0.005	r = 0.44, p = 0.01	r = 0.36, p = 0.04	r = 0.40, p = 0.03	r = 0.56, p = 0.002
Anuria (2%)	r = 0.61, p = 0.001	r = 0.33, p = 0.05	r = 0.51, p = 0.01	r = 0.34, p = 0.06	r = 0.58, p = 0.002



Heatmap 1 shows the correlation between clinical presentations and early complications in pediatric acute glomerulonephritis. It reveals that anuria and oliguria have the highest associations with severe complications such as acute kidney injury (AKI) and ICU admission, with correlation coefficients reaching up to 0.61 and 0.58, respectively. Hypertension also shows strong links to complications like AKI (r = 0.55) and heart failure (r = 0.39), underscoring its role as a critical early marker. Proteinuria and facial puffiness exhibit moderate correlations, particularly with neurological complications such as encephalopathy and convulsions

Clinical-pathological correlations in Table IX. Oliguria had the strongest correlation with endocapillary hypercellularity (r=0.65, p=0.001), meningeal hypercellularity (r=0.44, p=0.02), and C3 deposition (r=0.48, p=0.02). Hypertension also correlated with endocapillary changes (r=0.62, p=0.001) and crescent formation (r=0.38, p=0.04). Anuria, despite being infrequent, showed strong associations with severe histological features, including endocapillary hypercellularity (r=0.69, p<0.001) and crescent formation (r=0.61, p=0.01).[Table IX].

Table – IX: Correlation between Clinical Presentations and Histopathological Features

Clinical Presentation	Endocapillary Hypercellularity	Mesangial Hypercellularity	Crescent Formation	IgA Deposition	C3 Deposition
Hematuria	r = 0.58, p = 0.01	r = 0.35, p = 0.06	r = 0.26, p = 0.10	r = 0.22, p = 0.14	r = 0.30, p = 0.08
Proteinuria	r = 0.50, p = 0.02	r = 0.28, p = 0.09	r = 0.31, p = 0.07	r = 0.33, p = 0.06	r = 0.42, p = 0.03
Hypertension	r = 0.62, p = 0.001	r = 0.41, p = 0.03	r = 0.38, p = 0.04	r = 0.29, p = 0.08	r = 0.45, p = 0.02
Facial Puffiness	r = 0.49, p = 0.02	r = 0.26, p = 0.11	r = 0.22, p = 0.14	r = 0.25, p = 0.11	r = 0.33, p = 0.06
Oliguria	r = 0.65, p = 0.001	r = 0.44, p = 0.02	r = 0.40, p = 0.03	r = 0.31, p = 0.07	r = 0.48, p = 0.02
Anuria (2%)	r = 0.69, p < 0.001	r = 0.36, p = 0.05	r = 0.61, p = 0.01	r = 0.30, p = 0.09	r = 0.53, p = 0.01

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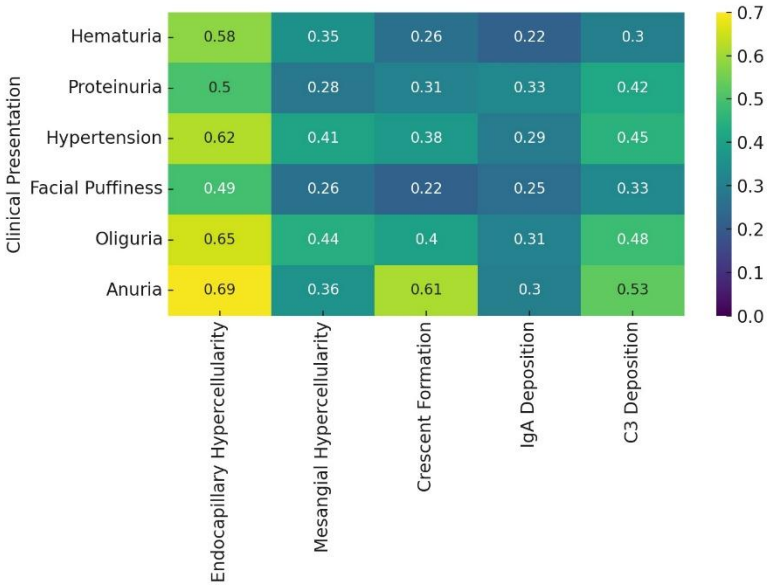

Heatmap 2 highlights the relationship between clinical presentations and histopathological features observed in renal biopsy. Anuria and oliguria again demonstrate the strongest correlations with severe histological changes, including endocapillary hypercellularity (r = 0.69 for anuria) and crescent formation (r = 0.61). Hypertension also correlates significantly with endocapillary changes and immune complex deposition, suggesting more aggressive kidney involvement.

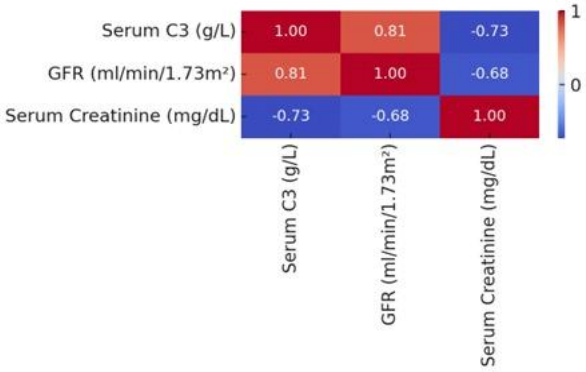

Figure – 3: Pearson Correlation between Serum C3, GFR, and Serum Creatinine

This heatmap demonstrates the strong correlation among Serum C3, GFR, and Serum Creatinine levels in the study population. The Pearson correlation analysis between serum C3, GFR, and serum creatinine revealed strong interrelationships that align with the expected pathophysiological patterns in glomerulonephritis. Serum C3 demonstrated a strong positive correlation with GFR (r = 0.81), indicating that higher complement levels are associated with better renal function. Conversely, serum C3 showed a strong negative correlation with serum creatinine (r = –0.73), suggesting that as complement levels decline, often due to ongoing immune-mediated kidney injury, while serum creatinine rises, reflecting reduced filtration capacity. GFR also showed a strong inverse correlation with serum creatinine (r = –0.68), consistent with the well-established clinical marker relationship in kidney function assessment.

DISCUSSION

This study of fifty pediatric patients with acute glomerulonephritis provides valuable insights into the clinical-pathological correlations and predictive factors for early complications. The demographic profile, with a predominance of school-age children and male gender, aligns with established epidemiological patterns of post-streptococcal glomerulonephritis in developing countries, which is shown by Nasr et al. [12]. Post-streptococcal glomerulonephritis remains one of the most common causes of acute nephritis among children, particularly in regions with limited access to healthcare and poor hygiene conditions [13]. The clinical presentation in our cohort demonstrated the classic nephritic syndrome with near-universal presence of hypertension (98%), oliguria (98%), and facial puffiness (96%). These findings are consistent with Pinto et al., that the characteristic triad of hematuria, oedema, and hypertension that defines acute glomerulonephritis results from sodium and water retention in the setting of renal impairment [14]. The

high prevalence of elevated ASO titers (98%) and negative autoimmune markers supports the post-infectious aetiology in the majority of cases [15]. The correlation analysis revealed significant associations between clinical parameters and both early complications and histopathological severity. The strong correlation between oliguria, hypertension, and adverse outcomes (AKI, ICU admission, heart failure) underscores the importance of these clinical markers for risk stratification. Early recognition of rapidly progressive patterns is crucial to prevent further renal function loss [16]. Although anuria was uncommon (2%), it demonstrated the highest correlation coefficients with severe complications, emphasising its clinical significance as a marker of advanced disease [17]. The histopathological findings in our study population revealed predominant endocapillary hypercellularity (61.11%) with variable immune complex deposition patterns. 50% patients of this had shown infection associated with GN, while post-infection proliferative GN was shown 22.2% that differs now-a-days. The correlation between immunofluorescence findings and clinical course has important prognostic implications [18]. The strong correlation between clinical severity markers (oliguria, hypertension) and histological features (endocapillary hypercellularity, crescent formation) suggests that clinical assessment can provide valuable information about underlying pathological severity even when renal biopsy is not immediately available [19].

Treatment outcomes were generally favourable, with 94% of patients showing improvement at discharge. However, the requirement for ICU admission in 26% of cases and dialysis in 12% highlights the potential severity of this condition. While most children recover completely, the 3-6% risk of progression to chronic kidney disease necessitates careful long-term follow-up [20]. The mean hospital stays of 10.2±5.2 days reflect the need for close monitoring and management of complications during the acute phase [21]. The biochemical profile demonstrated notable patterns, with universal C3 reduction (100%), a finding lower than expected compared with historical cohorts, possibly reflecting earlier presentation or regional disease variation.

Limitations of the Study:

The study took place at a single tertiary care centre, which may limit how applicable the findings are to other groups and healthcare settings. Kidney tissue examinations were done in only 36% of patients, which may cause bias towards more severe cases and restrict a complete assessment of clinical and pathological connections.

CONCLUSION

Clinical indicators such as reduced urine output, elevated blood pressure, anuria and associated infection serve as dependable predictors of early complications and kidney injury in children with acute glomerulonephritis. The close association between these clinical features and pathological findings suggests that non-invasive markers can be effectively used to assess risk and guide treatment decisions. These findings emphasize the importance of early monitoring of oliguria and hypertension to promptly identify high-risk patients requiring intensive care and timely intervention.

RECOMMENDATIONS

Future studies across multiple centers with larger groups and consistent biopsy methods are needed to confirm these clinical and pathological links in different populations. Long-term follow-up studies should also be conducted to check how well early clinical signs predict the development of chronic kidney disease and to create evidence-based guidelines for assessing risk in children with acute glomerulonephritis. Research into new biomarkers and non-invasive diagnostic tools could further improve the early identification of high-risk patients and lead to better treatment results.

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ORIGINAL ARTICLE

Cervical Cancer Awareness among Women Visiting a Tertiary Care Hospital in Bangladesh

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ABSTRACT

Background: *Cervical cancer is a major public health issue in Bangladesh. Limited awareness among women leads to late diagnoses and poor outcomes. This study aims to assess the cervical cancer knowledge, attitudes, and awareness among women at a tertiary hospital to support improved cancer control in Bangladesh.* ***Methods and materials:*** *This cross-sectional study took place over six months, from July 2022 to December 2022, at the Institute of Child and Mother Health. A total of 99 women aged 20 to 50 were enrolled using convenience sampling. Data were collected through face-to-face interviews with a semi-structured questionnaire. Data analysis was conducted using SPSS version 25.0.* ***Results:*** *Out of the 99 participants, 71.7% (n=71) were aware of cervical cancer. The average age was 29.78±6.96 years, and 74.7% were in the 20-30 age group. Most participants were housewives (67.7%) from rural areas (62.6%) and had primary education (42.4%). Among those who were aware, 71.8% recognized vaginal bleeding as a symptom, 90.1% knew about Pap smears, and 76.1% were familiar with VIA testing. However, only 39.4% identified HPV as a risk factor. Educational background showed a significant link with awareness levels (p=0.01). Most awareness levels were average (59.2%) or poor (21.1%).* ***Conclusion:*** *Although there is some basic awareness, there are significant gaps in knowledge about risk factors, especially HPV infection, and preventive measures. Educational programs aimed at rural, less-educated women are crucial to improve awareness of cervical cancer and the uptake of screening in Bangladesh.*

Keywords: *Cervical cancer, Bangladesh, Diagnosis, Cancer Awareness*

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INTRODUCTION

Cervical cancer is the fourth most prevalent cancer in women worldwide, with 604,000 new cases and 342,000 deaths reported in 2020 [1]. The disease disproportionately affects low- and middle-income countries (LMICs), where about 90% of cervical cancer deaths occur due to insufficient access to prevention, screening, and treatment services [2]. Cervical cancer is the second most common cancer among Bangladeshi women, reflecting broader problems with LMICs' attempts at controlling this preventable illness. Awareness about cervical cancer in Bangladesh is lacking, and only 45.2% of women are aware of it. Awareness is especially low among rural, illiterate, and poorer populations [3]. The Government of Bangladesh initiated a national screening program in 2005 in women between the age of 30–60 years using visual inspection with acetic acid (VIA), which is a cost-effective and feasible method for poor-resource settings [4]. Notwithstanding this, uptake of screening is less than 10% where services are available, evidencing the necessity for enhanced outreach and education. High-risk human papillomavirus (HPV) chronic infection contributes to approximately 99.7% of the world's cervical cancers [5]. Nevertheless, there is no awareness in Bangladeshi women about HPV as the main risk factor, and it is one of the causes of chronic preventable infections and cancer risk. The World Health Organization's target to eradicate cervical cancer by 2030 emphasizes the importance of having high vaccination coverage for HPV (90%), screening (70%), and treatment (90%) of precancerous and invasive lesions [6]. Social and cultural determinants play a significant role in cervical cancer awareness and screening practices in Bangladesh. Sex role attitudes, limited decision-making status, and stigma of gynecological examination limit the access to screening services [7]. Fatalism toward cancer, false beliefs about cancer, and fear of receiving the diagnosis also deter

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healthcare seeking. There are more obstacles for rural groups, such as lack of infrastructure, means of transport, and economic constraints. Educational interventions in South Asia have been effective for raising awareness and screening uptake, particularly when culturally tailored and designed to overcome literacy and mobility barriers [8]. However, there is a need for specific knowledge about barriers faced by Bangladeshi women to develop successful targeted interventions. Health workers have an essential role to play in promoting cervical cancer screening. Females prefer doctors for screening due to trust and specialist perceived, which indicates the significance of provider interaction, privacy, confidentiality, and communication clearness during screening [9]. Technological advancements as HPV-based screening and self-sampling have potential in increasing screening sensitivity and acceptability and bypassing cultural barriers, though there are limitations concerning implementation [10].

Understanding the current cervical cancer awareness and attitude in women presenting for care in Bangladesh is essential to the planning of an effective prevention program. In this study, the knowledge, attitudes, and awareness of cervical cancer, risk factors, screening tests, and preventive measures were elicited from women presenting at a tertiary-care hospital and contributing to the vital data to enhance cervical cancer control in Bangladesh.

METHODS & MATERIALS

This cross-sectional study took place over six months, from July 2022 to December 2022, at the outpatient department of the Institute of Child and Mother Health. The target group included women aged 20 to 50 years who visited the institute and agreed to participate. Although the sample size was calculated at 162 based on a 12% prevalence of cervical cancer, only 99 participants were enrolled due to resource and time constraints. Participants were selected using convenient sampling. Inclusion criteria included women within the specified age range who consented to participate, while women outside of this age range or those unwilling to be interviewed were excluded. Data collection involved a semi-structured questionnaire administered through face-to-face interviews. Key terms were defined, including awareness, which refers to knowledge and understanding of cervical cancer and screening, cervix anatomy, cervical cancer, and cervical screening methods such as the Papanicolaou (Pap) smear and Visual Inspection with Acetic Acid (VIA). The data were analyzed using SPSS version 25.0. We assessed participants' awareness levels using a scoring system based on 8 questions totaling 28 marks, with one mark for each correct answer. Scores were converted into percentages and categorized as excellent (>80%), good (70–80%), average (50–70%), or poor (≤50%) awareness. This scale helped quantify participants' knowledge about cervical cancer and screening practices. Ethical approval was granted by the Institutional Review Board of ICMH. Participants provided informed consent in Bengali, with options for finger impressions if they could not sign.

RESULTS

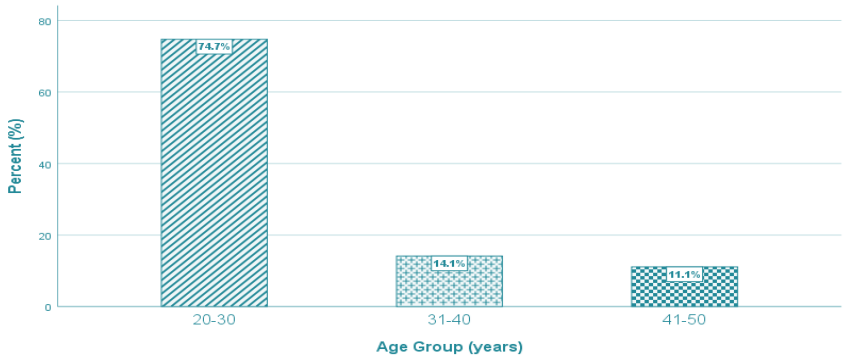

Figure – 1: Distribution of the study participants by age group

Figure 1 illustrates the distribution of study participants by age group. Most responses, 74.7%, were between the ages of 20 and 30, indicating that the study's participants were primarily young people. The 31 to 40 age group accounted for 14.1% of the participants. The age group of 41 to 50 was the smallest, accounting for 11.1%.

Table I shows the socio-demographic profile of the study participants. Most women (74.7%) were in the 20-30 years age group, with an average age of 29.78±6.96 years. Most participants identified as Muslim (65.7%), aligning with the religious demographics of Bangladesh. Educational attainment was generally low, with 42.4% having only primary education and 31.3% being illiterate. Regarding employment, 67.7% were housewives, suggesting traditional gender roles and limited participation in the workforce. In terms of rural-urban distribution, 62.6% came from rural areas. Concerning marital status, 59.6% were married, 25.3% were unmarried, and 15.2% fell into other categories, including divorced or widowed, indicating a variety of family structures within the study population. [Table I].

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Table – I: Distribution of study participants by the socio-demographic characteristics (*n*=99)

Variables	Values of variable	Frequency (n)	Percentage (%)
Age group	20-30 (years)	74	74.7
	31-40 (years)	14	14.1
	41-50 (years)	11	11.1
Mean± SD	**29.78 ± 6.96**		
Religion	Islam	65	65.7
	Others	34	34.3
Educational qualification	Illiterate	31	31.3
	Primary	42	42.4
	SSC	11	11.1
	HSC or above	15	15.2
Occupation	Student	14	14.1
	Housewife	67	67.7
	Service holder	18	18.2
Residence	Urban	37	37.4
	Rural	62	62.6
Marital Status	Married	59	59.6
	Unmarried	25	25.3
	Others	15	15.2

Table II shows the knowledge levels among the 71 participants who were aware of cervical cancer. Recognition of symptoms was moderate, with 71.8% identifying vaginal bleeding and pain during intercourse as key symptoms. Fewer recognized vaginal discharge (46.5%) and growth in the cervix or uterus (40.8%). Awareness of risk factors showed concerning gaps, especially regarding HPV infection (39.4%), despite it being the main cause. More participants recognized behavioral risk factors like multiple sexual partners (62.0%) and early sexual activity (63.4%). Awareness of screening methods was promising, with 95.8% knowing about screening options and 90.1% being aware of Pap smear testing. Consultation with doctors and regular screening were most recognized (54.9% each), while lifestyle changes like avoiding multiple partners (38.0%) and early sexual activity (36.6%) were less commonly identified. [Table II].

Table – II: Level of awareness of respondents about Cervical cancer

Variables	Frequency (n)	Percentage (%)
Aware about cervical cancer		
1. Yes	71	71.7
2. No	28	28.3
Symptoms of cervical cancer		
1. Vaginal bleeding	51	71.8
2. Vaginal infection	39	54.9
3. Discharge from vagina	33	46.5
4. Pain after intercourse	51	71.8
5. Growth in cervix/uterus	29	40.8
Risk factors for cervical cancer		
1. Oral contraceptive pill (OCP)	46	64.8
2. Multiple sexual partner	44	62.0
3. Having sex at an early age	45	63.4
4. Multiparty	41	57.7
5. Smoking	33	46.5
6. Virus (HPV)	28	39.4
Aware about screening method for cervical cancer		
1. Yes	68	95.8
2. No	3	4.2
Type of screening method		
1. VIA test	54	76.1
2. Pap smear	64	90.1
Aware about pre-cancerous conditions of Ca cervix		
1. Yes	59	83.1
2. No	12	16.9
Treatment of pre-cancerous condition of Ca cervix		
1. Electrocautery	51	71.8
2. LEEP	50	70.4

3.	TAH	36	50.7
4.	Diagnostic D & C	28	39.4
Preventive measure of Ca cervix			
1.	Through consulting with physicians	39	54.9
2.	Regular cervical cancer screening	39	54.9
3.	Informed about ideal screening centers	36	50.7
4.	Treatment of precancerous lesion	38	53.5
5.	Vaccination	32	45.1
6.	Avoid multiple sexual partner	27	38.0
7.	Avoid early age of sexual intercourse	26	36.6
8.	Early treatment of STIS	25	35.2

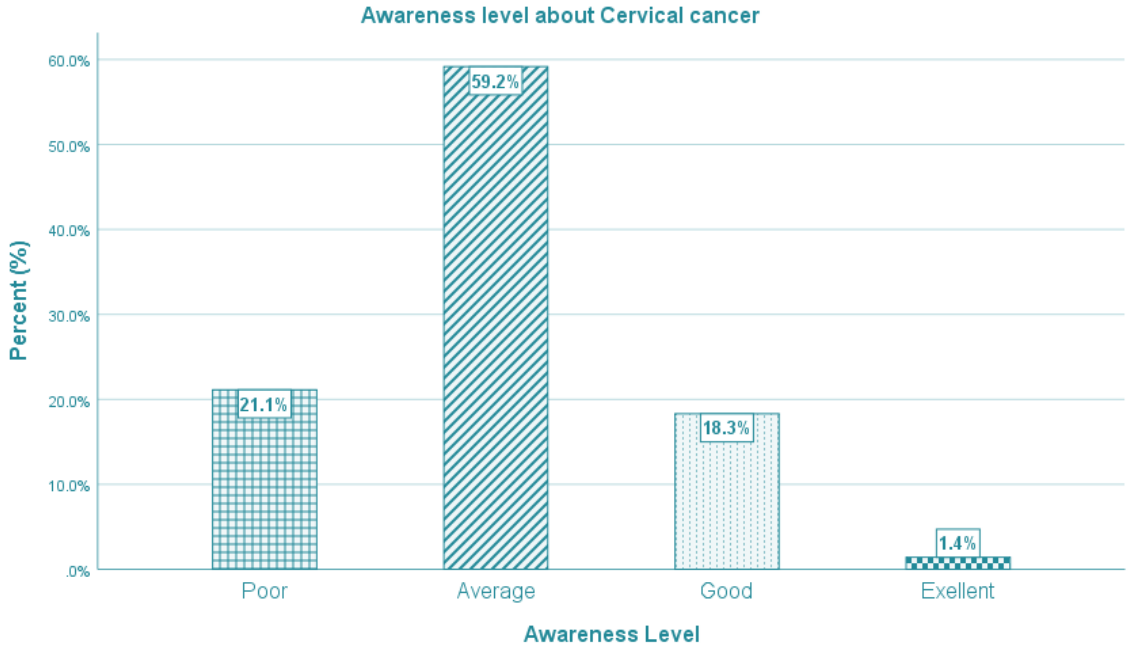

Figure – 2: Level of awareness regarding cervical cancer among study participants

Figure 2 illustrates that the average awareness score about cervical. Most participants, 59.2%, had an average level of awareness. Only a small percentage, 1.4%, showed excellent awareness. The remaining participants were poor, at 21.1%, and good, at 18.3%.

Table III divides the knowledge of the 71 aware participants into poor, average, good, and excellent levels across five key areas. Knowledge of screening methods was the strongest, with 70.4% showing excellent understanding. However, knowledge of preventive measures was the weakest, with 69.0% having poor understanding. Awareness of risk factors was also troubling, with 53.5% showing poor knowledge, even though this is critical for prevention. Recognition of symptoms yielded mixed results; 42.3% had poor knowledge and only 5.6% had excellent awareness. Knowledge about treating pre-cancerous conditions showed moderate results, with 50.7% having poor understanding but 15.5% demonstrating excellent knowledge. The average scores ranged from 1.66 for screening methods, indicating good knowledge, to 3.68 for preventive measures, indicating poor knowledge. [Table III].

Table – III: Awareness level among respondents into different variables (*n*=71)

Variables	Level of Awareness				Mean (score)	Std.
	Poor n (%)	Average n (%)	Good n (%)	Excellent n (%)		
Symptoms of cervical cancer	30(42.3)	20(28.2)	17(23.9)	4(5.6)	2.86	1.05
Risk factors for cervical cancer	38(53.5)	20(28.2)	0	13(18.3)	3.35	1.24
Type of screening method	21(29.6)	0	0	50(70.4)	1.66	0.56
Treatment of pre-cancerous condition of Ca cervix	36(50.7)	0	24(33.8)	11(15.5)	2.32	1.16
Preventive measure of Ca cervix	49(69.0)	11(15.5)	6(8.5)	5(7.0)	3.68	1.72

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Table IV explores the relationship between socio-demographic factors and awareness levels. Educational qualification showed a significant association with awareness (p=0.01), where higher education levels linked to better awareness. Illiterate participants had an equal distribution between average (50%) and good (50%) awareness levels while those with HSC or higher education showed the highest proportions of good (26.7%) and excellent (6.7%) awareness. The high prevalence of average awareness (ranging from 48% to 77.8% across groups) suggests uniform knowledge gaps across demographic categories. The limited excellent awareness (0-7.7%) signals overall insufficient knowledge, regardless of demographic factors, highlighting the need for widespread educational initiatives. [Table IV].

Table – IV: Association between awareness level and Socio-demographic characteristics

Variables	Categories	Level of Awareness				P value
		Poor	Average	Good	Excellent	
		n (%)	n (%)	n (%)	n (%)	
Age group	20-30 (years)	15 (27.3)	30(54.5)	9 (16.4)	1 (1.8)	**0.34**
	31-40 (years)	0	6 (85.7)	1 (14.3)	0	
	41-50 (years)	0	6 (66.7)	3 (33.3)	0	
Marital Status	Married	10 (22.7)	24 54.5)	9 (20.5)	1 (2.3)	**0.84**
	Unmarried	2 (12.5)	12 75.0)	2 (12.5)	0	
	Others	3 (27.3)	6 (54.5)	2 (18.2)	0	
Educational qualification	Illiterate	0	5 (50.0)	5 (50.0)	0	**0.01**
	Primary	13 (35.1)	21 (56.8)	3 (8.1)	0	
	SSC	1 (11.1)	7 (77.8)	1 (11.1)	0	
	HSC or Above	1 (6.7)	9 (60.0)	4 (26.7)	1 (6.7)	
Occupation	Student	2 (15.4)	9 (69.2)	1 (7.7)	1(7.7)	**0.29**
	Housewife	11 (23.4)	25 53.2)	11 23.4)	0	
	Service holder	2 (18.2)	8 (72.7)	1 (9.1)	0	
Religion	Islam	9 (19.6)	30 65.2)	7 (15.2)	0	**0.33**
	Others	6 (24.0)	12 48.0)	6 (24.0)	1 (4.0)	
Residence	Urban	4 (18.2)	13 59.1)	5 (22.7)	0	**0.91**
	Rural	11 (22.4)	29 59.2)	8 (16.3)	1 (2.0)	

DISCUSSION

This study identified cervical cancer awareness among women who attend a tertiary hospital in Bangladesh. A prominent finding was that 71.7% of the study participants were aware of cervical cancer, representing a considerable improvement from earlier national surveys that showed awareness to be between 12% and 45.2% among Bangladeshi women [11,12]. This increased awareness is likely most likely an expression of the study population's medical contact and healthcare-seeking behavior, suggesting hospital-based programs could be reasonable channels by which to disseminate information about cervical cancer. The sociodemographic characteristics of respondents offer a women's predominance of the 20–30 years age group (74.7%), as with reproductive health service utilization in Bangladesh. However, the sample also includes a high proportion of rural residents (62.6%) and poorly educated women, with 73.7% having primary education or below. Statistical correlation of education with awareness (p=0.01) validates findings of other developing countries emphasizing education as a key determinant of health knowledge [13]. This point to the need for literacy-sensitive health education programs to address prevailing knowledge differentials. Despite relatively good general awareness, considerable disparities exist in what people know about risk factors for cervical cancer, i.e., the role of human papillomavirus (HPV) infection. Among the aware, as few as 39.4% recognized HPV as a cause, an incredibly low percentage given the virtual ubiquity of HPV's role in cervical carcinogenesis [14]. The trend parallels that observed in low- and middle-income countries where awareness about HPV is also partial. Conversely, such behavioral risk factors as having multiple sexual partners (62.0%) and early sexual initiation (63.4%) were more widely recognized in accordance with the greater emphasis among the public health messages on lifestyle aspects compared to biological determinants. Screening methods of cervical cancer were highly familiar in motivating numbers: 95.8% of respondents who were aware recognized screening in general, while 90.1% named Pap smear testing. The awareness regarding visual inspection with acetic acid (VIA) screening was also 76.1%, reflective of its being the national screening tool in Bangladesh due to cost-effectiveness and feasibility in low-resource settings [15,16]. But despite such awareness, screening uptake is low at the national level, suggesting that awareness does not always result in participation. The most important issue found in this study is the poor knowledge of preventive measures since 69.0% of the participants indicated poor knowledge about this aspect. This deficiency is crucial since prevention is cost-effective relative to treatment at more advanced stages [17]. Awareness of HPV vaccination was not common among 45.1%, and only 35.2% were aware of the importance of early sexual infection treatment. This implies missed opportunities for primary prevention education, though evidence has shown that programs of HPV immunization can reduce the rate of cervical cancer [18]. Treatment option awareness of precancerous cervical lesions

was uneven; greater than half (50.7%) reported low awareness. In this category, however, individuals with good knowledge exhibited relatively high treatment procedure awareness such as electrocautery (71.8%) and loop electrosurgical excision procedure (LEEP) (70.4%). This would suggest that healthcare workers could be effectively educating patients presenting for care regarding treatment modalities, with a focus on patient counseling and education in clinical settings. Social and cultural dynamics probably underlie these awareness patterns. The population was mostly Muslim (65.7%) and mostly housewives (67.7%), representing traditional societal values that could impact women's health decision-making autonomy and information access [19]. Evidence from comparable settings indicates that health education strategies that are culturally appropriate, activating community leaders and using proper communication channels, are vital to enhancing women's health knowledge and behaviors.

These findings have important implications for Bangladesh's progress towards the World Health Organization target of cervical cancer elimination by the year 2030. Achievements in attainment of the target of 70% screening coverage will not only be a function of the accessibility of services but also improved knowledge and favorable attitudes towards screening [20]. The knowledge gaps identified here, especially on HPVs and prevention, are major barriers that must be addressed through combined, contextually effective education interventions. Briefly, augmenting HPV-related education and incorporating cervical cancer awareness into broader maternal and reproductive health care can potentially capitalize on current healthcare contact to enhance prevention. Also, the established relationship between education and awareness implies the potential of adult literacy programs as a means for transmitting health education, especially in rural areas where both education and healthcare access are limited.

Limitations of the study:

This study had a small sample size (n=99) due to limited resources and time, which may affect how well the findings apply to the wider Bangladeshi population. The use of convenient sampling and recruiting from a hospital may have created selection bias, as participants were already engaged with healthcare services and likely more health-conscious than the general population.

CONCLUSION

This study demonstrates that women visiting a tertiary care hospital in Bangladesh have moderate awareness of cervical cancer. However, there are significant gaps in knowledge about HPV infection as a primary risk factor and in preventive measures. Educational qualification is the strongest predictor of awareness levels, stressing the important role of literacy in gaining health knowledge. While awareness of screening methods is encouraging, the lack of understanding of prevention strategies represents a missed opportunity for primary prevention efforts. Targeted educational programs, especially for rural and less-educated women, are crucial to close these knowledge gaps and support Bangladesh's goals for cervical cancer elimination.

RECOMMENDATIONS

Future studies should use larger, community-based representative samples to gain a better understanding of cervical cancer awareness across different groups in Bangladesh. It is necessary to develop and implement educational programs that are culturally relevant, focusing on the identified knowledge gaps, especially in HPV awareness and prevention strategies. Integrating cervical cancer education into existing maternal and reproductive health programs, along with community health education initiatives that involve local leaders and peer educators, should be a priority to maximize reach and impact among underserved populations.

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ORIGINAL ARTICLE

A Comparative Study of Complication Rates of Total Thyroidectomy and Hemithyroidectomy in the Treatment of Papillary Thyroid Carcinoma

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ABSTRACT

Background: *Thyroid carcinoma is the most common endocrine malignancy, and papillary thyroid carcinoma (PTC) is the most common histologic type. Surgery remains the mainstay of therapy, and the two most encountered surgical procedures are total thyroidectomy (TT) and hemithyroidectomy (HT). The choice of surgery is often determined by tumor characteristics, surgeon preference, and institutional practice, each having certain.* ***Objectives:*** *The aim of this study was to assess the complication rates of total thyroidectomy versus Hemithyroidectomy in the treatment of papillary thyroid carcinoma.* ***Methods & Materials:*** *This cross-sectional observational study was conducted in the Department of ENT, Head and Neck Surgery, Anwer Khan Modern Medical College Hospital, Dhaka, Bangladesh from June 2023 to May 2025. Total 120 patients diagnosed with papillary thyroid carcinoma (PTC) were included in this study.* ***Results:*** *The two groups were comparable in baseline demographic and clinical characteristics (p>0.05). The majority of surgeries lasted less than 60 minutes in both groups (70.8%) (p=0.841). Intraoperative hemorrhage occurred in 56.7% of cases, with no statistical difference between TT and HT groups (p=0.711). Postoperatively, pain was the most frequent complication (51.7%), followed by hemorrhage (32.5%). Vocal cord paralysis was significantly higher in the TT group (11.7% vs. 1.7%, p=0.0291), while other complications such as pain, hemorrhage, and voice change showed no significant group differences.* ***Conclusion:*** *Both surgical approaches demonstrated comparable safety profile. However, total thyroidectomy carried a higher risk of vocal cord paralysis. Hemithyroidectomy can therefore be utilized as a safer alternative in well-selected PTC patients.*

Keywords: *Complication Rates, Total Thyroidectomy, Hemithyroidectomy, and Papillary Thyroid Carcinoma.*

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INTRODUCTION

Papillary thyroid carcinoma (PTC) is the most prevalent type of thyroid cancer, accounting for approximately 85–90% of all thyroid cancer cases worldwide.[1] The disease typically follows an indolent course with excellent long-term outcomes, and 10-year survival rates exceeding 95% have been repeatedly shown in large population-based studies.[1,2] Against this favorable oncological background, surgery remains the cornerstone of management, and controversy about the degree of surgery, total thyroidectomy (TT) versus hemithyroidectomy (HT)—has persisted for decades.[3,4]

Over the last decade, international guidelines have moved to accept that less surgery may be appropriate for well-selected patients. The 2015 American Thyroid Association (ATA) guidelines were a paradigm shift as they officially recognized lobectomy or HT as an acceptable definitive treatment for low-risk, intrathyroidal PTCs up to 4 cm.[5] This was corroborated by accumulating observational data demonstrating no survival advantage of TT over HT in this group of patients. Conversely, the National Comprehensive Cancer Network (NCCN) continues to recommend TT in patients with higher risk features such as extrathyroidal extension, nodal or distant metastasis, aggressive histological subtypes, bilateral disease, or a history of previous radiation exposure.[6,7] These risk-stratified strategies have yielded a measurable increase in the

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use of HT worldwide, reflecting a broader trend for de-escalation in surgical oncology.[7]

This de-escalation has created a well-defined risk–benefit trade-off. TT provides pragmatic advantages, including the facility of postoperative radioactive iodine (RAI) ablation and more reliable thyroglobulin-based surveillance.[8] However, excision of the entire gland significantly increases the risk of postoperative complications, most commonly transient hypocalcaemia, which occurs in 20–30% of TT patients, and permanent hypoparathyroidism, which occurs in approximately 1–3%.[9,10] In addition, recurrent laryngeal nerve (RLN) palsy has been reported in 1–5% of cases, permanent injury in less than 1% but consistently more frequent after TT than HT.[11,12] Less frequent complications of postoperative haematoma, infection, and chyle leak have a disproportionate impact on morbidity and can require urgent reoperation.[13,14] In contrast, HT reduces many of these risks by avoiding bilateral gland dissection but at the cost of potentially more complicated surveillance and an increased risk of contralateral recurrence necessitating completion thyroidectomy.[15,16]

Contemporary comparative data showcases these conflicting outcomes. Meta-analyses all demonstrate that HT is associated with significantly fewer complications but with a modestly increased risk of recurrence, particularly contralateral recurrences.[3,15-17] Oncologic equivalence in the long term is contentious, with survival outcomes appearing comparable between methods but recurrence-free survival tending to favour TT, especially in intermediate-risk tumours.[1,18] Importantly, these comparisons are constrained by significant heterogeneity in complication definitions, patient selection criteria, and surgical experience among studies, precluding direct comparison.[7,16] The recent meta-analyses' methodological shortcomings also underline the need for robust, standardised comparison studies.[16]

Taken together, this evolving body of evidence emphasizes the urgent requirement for contemporary, carefully designed comparative analyses to guide surgical decision-making in PTC. The present study aims to evaluate and compare the complication profiles of total thyroidectomy and hemithyroidectomy in the treatment of papillary thyroid carcinoma.

OBJECTIVES

To assess the complication rates of total thyroidectomy versus Hemithyroidectomy in the treatment of papillary thyroid carcinoma.

METHODS & MATERIALS

This cross-sectional observational study was conducted in the Department of ENT, Head and Neck Surgery, Anwer Khan Modern Medical College Hospital, Dhaka, Bangladesh, over a two-year period from June 2023 to May 2025. Total 120 patients diagnosed with papillary thyroid carcinoma (PTC) were included in this study. All patients were evaluated through detailed history-taking, clinical examination, imaging, and fine-needle aspiration cytology (FNAC) to confirm the diagnosis and assess disease extent. The study patients were divided into two groups, each containing 60 participants, based on the extent of surgery: those who underwent total thyroidectomy (TT) and those who underwent hemithyroidectomy (HT). The choice of surgical procedure was made in accordance with established American Thyroid Association (ATA) and National Comprehensive Cancer Network (NCCN) guidelines, as well as patient preference and intraoperative findings. Central or lateral neck dissections were performed in patients with clinically or radiologically evident nodal metastasis. All surgeries were carried out by experienced head and neck surgeons using standardized operative techniques. Intraoperative details, including operative time, estimated blood loss, use of intraoperative nerve monitoring, and parathyroid gland identification or auto-transplantation, were recorded. Postoperative monitoring included serial assessment of serum calcium and parathyroid hormone levels at 6, 24, and 48 hours, along with laryngoscopic evaluation of vocal cord mobility to detect recurrent laryngeal nerve (RLN) injury. Patients were followed during their hospital stay and subsequently at 1, 3, 6, and 12 months postoperatively, with further follow-up as clinically indicated. The primary outcomes assessed were the incidence of postoperative complications, including temporary and permanent hypocalcemia/hypoparathyroidism, temporary and permanent RLN palsy, postoperative hematoma, surgical site infection, and chyle leak. Temporary hypocalcemia was defined as symptomatic or biochemical hypocalcemia requiring supplementation that resolved within six months, whereas permanent hypoparathyroidism was defined as persistent hypocalcemia requiring supplementation beyond six months. Similarly, temporary RLN palsy was defined as postoperative vocal cord dysfunction resolving within six months, while permanent palsy was defined as persistence beyond this period. Secondary outcomes included need for reoperation, 30-day readmission, and recurrence during the study period. Data were collected using a structured case record form and entered into a secured database. Comparative analysis between the TT and HT groups was performed using the chi-square test. A p-value of <0.05 was considered statistically significant. Statistical analysis was performed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Ethical approval for the study was obtained from the Institutional Review Board of Anwer Khan Modern Medical College Hospital. Written informed consent was obtained from all participants prior to enrolment.

RESULTS

Table I shows the demographic characteristics of the study population comprising 120 patients, equally divided into the total thyroidectomy (TT) group (n=60) and the hemithyroidectomy (HT) group (n=60). The age distribution revealed that the majority of patients were within 41–60 years (54.2%), followed by 21–40 years (39.2%), while only 6.7% were aged 0–20 years. The mean age distribution was comparable between the two groups, with no significant difference (p=0.991). Female patients predominated overall, accounting for 65% of the study population, compared to 35% males, with a similar distribution across both groups

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(p=0.698). Regarding occupation, 38.3% of participants were employed, 35.8% were housewives, and 25.8% were students, with no statistically significant difference between the TT and HT groups (p=0.923). Thus, the two study groups were well-matched in terms of baseline demographic characteristics.

Figure 1 illustrates the distribution of blood groups across the study population, showing that the most common blood group was B-positive, observed in 40.8% of patients, with a slightly higher prevalence in the hemithyroidectomy (HT) group (43.3%) compared to the total thyroidectomy (TT) group (38.3%). O-positive blood group accounted for 35.0% of the study population, distributed nearly equally between the TT group (36.7%) and the HT group (33.3%). A-positive blood group was the least common, present in 24.2% of cases, with similar proportions in both TT (25.0%) and HT (23.3%) groups. Statistical analysis showed no significant difference in blood group distribution between the two groups (p=0.801), indicating comparability with respect to this baseline characteristic.

Table II presents intra-operative outcomes. The duration of surgery was less than 60 minutes in the majority of cases (70.8%), with 71.7% in the HT group and 70.0% in the TT group, while the remaining cases lasted 60–80 minutes. The difference in operative duration between the two groups was not statistically significant (p=0.841). Intra-operative hemorrhage was the most frequent complication, observed in 56.7% of cases, affecting 58.3% of TT patients and 55.0% of HT patients, again showing no significant difference between groups (p=0.711).

Table III highlights the post-operative complications encountered. Pain was the most common complication, affecting 51.7% of patients, and was more frequent in the HT group (60%) compared to the TT group (43.3%), though this difference did not reach statistical significance (p=0.0683). Hemorrhage occurred in 32.5% of cases, nearly equally distributed between TT (33.3%) and HT (31.7%) groups (p=0.8522). Vocal cord paralysis was identified in 6.7% of patients, with a significantly higher incidence in the TT group (11.7%) compared to the HT group (1.7%) (p=0.0291). Voice change was reported in 9.2% of cases, with a slightly higher proportion in the TT group (11.7%) compared to HT (6.7%), but the difference was not statistically significant (p=0.3454).

Table – I: Demographic characteristics of the study groups (N=120)

Characteristics	Total thyroidectomy group (n=60)	Hemithyroidectomy group (n=60)	Total (N=120)	P-value
Age group (years)				
0–20	4 (6.7%)	4 (6.7%)	8 (6.7%)	0.991
21–40	23 (38.3%)	24 (40.0%)	47 (39.2%)	
41–60	33 (55.0%)	32 (53.3%)	65 (54.2%)	
Sex				
Male	22 (36.7%)	20 (33.3%)	42 (35.0%)	0.698
Female	38 (63.3%)	40 (66.7%)	78 (65.0%)	
Occupation				
Student	16 (26.7%)	15 (25.0%)	31 (25.8%)	0.923
Housewife	21 (35.0%)	22 (36.7%)	43 (35.8%)	
Job	23 (38.3%)	23 (38.3%)	46 (38.3%)	

P-value calculated using chi-square test

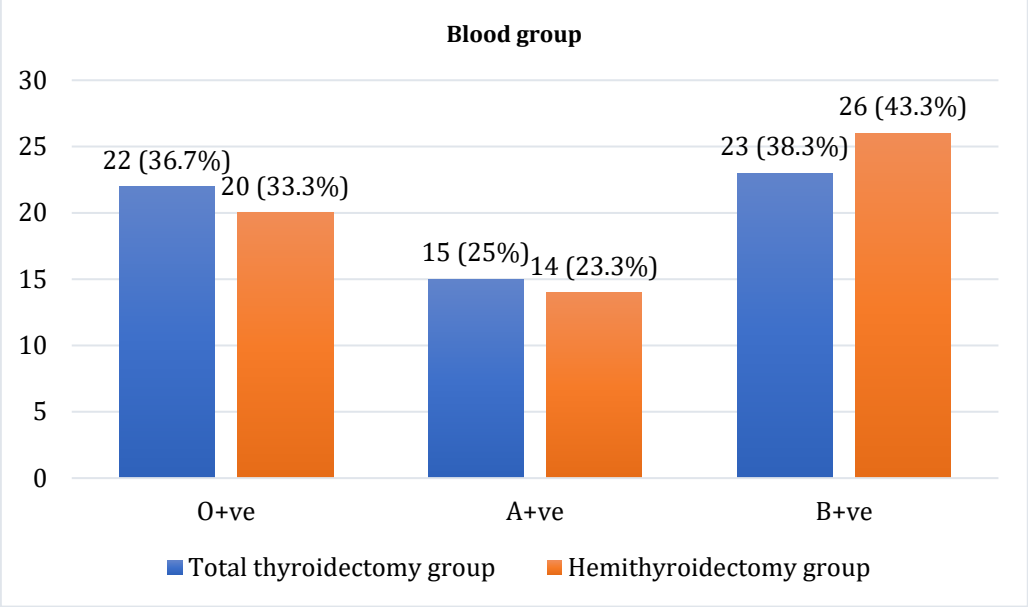

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Figure – 1: Blood group distribution between the study groups (*n*=120)

Table – II: Comparison of intra-operative outcome between the study groups (*n*=120)

Intra-operative outcome	Total thyroidectomy group (n=60)	Hemithyroidectomy group (n=60)	Total (N=120)	P-value
Duration				
0–60 min	42 (70.0%)	43 (71.7%)	85 (70.8%)	0.841
60–80 min	18 (30.0%)	17 (28.3%)	35 (29.2%)	
Complication				
Hemorrhage	35 (58.3%)	33 (55.0%)	68 (56.7%)	0.711

P-value calculated using chi-square test

Table – III: Comparison of post-operative complications between the study groups (*n*=120)

Complications	Total thyroidectomy group (n=60)	Hemithyroidectomy group (n=60)	Total (N=120)	P-value
Pain	26 (43.3%)	36 (60%)	62 (51.7%)	0.068
Hemorrhage	20 (33.3%)	19 (31.7%)	39 (32.5%)	0.852
Vocal cord paralysis	7 (11.7%)	1 (1.7%)	8 (6.7%)	0.029*
Voice change	7 (11.7%)	4 (6.7%)	11 (9.2%)	0.345

P-value calculated using chi-square test
**= significant*

DISCUSSION

This study contrasted complication profiles for hemithyroidectomy (HT) and total thyroidectomy (TT) in papillary thyroid carcinoma (PTC) patients, with regard to demographic similarity, intraoperative results, and postoperative complications. Our demographic profile showed that the majority of the patients were middle-aged, particularly in the 41–60 years group, consistent with prevailing epidemiological data suggesting PTC is most prevalent among women and usually diagnosed between the third and sixth decades of life.[19] This female predominance (65%) in our cohort is also consistent with international reports in which women are disproportionately represented, a trend explained by both hormonal and genetic susceptibility.[20] Notably, the lack of any large demographic differences between TT and HT groups supports the value of ensuing comparisons in surgical and complication outcomes.

Blood group distribution in the current study showed B-positive to be most prevalent, followed by O-positive and A-positive. Although no statistically significant variations were noted between TT and HT groups, the result has been in accordance with regional data showing variable distribution of ABO blood groups in populations of thyroid carcinomas. However, the absence of certain biologic relationship between thyroid surgical outcome and blood type diminishes the interpretive importance of this result, but it contributes to the characterization of the patient population.

Intraoperative outcomes indicated that the majority of operations were completed within 60 minutes, and operating time was not meaningfully different for TT and HT. This finding is in agreement with data indicating that operative duration is more related to intraoperative anatomy and surgeon skill than to extent of surgery alone.[21] Intraoperative bleeding was observed in more than half of patients, again with no noteworthy group differences. Although in the study of Dralle et al.[22], postoperative hemorrhage ranged from 0.3% to 4.2%, our experience may reflect the accumulation of small intraoperative bleeding incidents not always included as complications elsewhere. Because the thyroid is so very vascular, this finding places emphasis on the attention to detail in hemostatic technique regardless of size of operation.

Postoperative complication was the middle comparative component of this research. The most frequent postoperative symptom was pain in 51.7% of the patients, with a tendency toward higher frequency in HT, but not significantly statistical. This contrasts with the study of Pagliaro et al.[23] that reported higher pain with more prolonged neck hyperextension in TT, but agrees with findings of Lang et al.[24] that surgical position and subjective pain perception can cause postoperative discomfort. Hemorrhage was recorded in about one-third of the patients, equally distributed between TT and HT, a finding that the level of resection does not in itself signify risk of bleeding, in line with reviews placing thyroid vascularity and intraoperative factors above surgery extent.[25]

Of particular note, vocal cord paralysis was also significantly more frequent in TT (11.7%) compared to HT (1.7%). This finding is clinically relevant since RLN injury is a recognized complication, with the study of Han et al.[26], reporting temporary paralysis rates in the order of 3–4% and permanent paralysis less than 1%. Our incidences are greater than many contemporary series, possibly due to the greater anatomical dissection and bilateral exposure of the nerve inherent to TT. Similarly, in the study of Lee et al.[27], voice change was found in 9.2% of all patients, moderate compared to evidence that 87% of all patients report subjective voice trouble following thyroidectomy independent of nerve damage. These differences may result from heterogeneity of patient-reported outcomes, surgeon preference, and perioperative care.

Overall, our findings confirm the growing literature that while TT allows for adjuvant treatment and oncological follow-up, it

subjects the patient to more complications, specifically RLN injury, compared to HT. Conversely, HT offers lower complication rates but could adversely affect follow-up and treatment in high-risk patients.

CONCLUSION

This study concludes that both total thyroidectomy and hemithyroidectomy are effective surgical options for managing papillary thyroid carcinoma, with comparable demographic distribution, operative duration, and general complication rates. However, total thyroidectomy was associated with a significantly higher incidence of vocal cord paralysis, underscoring its greater risk profile. In contrast, hemithyroidectomy offered a safer alternative with fewer major complications. Careful patient selection and individualized surgical planning remain essential to optimize outcomes and minimize postoperative morbidity in thyroid carcinoma management.

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ORIGINAL ARTICLE

Discovering the missense variant allele in rs7041 of GC gene among individuals with low serum vitamin D

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ABSTRACT

Background: *Vitamin D deficiency is a global health concern affecting more than a billion people and is increasingly recognized in tropical countries like Bangladesh despite adequate sunlight. Genetic variations, particularly in the Group-specific component (GC) gene encoding vitamin D binding protein (DBP), may influence serum vitamin D levels. The present study aimed to investigate the association of rs7041 polymorphism of the GC gene with serum vitamin D status among healthy Bangladeshi adults.* ***Methods:*** *This cross-sectional study was conducted at the Department of Physiology, Dhaka Medical College, from July 2019 to June 2020. A total of 59 healthy adults were screened for serum vitamin D, of whom 32 with low levels (<30 ng/ml) were included as the study population and 10 with normal levels as controls. Socio-demographic, anthropometric, and biochemical data were collected. Genotyping of rs7041 of the GC gene was performed at the Center for Medical Biotechnology (CMBT), Mohakhali, using PCR, agarose gel electrophoresis, purification, and sequencing. Statistical analysis was carried out with chi-square testing, with p<0.05 considered significant.* ***Results:*** *The mean serum vitamin D level of the study population was 18.91 ± 4.86 ng/ml compared to 49.23±16.29 ng/ml in controls. The allele frequency distribution of rs7041 among the study population revealed major allele T (59.4%) and minor allele G (40.6%) with a minor allele frequency of 0.406. In controls, allele T was 45% and allele G was 55%. The chi-square test showed no statistically significant difference in allele distribution between study and control groups (p=0.258). However, low serum vitamin D was observed more frequently in carriers of the T allele.* ***Conclusions:*** *The findings suggest a possible association of the rs7041 T allele of the GC gene with low serum vitamin D levels in Bangladeshi adults, despite adequate sun exposure. This highlights the importance of genetic determinants in vitamin D status and suggests the need for further large-scale studies to better define population-specific reference ranges and risk groups.*

Keywords: *Vitamin D deficiency, GC gene, rs7041 polymorphism, Vitamin D binding protein, Bangladesh, Genetic association*

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INTRODUCTION

Vitamin D deficiency is a global public health issue affecting more than one billion people worldwide. Deficiency of vitamin D leads to a wide range of complications like osteoporosis, fractures, childhood rickets, osteomalacia, cardiovascular diseases, obesity, diabetes mellitus, asthma, multiple sclerosis and even certain types of carcinomas. Researchers are considering it to be a potential risk factor for impaired immunity as well. Finding the cause is no less important than treating this upcoming pandemic.[1,2,3] Vitamin D acts as a hormone concerned with calcium homeostasis, bone metabolism, body growth and development. It increases the intestinal absorption of calcium and phosphate and boosts up the immune system. Being fat-soluble and hydrophobic, it cannot circulate freely in blood. So, vitamin D is transported within the blood, bound to a carrier protein called vitamin D binding protein or DBP. Vitamin D binding protein exerts its highest affinity for serum levels of 25-hydroxyvitamin D or 25(OH) D. Due to the rigid binding affinity and high plasma concentration (0.3 to 0.5 mg/ml) of all 25(OH) D in the circulation is combined with vitamin D binding protein. DBP also is complexed to megalin protein to limit the excretion of 25(OH) D through proximal convoluted tubule in the kidneys.[3,4,5] The richest source of vitamin D is sunlight exposure. When the sun light containing UVB falls on skin the pre-vitamin D3 is activated. After activation in the skin,

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vitamin D is carried in the blood to the liver by a circulating protein called vitamin D binding protein (DBP).[6] Vitamin D Binding protein (DBP) binds to ergocalciferol (vitamin D2), cholecalciferol (vitamin D3), 25-hydroxylated form (calcifediol) and the active product 1,25-dihydroxyvitamin D (calcitriol). It transports vitamin D between skin, liver and kidney and then on target tissues.[7] It is the primary carrier protein for vitamin D. It binds to 85% to 90% of the total circulating 25-hydroxyvitamin D. The rest is non-vitamin D-binding protein fraction (bioavailable 25- hydroxyvitamin D), around 10% to 15% which binds to albumin, and less than 1% 25-hydroxyvitamin D remain in the free form. Some of the actions of vitamin D might be inhibited by vitamin D binding protein as the bound form is not available to act on the target cell.[8] Vitamin D binding protein (DBP) is decreased in sepsis, cutaneous malignant melanoma, hepatocellular carcinoma, primary non-metastatic breast cancer.[9,10,11,12] Hypovitaminosis D is an alarming problem affecting all continents, ethnicities, and age groups. Apart from different cultural behavior, latitude and sun exposure, skin pigmentation, clothing, sunscreen use and nutritional gain, the genetic traits are important contributing factors for the low vitamin D status of healthy individuals.[13,14] The dietary source serves very little in comparison to the cutaneous synthesis for maintenance of a sufficient vitamin D level in the circulation.[15] The best indicator of vitamin D status is the serum 25-hydroxyvitamin D or 25 (OH) D. The serum 25(OH) D has a 1000 fold greater circulating level than 1, 25 (OH) D. It has a half- life of 3-4 weeks whereas 1, 25 (OH) D has 3-4 hours. The concentration of serum 25(OH) D in blood reflects the endogenous generation via UVB exposure. Genetic variation exerts a great impact on the circulating 25(OH) D levels. It is important to identify the people at risk to develop hypovitaminosis D. This will eventually help to expand our knowledge about the association between vitamin D and the diseases related to this condition[2,17] Bangladesh being a tropical country receives a good source of sunlight round the year. Despite abundant sun exposure, different studies have revealed the evidence of low serum vitamin D status among different age groups, gender, occupation, and several disease conditions.[18,19,20] In Bangladesh a laboratory investigation-based study revealed that, out of 793 vitamin D reports 61.4% are deficient, 24.1% are insufficient and 13.1% are sufficient[21].

METHODS & MATERIALS

Study Procedure & Study design:

It was a cross-sectional type of study conducted at the Department of Physiology, Dhaka Medical College, Dhaka, Bangladesh, from July 2019 to June 2020, in this study, a total of 59 apparently healthy adults participated from different areas of Dhaka city. Among them, 32 subjects with low serum vitamin D were enrolled as study population (N=32). From the rest of the subjects with normal serum vitamin D 10 subjects were enrolled as control for comparison. Healthy Bangladeshi adults were the study population. Data were collected with face-to-face interviews. A semi-structured questionnaire was developed to collect data according to the objectives of the study. After explaining the purpose of the study, written and verbal consent was obtained from the respondents.

Among the study population, the age range was 18-53 years, 26 were males and 6 were females and with a Body Mass Index (BMI) range 18.62–24.90 kg/m^2 were included. All of them belonged to middle class socioeconomic background and from different occupations such as outdoor players, health workers and traffic police. The duration of sun exposure was 2-9 hours. Other biochemical parameters like, serum calcium, serum albumin, serum creatinine, fasting blood sugar, prothrombin time were done to fulfill the sample size according to inclusion and exclusion criteria. Individuals with a use of sunscreen and umbrella, veiled women and people with any supplements were excluded. Same criteria were taken for the control group also.

Blood sample collection & Biochemical tests:

Collection of blood samples was done until accomplishment of the sample size. A total number of 59 blood samples were collected. Among them 32 samples were found to have low serum vitamin D and considered as study population (N=32). Rest of the subjects had normal serum vitamin D. Among them, 10 samples with normal serum vitamin D were selected as controls for comparison.

Genetic study:

Genetic study involves very sensitive and delicate procedures. The whole procedure was performed in Center for Medical Biotechnology (CMBT), Mohakhali, Dhaka. Genotyping of target region of GC gene rs7041 was done into following steps: Primer designing and Validation, DNA Extraction and Quantification, PCR (Polymerase Chain Reaction), Agarose Gel Electrophoresis, PCR Purification and Sequencing.

RESULTS

Table 1 shows the sociodemographic and physiological characteristics of both groups. Age ranged 18–53 years (mean 30.91±11.31) in the study group and 20–48 years (mean 32.90±7.89) in controls. Mean BMI was 20.94±1.94 kg/m^2 in the study group versus 22.89±1.63 kg/m^2 in controls. Systolic BP ranged 100–120 mmHg (mean 113.28±6.91) in the study group and 110.00±8.16 in controls; diastolic BP ranged 60–85 mmHg and 60–80 mmHg, respectively. Serum calcium levels were within the normal range, with mean values showing no remarkable variation. Similarly, serum albumin, serum creatinine, fasting blood sugar, and prothrombin time were all recorded within normal limits across the participants, confirming that no metabolic or renal dysfunction influenced the study outcome (Table 2). Table 3 summarizes the molecular and genomic features of the rs7041 single nucleotide variation (SNV) in the GC gene. The variation occurs in *Homo sapiens* at chromosomal position chr4:71752617 (GRCh38.p12), with alleles A>G>T, and represents a missense variant affecting the GC gene. The gene is located on chromosome 4 at cytogenetic band 4q13.3, with a variant length of 1 base pair. Additional identifiers include Gene ID 2638 and Allele ID 31026, as referenced in GRCh38 and UCSC genome assemblies. In the study population, the T

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allele (59.4%) was more common than G (40.6%), while in the control group, the G allele (55%) was more frequent than T (45%). The chi-square test revealed a value of 5.7828 with a p-value of 0.016, suggesting significant deviation from Hardy-Weinberg equilibrium (Table 4). In the proportion of T and G alleles among the study group, T allele predominated with 61.00% compared to G at 39.00% (Figure 1). Figure 2 demonstrated the distribution of alleles among controls, showing G allele predominance (55%) compared to T allele (45%). Table 5 presented the distribution of rs7041 alleles (T and G) among individuals with low serum vitamin D levels (study population, N=32, total alleles n×2=64) and healthy controls with normal serum vitamin D levels (Nc=10, total alleles Nc×2=20). In the study population, the T allele was observed in 38 alleles (59.4%) and the G allele in 26 alleles (40.6%). Among controls, the T and G alleles were observed in 9 (45%) and 11 (55%) alleles, respectively. This bar graph illustrated the number of T and G alleles of the GC gene among individuals with low serum vitamin D levels (study population, N=32) and healthy controls with normal serum vitamin D levels (Nc=10). The study population shows 38 T alleles and 26 G alleles, while controls show 9 T alleles and 11 G alleles (Figure 3).

Table – I: Socio-demographic characteristics of study population and controls

Parameters	Study population (N=32)	Controls (Nc=10)
Age (in years)	18-53	20-48
Gender:		
Male	26 (81.3%)	05 (50%)
Female	06 (18.8%)	05 (50%)
BMI (Kg/m^2)	18.62-24.90	20.55-24.65
Systolic Blood Pressure (in mmHg)	100-120	100-120
Diastolic Blood Pressure (in mmHg)	60-85	60-80
Occupation:		
Outdoor Players	14 (43.8%)	03 (30%)
Health Workers	06 (18.8%)	03 (30%)
Traffic Police	12 (37.5%)	04 (40%)
Duration of sun exposure (in hours)	2-9	2-5
Skin complexion (Light brown)	32 (100%)	10 (100%)
Socio-economic status Middle Class)	32 (100%)	10 (100%)

Table – II: Biochemical parameters of the study population (*n*=32) and controls (*n*=10)

Parameter	Study population (N=32)	Controls (Nc=10)
Serum vitamin D (ng/ml)	12.45-29.03	32.03-78.19
Serum Calcium (mg/dl)	08.58-10.00	08.56-9.91
Serum Albumin (gm/dl)	03.51-05.02	03.77-5.00
Fasting blood glucose (mmol/L)	03.98-06.01	03.89-5.55
Serum Creatinine (mg/dl)	0.41-01.21	0.67-0.98
Prothrombin time (seconds)	11-15	11-14

Table – III: General characteristics of rs7041 of GC gene

Organism	Position	Alleles	Variation Type	Gene Consequence
Homo sapiens	chr4:71752617 (GRCh38.p12)	A>G>T	SNV (Single Nucleotide variation)	GC Missense Variant
Gene ID	**Allele ID**	**Variant length[b]**	**Cytogenetic location[a]**	**Genomic location**
2638	31026	1 bp	4q13.3	4:71752617 (GRCh38) GRCh38 UCSC

[a] *SNP identifier based on NCBI dbSNP.*

[b] *Chromosomal location based on NCBI Human Genome Build 35 coordinates.*

Table – IV: Alleles frequency among study population (*n*=32)

Alleles (NA=N×2=64)	Frequency	Percentages
Major Allele: T (38)	0.595	59.4%
Minor Allele: G (26)	0.405	40.6%
Alleles (NcA=Nc×2=20)		
Major Allele: T (09)	0.45	45%
Minor Allele: G (11)	0.55	55%

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Minor Allele Frequency (MAF)	0.406
Hardy Weinberg Equilibrium (HWE)	
chi- squared value	5.7828
chi-squared test p-value	0.016184

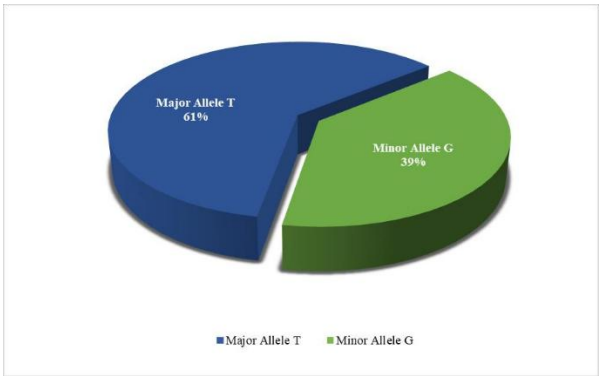

Figure – 1: Distribution of the major and minor alleles of rs7041 of GC gene among the study population (*n*=32)

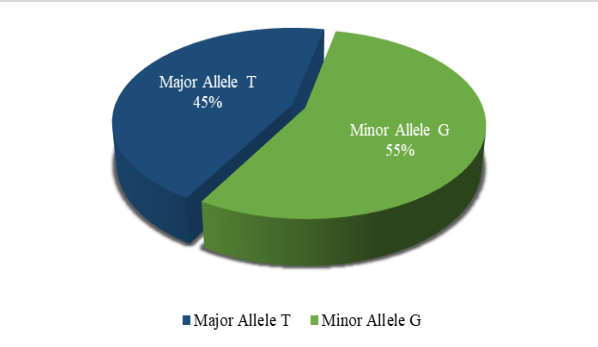

Figure – 2: Distribution of the major and minor alleles of rs7041 of GC gene among the control (NC=10)

Table – V: Comparison of alleles among the study population (*n*=32) and control (NC=10).

Serum vitamin D	Alleles		p- value
Study population with	**T (NT=47)**	**G (NG=37)**	
low serum vitamin D	38	26	0.258^{ns}
(n×2=64)	(59.4%)	(40.6%)	
Controls with normal	09	11	
serum vitamin D (N_c×2=20)	(45%)	(55%)	

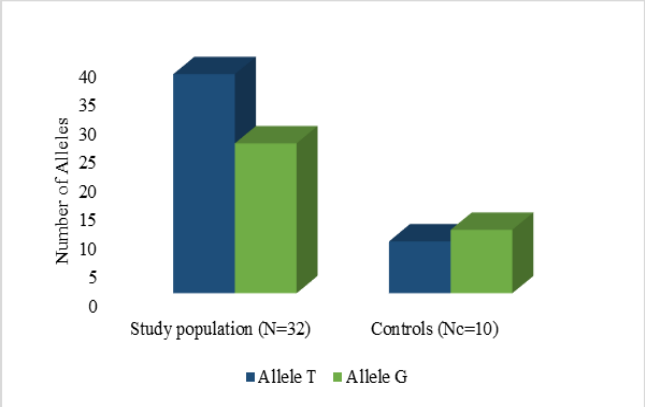

Figure – 3: Distribution of alleles among study population (*n*=32) and controls (Nc=10)

DISCUSSION

The present study was undertaken to observe the relationship between variants in rs7041 of Group specific component (GC) gene with low serum vitamin D level among Bangladeshi adults. For this cross-sectional study, a total number of 32 adults with low serum vitamin D level and 10 adults with normal serum vitamin D level were enlisted on the basis of inclusion and exclusion criteria. The genotype of rs7041 of Group specific component (GC) gene was the study parameter. A total number of 59 individuals were investigated for serum vitamin D. Finally, a number of 32 two subjects were found to have low serum vitamin D and enrolled as the study population (N=32). Their age ranged from 18-53 years. The Body Mass Index (BMI) ranged from 18.62-24.90 kg/m2. Among them, 26 were males and 06 were females. All belonged to middle class socioeconomic background and from different occupations like outdoor players 14 (43.8%), community health workers 6 (18.8%) and traffic police 12 (37.5%) who were adequately exposed to sunlight. The duration of sun exposure ranged from 2-9 hours with a mean (± SD) of 6.5 ±1.85 hours. Among the controls, age ranged from 20-48 years with a mean (± SD) age of 32.90 ± 7.89 years. There were 5 males and 5 females. The Body Mass Index (BMI) of the controls ranged from 20.55–24.65 kg/m^2 with mean (± SD) of 22.89 ± 1.63 kg/m^2. All of them belonged to middle class socioeconomic background and from different occupations like 3 outdoor players, 4 health workers and 3 traffic police.

In this study, out of all (NT=59), 32 subjects with a serum vitamin D level below 30 ng/ml (54%) were included as study population (N=32). The serum vitamin D of the study population (N=32) ranged from 12.45-29.03 ng/ml with mean (± SD) of 18.91± 4.86 ng/ml. The mean serum vitamin D of the controls were 49.23 ± 16.29 ng/ml and ranged from 32.03-78.19 ng/ml.[22] Prevalence of low serum vitamin D of other studies are similar to this study (55.6%). This percentage was higher among Jordanians.[23,24,25] Jordan and Pakistan are countries with adequate sun exposure, but the effect of clothing style of the people covering nearly the whole body and unavailability of food fortification with vitamin D might be factors contributing to the high prevalence of vitamin D deficiency.

The current study was concerned with assessment of the genotype of a single nucleotide variant (SNV) of Group specific component (GC) gene with the reference sequence accession number rs7041. Out of total 64 allele 'T' was the major allele with a total number of 38 (59.4%) and 'G' was the minor allele with a total number of 26 (40.6%). The minor allelic frequency (MAF) was found to be 0.406. So, 40% of the population has G allele versus the most common allele or major allele T, which was 60% of the population. The Hardy Weinberg formula Chi squared test p value was 0.016. The major allele was T, found in 09 subjects (45%) and the minor allele was G, found in 11 subjects (55%). A comparative study was performed between the distribution of alleles among the study population and controls were not statistically significant.

The observations of this study were analogous to other researchers round the world.[22] A significant association between low serum vitamin D status of heathy subjects with heterozygous and homozygous genotypes containing nonsynonymous polymorphism rs7041 carrying variant allele T among Jordanians.[25] The geographical location, latitude, ethnicity, food habit, cultural and religious behaviour, clothing style of Bangladeshi population are similar to the people of South Asian population as well as to some extent to the countries of Middle East like Jordan. Therefore, these might be potential causal factors for sharing similar pattern of genotypic variants among the population of Bangladesh, rest of South Asian and Middle East countries.

The presence of allele G might contribute to the normal function of vitamin D binding protein (DBP) thus leading to a normal serum vitamin D level.[26]

This study reports an association of low serum vitamin D with genotype TG and TT carrying major allele T which exists in a larger proportion (60%) among the population. Similarly, significant associations between T allele in rs7041 and low serum vitamin D has been reported in several studies around the world. The T allele was associated with low serum vitamin D.[27] Similar results were reported in studies conducted among Americans,[28,29,30,31] Brazilians, Chinese Singaporean and Chinese pregnant women. A study performed among black and white Americans has also found the association of T allele with low serum vitamin D.[32] Genome wide association studies (GWAS) conducted on different ethnicities and races have also exhibited strong associations between rs7041 GC gene and low serum vitamin D level in Finnish population[33] and a large population from European ancestry in five different cohorts.[34]

The possible mechanism to explain the effect of variants in the single nucleotide variant (SNV) rs7041 in exon 11 of Group specific component (GC) gene is suggested by many researchers round the world. The single nucleotide variant (SNV) occurs due to substitution of a single nucleotide T in the genetic codon 416, resulting in production of an amino acid glutamic acid that is different from the usual amino acid aspartic acid at that position. This substitution does not result into any pathogenic variant that is it does not produce any disease, rather might refer to evolution of a variant allele from the ancestral allele and exhibits variation in the same SNV among different ethnicities and population.[29,35,34,4]

The relationship of low levels of serum vitamin D among Bangladeshi adults with the SNV rs7041 Group specific component gene can likely be explained by the functional alteration of the binding protein encoded by this variant SNV rs7041 due to variation with the presence of major allele T. This leads to either decreased synthesis or faulty function of vitamin D binding protein (DBP), ultimately forming functionally lower concentrations or a decreased binding capacity of vitamin D binding protein (DBP) in serum. This might lead to a low count of serum vitamin D.

On the contrary, a Genome Wide Association study (GWAS) conducted among five different cohorts from European ancestry including 4051 individuals did not find any significant association with rs7041 and low vitamin D

status[17]. Difference in ethnicity, race, latitude, sociodemographic factors, variations in methodology of different studies contribute to the dissimilarity also could not show significant association of low serum vitamin D with rs7041 of Group specific component gene.[36]

The circulating vitamin D level is affected by various environmental and behavioural factors which were avoided during setting up the exclusion and inclusion criteria in this study. For example, a minimum of 45 min exposure to sunlight, a healthy diet and nutritional factors were ensured, clothing style like hijab wearer and veiled participants were excluded, sunscreen and umbrella users were not included in this study, individuals with vitamin D supplementation were excluded. It was a strength of this study that all these contributing factors were taken care of which might had influenced the natural synthetic pathway of serum vitamin D. This ensured avoidance of any interruption in vitamin D synthesis other than genetic conformation of the population. The current study included apparently heathy Bangladeshi population with the increased prevalence of low serum vitamin D status and the genotype evaluation exhibited observations different from other races and ethnicities. This might be an effect of natural adaptive changes from ancestral genetic configuration which ensures better survival from various environmental stress factors.

LIMITATIONS

1) The allele and genotype analysis of other variant single nucleotide polymorphisms on the same Group specific component gene could have helped to obtain more detailed knowledge to the etiology of low-level vitamin D of Bangladeshi people, which was not possible due to financial constraints.

2) The sample size was small. Due to financial constraints the study could not include a large number of populations.

CONCLUSIONS

The present study has reported presence of a single nucleotide variant allele T at rs7041 of Group specific component (GC) gene with low serum vitamin D level among Bangladeshi adults which might be a determining factor for low serum vitamin D level of Bangladeshi population. Therefore, it might be important to consider the impact of Group specific component gene in respect of redefining the reference range of serum vitamin D level in adults of Bangladesh.

DECLARATIONS

Funding: *No funding sources*

Conflict of interest: *None declared*

Ethical approval: *The study was approved by the Institutional Ethics Committee.*

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ORIGINAL ARTICLE

Association of Serum Uric Acid with the Degree of Severity and Prognostic Outcomes in Patients with Acute Exacerbation of COPD

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ABSTRACT

Background: *Serum uric acid levels rise in response to systemic infections and hypoxic states. Given this, an association between elevated uric acid and COPD has been established, leading to the hypothesis that it may serve as a prognostic predictor for outcomes in Acute Exacerbations of COPD (AECOPD).* ***Objective:*** *To determine the association of serum uric acid with the degree of severity and prognostic outcome in patients with AECOPD.* ***Methods:*** *This one-year observational analytic study was conducted at the National Institute of Diseases of the Chest and Hospital (NIDCH) from July 2019 to June 2020. After screening, 96 AECOPD patients were enrolled based on inclusion/exclusion criteria. Following informed consent, all participants underwent a physical examination, relevant investigations, and a severity assessment using the GOLD criteria. Serum uric acid levels were measured. Ethical and health standards were strictly maintained, and data were analyzed using SPSS version 20.* ***Results:*** *The mean ages of Groups A and B were comparable (54.42±8.14 vs. 55.94±8.9 years; p>0.05), as were other socio-demographic profiles. Uric acid was significantly higher in Group B (8.42±1.02 vs. 5.7±0.77 mg/dl). Levels increased with GOLD stage severity (P < 0.001). Hyperuricemia was significantly associated with longer hospital stays, more ICU referrals, and a 10.42% mortality rate in AECOPD patients (p<0.05 for all).* ***Conclusion:*** *Elevated serum uric acid is a significant biomarker for predicting both disease severity and short-term outcomes in patients experiencing an Acute Exacerbation of COPD (AECOPD).*

Keywords: *Acute exacerbation, Biomarker, COPD, Hyperuricemia, Prognostic outcome, Serum uric acid, Spirometry*

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INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is one of the leading causes of morbidity and mortality with increasing prevalence worldwide. An acute exacerbation of COPD (AECOPD) is characterized by a significant change in symptoms that is acute in onset and may warrant a change in regular medication. [1] COPD encompasses chronic bronchitis and emphysema and is characterized by airflow limitation, breathing difficulty, coughing, and other symptoms/signs. It has high morbidity and mortality rates and is the third leading cause of death in developed countries. [2] COPD is still a smoking-related disorder and one of the most common causes of death. Although COPD mainly affects persons in the age group of 40–50 years, the pathogenesis of this disease can begin in early life and result in early death. There are several risk factors associated with COPD in later life, such as smoking, diabetes, and vitamin D deficiency. According to the World Health Organization (WHO), 64 million people were estimated to have moderate to severe COPD, and more than 3 million or 5% of deaths in 2005 were attributed to COPD worldwide. Almost 90% of COPD deaths occur in low- and middle-income countries. [3] Generally, COPD has a poor prognosis. Several studies have been done to determine the prognostic factors that can assist in various areas, such as grading the severity of COPD, further management, predicting lung function decline, clinical practice for educating patients, and providing patients with realistic expectations. Decreased forced expiratory volume in one second (FEV1) is a well-established prognostic factor along with variables such as smoking, low body mass index (BMI), exercise capacity, male gender, and comorbid

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diseases, especially heart failure. The BODE index (Body mass index, airflow Obstruction, Dyspnoea, and Exercise) was developed specifically for COPD patients to evaluate mortality and hospitalization risk. [4] Serum uric acid is the final product of purine degradation, which increases significantly during hypoxia. Elevated serum uric acid levels have been associated with the presence of systemic inflammation and increased cardiovascular risk. In this context, increased levels of serum uric acid have been shown in respiratory disorders, including obstructive sleep apnea and pulmonary hypertension. In COPD, cigarette smoke induces oxidative stress and lung inflammation, resulting in lung tissue damage and decline of pulmonary function. Impairment of pulmonary function reduces oxygen intake, resulting in tissue hypoxia, which is more prominent during AECOPD. [4] UA is one of the main non-enzymatic antioxidants found in the lungs. UA, together with other antioxidants, counteract the effects of oxidants produced by cigarette smoke. The antioxidant property of UA has been shown to have beneficial effects in reducing the development of COPD and lung cancer. [5] The present study aimed to evaluate the possible role of serum uric acid as a biomarker for the prediction of the outcome of patients hospitalized for AECOPD. The outcomes included the duration of hospitalization and (elaboration) NIV support.

METHODS & MATERIALS

Study population: This observational analytical study was conducted in the Department of Respiratory Medicine at the National Institute of Diseases of the Chest and Hospital (NIDCH). The study population consisted of all patients admitted to NIDCH with a primary diagnosis of Acute Exacerbation of COPD (AECOPD) during the one year from July 2019 to June 2020. A final cohort of 96 patients was selected through purposive sampling based on predefined criteria.

Inclusion and exclusion criteria: Patients were included if they were aged over 40 years and were admitted with a confirmed diagnosis of AECOPD. Key exclusion criteria were a history of gout, chronic kidney disease, hepatic failure, other significant respiratory diseases, or being debilitated or disoriented. These criteria were applied to minimize confounding variables that could influence serum uric acid levels.

Study procedure: After obtaining ethical permission from the institutional review board, 96 eligible patients provided informed written consent. Participants were categorized into two groups based on their serum uric acid levels: Group A (low, <6.9 mg/dL) and Group B (high, ≥6.9 mg/dL), each containing 48 patients. Data collected included socio-demographic details (age, sex, occupation, economic status), disease-related variables (symptoms, smoking history, severity via GOLD criteria), and results from investigations like spirometry, arterial blood gas, chest X-ray, and comprehensive blood tests.

Data collection: A structured questionnaire was used to systematically gather all data points. For each patient, the severity of AECOPD was recorded as an input variable, while the serum uric acid level was the primary outcome variable measured. All relevant clinical investigations were performed uniformly for every participant in the study.

Data analysis: Collected data were verified, compiled in Microsoft Excel 2016, and analyzed using SPSS version 20. Categorical variables were expressed as percentages, and continuous variables as mean ± standard deviation. Statistical significance was determined using Pearson's chi-square, Student's t-test, independent samples t-test, and Pearson's correlation test, where appropriate, with a p-value <0.05 considered significant.

RESULT

The mean age of the entire study cohort was 55.18 ± 8.52 years. No significant differences were observed in the mean age, age group distribution, sex distribution, or mean BMI (21.83 ± 3.23) between Group A (low serum uric acid) and Group B (high serum uric acid), as all corresponding p-values were greater than 0.05. A stark contrast was evident in COPD severity between the groups. The majority of patients in Group A (77.08%) were classified with mild or moderate COPD (GOLD stages I-II), with over half (54.17%) in stage II. Conversely, the majority in Group B (83.33%) had severe or very severe COPD (GOLD stages III-IV), with 58.33% in stage III. This difference in GOLD stage distribution was highly significant ($p < 0.001$). Consequently, complications were more frequent in Group B; 64.58% of these patients presented with acute respiratory failure upon admission, a significantly higher proportion compared to the 22.92% in Group A ($p = 0.001$). Laboratory findings revealed significant differences between the groups. All measured parameters, including arterial blood gases, showed statistically significant variations ($p < 0.05$). Most notably, a direct correlation was found between serum uric acid levels and COPD severity. The median serum uric acid level exhibited a progressive and significant increase with each advancing GOLD stage, from 4.79 mg/dL in stage I to 9.67 mg/dL in stage IV ($P < 0.001$). Correlation analyses further solidified this relationship. Serum uric acid demonstrated a highly significant negative correlation with FEV1 ($R=-0.922$, $p < 0.001$) and SpO2 ($R=-0.776$, $p < 0.001$). It also showed a strong positive correlation with PaCO2 ($R= 0.956$, $p < 0.001$) and a moderate negative correlation with PaO2 ($R= -0.656$, $p < 0.001$). These results consistently indicate that elevated uric acid is strongly associated with worse lung function and impaired gas exchange.

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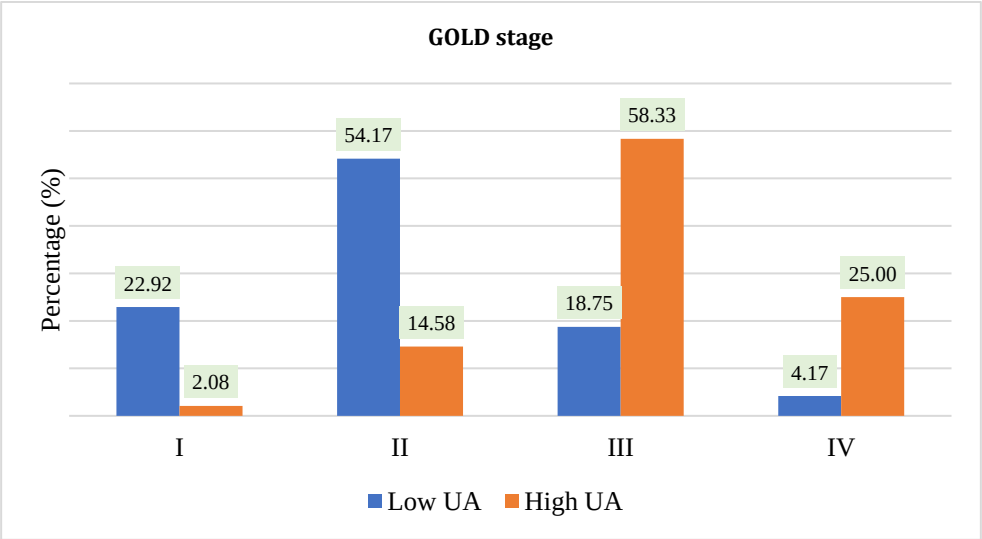

Figure – 1: GOLD stage of COPD among patients (*n*=96)

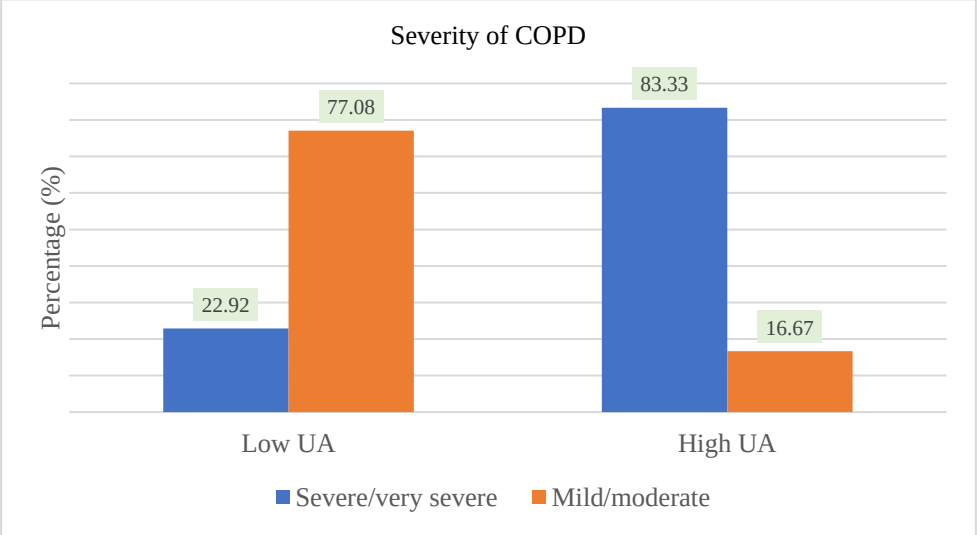

Figure – 2: Severity of COPD among patients (*n*=96)

Table – I: Classification of acute exacerbation of COPD patients (*n*=96)

Types	Group A (n=48) No. (%)	Group B (n=48) No. (%)	Total (n=96) No. (%)	p value
Mild	11 (22.92%)	0 (0%)	11 (11.46%)	<0.001
Moderate	26 (54.17%)	8 (16.67%)	34 (35.42%)	
Severe	11 (22.92%)	40 (83.33%)	51 (53.13%)	
Classes of severe types of acute exacerbation of COPD				
No respiratory failure	9 (18.75%)	9 (18.75%)	18 (18.75%)	<0.001
Acute respiratory failure is non-life-threatening	2 (4.17%)	19 (39.58%)	21 (21.88%)	
Acute respiratory failure life life-threatening	0 (0%)	12 (25%)	12 (12.50%)	

p-value was determined by the Pearson Chi-square test

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Table – II: Laboratory findings of both groups (*n*=96)

Variables	Group A(n=48) n (%)	Group B(n=48) n (%)	P value
Uric acid	5.7±0.77	8.42±1.02	<0.001**
FEV1 (%)	62.10±14.91	37.92±12.03	<0.001**
pH	7.40±0.03	7.37±0.04	<0.001**
PaO_2	64.73±5.34	61.60±6.82	0.014**
$PaCO_2$	41.02±3.26	43.38±4.77	0.006**
SpO_2 (%)	95.19±2.62	92.21±3.92	<0.001**

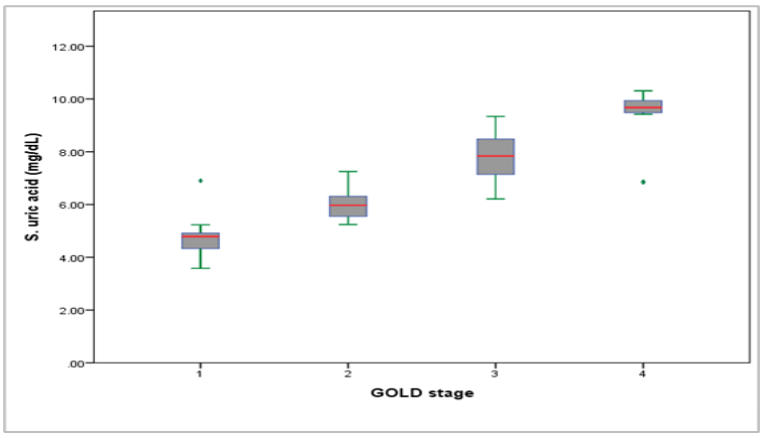

Figure – 3: Serum uric acid levels on admission in all studied patients according to GOLD stage (*n*=96)

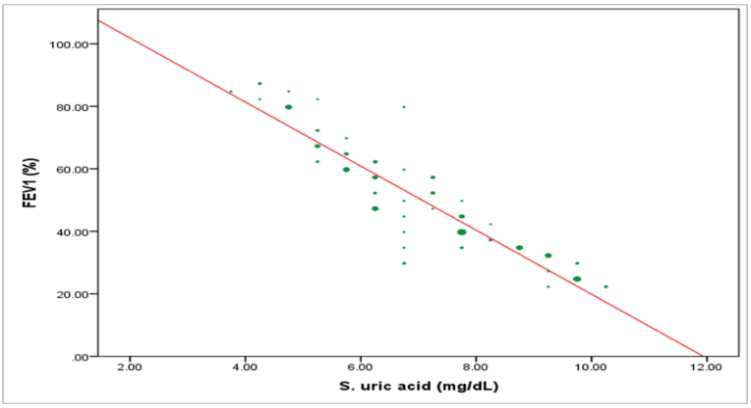

Figure – 4: Correlation between serum uric acid level and FEV1 among patients. (*n*=96)

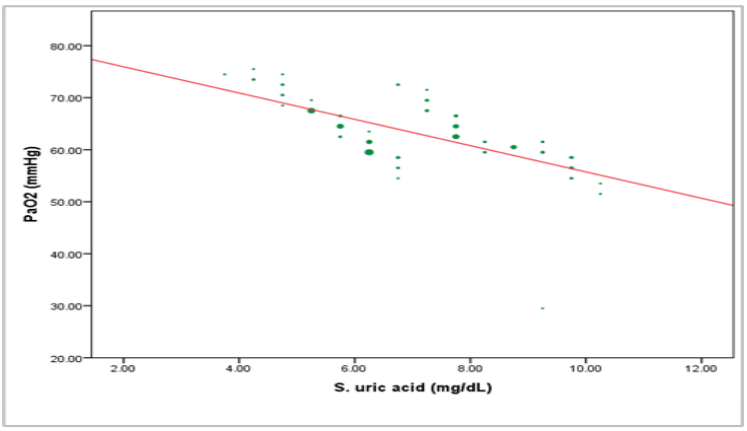

Figure – 5: Correlation between serum uric acid level and PaO2 among patients (*n*=96)

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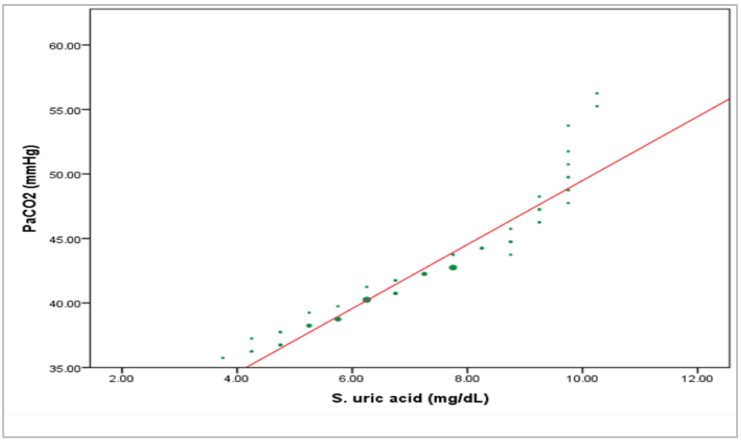

Figure – 6: Correlation between serum uric acid level and PaCO2 among patients (*n*=96)

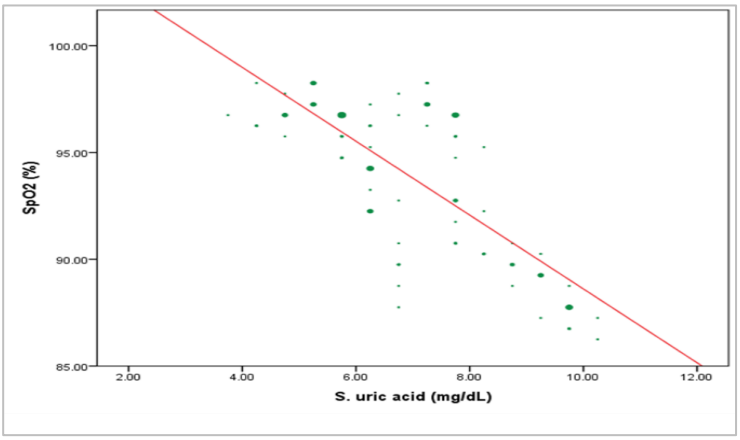

Figure – 7: Correlation between serum uric acid level and SpO2 among patients (*n*=96)

Table – III: Outcome of both groups (*n*=96)

Characteristics	Group A (n=48) n (%)	Group B (n=48) n (%)	p value
Length of hospital stay (days)	4.75±1.78	9.71±2.63	<0.001**
Need for ICU admission	1 (2.08%)	8 (16.67%)	0.031*
In hospital mortality	-	5 (10.42%)	0.022*

DISCUSSION

Chronic obstructive pulmonary disease (COPD) remains a leading cause of global morbidity and mortality, ranking as the third most common cause of death in developed nations. [6] The identification of reliable prognostic biomarkers is therefore critical, as it could facilitate early, intensified therapeutic interventions for high-risk patients, potentially improving survival outcomes. In this study, the mean patient age was 55.18 ± 8.52 years, with a majority (36.46%) aged 40-49. While no significant age difference existed between the comparison groups, this demographic aligns with the natural history of COPD, where a physiological decline in lung function begins around ages 30-40, leading to increased prevalence with advancing age. [7] A pronounced male predominance (82.29%) was observed, consistent with classical epidemiological patterns attributing higher historical COPD risk in males to greater smoking rates and occupational exposures, though no significant difference was found between the groups in our cohort (p=0.189). The distribution of disease severity, assessed by GOLD criteria, revealed a highly significant disparity between patients with normal and elevated serum uric acid (SUA) levels. The majority of patients with normal SUA (54.17%) were classified as GOLD stage II, whereas most with high SUA (58.33%) were in stage III. The mean SUA level across all patients was 7.06 ± 1.63 mg/dL, with a stark and highly significant difference between the groups (5.7 ± 0.77 vs. 8.42 ± 1.02 mg/dL, p<0.001). Receiver operator curve analysis further established a clinically robust cut-off value of 7.38 mg/dL for assessing COPD severity, demonstrating 76.5% sensitivity and 100% specificity (p<0.001). These findings are strongly supported by existing literature. Our results concord with those of Bartziokas et al., [5] who identified SUA as a predictor of severity, noting higher levels in patients with severe airflow limitation, cardiovascular comorbidity, and frequent exacerbations. Similarly, some other studies reported a significant correlation between SUA, hypoxemia, and COPD severity, a result bolstered by several other studies. [8,9] The pathophysiological link is believed to be increased purine catabolism secondary to tissue hypoxia, leading to elevated SUA. [10,11] The correlation analysis in our

study provides mechanistic insight, revealing a highly significant, strong negative association between SUA and both FEV1 (R=-0.922, p<0.001) and SpO2 (R=-0.776, p<0.001). A strong positive correlation was found with PaCO2 (R= 0.956, p<0.001), and a moderate negative correlation with PaO2 (R= -0.656, p<0.001). These results position SUA as a strong indicator of impaired gas exchange and ventilatory function, consistent with cross-sectional studies that have linked uric acid to clinical and functional characteristics in COPD. [1,12] However, the relationship between SUA and hypoxia is complex. While our study found significant differences in blood gas parameters between groups, other studies have reported no direct correlation between SUA and arterial oxygen saturation.[13,14] This inconsistency might arise because tissue hypoxia depends not only on arterial oxygen saturation but also on a complex combination of factors such as hemoglobin levels, cardiac output, blood flow to tissues, and how much oxygen the tissues require.[15] Furthermore, several key limitations should be noted. Uric acid (SUA) levels are affected by multiple confounding variables, including pre-existing heart disease, dietary habits, alcohol intake, and genetic predispositions affecting purine processing or inflammation.[16] Although we excluded patients with renal failure, hepatic failure, and gout, residual confounding from unmeasured variables may persist. Despite these limitations, the cumulative evidence from this study strongly suggests that serum uric acid serves as a valuable biomarker, reflecting disease severity and identifying AECOPD patients with a worse prognosis, including longer hospital stays, higher ICU referral rates, and increased mortality. Its integration into clinical assessment could enhance risk stratification and guide more aggressive management strategies for this vulnerable patient population.

Limitations:

The limitations of this study include the lack of comparison between different pre-hospital treatment modalities and the exclusion of patients with other significant co-morbid conditions, which may affect the generalizability of the results.

CONCLUSION

Elevated serum uric acid is a significant biomarker in Acute Exacerbations of COPD (AECOPD), demonstrating a strong positive correlation with the severity of airflow limitation (lower FEV1) and disease severity as classified by GOLD criteria. Higher levels are predictive of worse clinical outcomes, including prolonged hospitalization, increased need for ICU admission, and higher mortality. Its measurement provides valuable prognostic information that can aid in risk stratification and management planning for AECOPD patients.

Recommendation:

Future prospective studies should compare serum uric acid levels during exacerbation and stable COPD phases. Research should also include heterogeneous populations, incorporating various treatment histories and co-morbid conditions to enhance the generalizability of the findings.

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ORIGINAL ARTICLE

Therapeutic Role of Danazol in Scar Endometriosis - Evidence from a Favorable Clinical Outcome

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ABSTRACT

Background: *Scar endometriosis (SE) is a rare extra-pelvic manifestation of endometriosis, most often associated with prior abdominal surgery, particularly cesarean sections. While surgical excision remains the standard of care, medical therapy such as danazol may offer a valuable alternative in select patients, especially in resource-constrained settings. The objective of the study is to evaluate the clinical efficacy and safety of danazol in the treatment of SE in a large Bangladeshi cohort.* ***Methods & Materials:*** *We conducted a retrospective observational study of 110 women with clinically diagnosed SE treated with danazol 200 mg doses twice per day for six months. Baseline demographics, pain score (VAS), lesion size, and palpability were recorded. Post-treatment outcomes, recurrence at six months, and adverse effects were analyzed using paired t-tests, McNemar's test, and logistic regression.* ***Results:*** *Pain reduction ≥50% was achieved in 83.6% (p = 0.001), lesion size reduction ≥30% in 77.3% (p = 0.002), and complete clinical resolution in 60.0% (p = 0.015). Recurrence at six months occurred in 10.9% (p = 0.0005). Mean VAS decreased from 7.8 ± 1.2 to 3.2 ± 1.5 (p < 0.001), and mean lesion size from 3.4 ± 1.1 cm to 1.9 ± 0.9 cm (p < 0.001). Most patients (71.8%) reported no adverse effects. Logistic regression identified danazol therapy (OR 4.8), baseline pain ≥7 (OR 1.8), and age ≥30 years (OR 1.2) as significant predictors of favorable outcome.* ***Conclusion:*** *Danazol offers an effective, well-tolerated non-surgical option for SE, with substantial clinical benefits and low short-term recurrence in a Bangladeshi population.*

Keywords: *Scar Endometriosis, Danazol, Anterior Endometriosis, Medical Therapy*

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INTRODUCTION

Scar endometriosis (SE) is a rare extra-pelvic manifestation of endometriosis characterized by the presence of functional endometrial glands and stroma in surgical scars, most commonly following obstetric and gynecologic procedures such as cesarean section [1]. It represents a diagnostic challenge due to its low incidence and often nonspecific presentation, typically manifesting as cyclical pain and swelling at or near the scar site [2]. Globally, the reported incidence of SE after cesarean section ranges from 0.03% to 1.08%, although actual prevalence may be underestimated, particularly in Low- and Middle-Income Countries (LMICs) such as Bangladesh, where awareness of the condition is limited and diagnostic resources, including high-resolution imaging and histopathological evaluation, are not uniformly accessible [1,3,4]. The pathogenesis of SE is most commonly explained by the iatrogenic transplantation theory, in which viable endometrial cells are mechanically implanted into surgical wounds during uterine incision closure; these cells subsequently survive and proliferate under the influence of estrogen [5]. Alternative hypotheses include coelomic metaplasia and lymphatic or hematogenous dissemination, although these are less supported in the context of abdominal wall involvement [6].

Surgical excision with wide, tumor-free margins remains the definitive treatment for SE [7]. Multiple case series and retrospective reviews have demonstrated high success rates with excision, but recurrence rates of approximately 6% have been reported, even with adequate margins [8]. Surgery also carries inherent risks, including wound complications, hematoma, infection, and delayed recovery, in addition to resource burdens in high-volume obstetric centers [9]. In LMIC settings, surgical capacity constraints, long wait times, and patient reluctance to undergo repeat operations can further limit the feasibility of surgical intervention. Consequently, medical therapy has been considered in selected cases—either as a stand-alone approach for patients unfit for surgery

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or unwilling to undergo another operation, or as an adjunct to reduce lesion size preoperatively [10].

Danazol, a synthetic isoxazole derivative of 17α-ethinyl testosterone, has been used historically in the treatment of pelvic endometriosis due to its ability to suppress pituitary gonadotropin secretion, thereby inducing a hypoestrogenic and hyperandrogenic environment that leads to decidualization and atrophy of ectopic endometrial tissue [11]. Early clinical trials established effective dosing regimens ranging from 200 to 800 mg/day for treatment durations of 3 to 9 months, with higher doses achieving faster symptom resolution but a greater incidence of side effects [12,13]. Adverse effects, including weight gain, acne, seborrhea, voice deepening, and hepatotoxicity, have contributed to a decline in danazol's use in pelvic endometriosis, as reflected in modern guidelines, which favor other hormonal agents [14,15]. Nonetheless, in resource-constrained environments or in cases where surgery is contraindicated, danazol may remain a relevant and practical therapeutic option [15].

Despite decades of clinical use in pelvic disease, there is a conspicuous lack of high-quality evidence for danazol in the treatment of SE specifically. Most published reports on its use in this context are isolated case reports or small case series, limiting generalizability and precluding robust conclusions about efficacy, optimal dosing, and long-term outcomes [16,17]. The few available Bangladeshi publications on SE primarily address surgical management and diagnostic challenges, without systematically examining medical management outcomes [2]. Broader epidemiological studies on endometriosis in Bangladesh similarly highlight underdiagnosis and inconsistent treatment pathways, but do not focus on danazol or scar-associated disease. Moreover, no retrospective cohort studies to date have evaluated real-world outcomes of danazol therapy in a sizable SE population, leaving an important gap in both global and regional literature.

Given the increasing rates of cesarean delivery in Bangladesh, which may drive a proportional rise in SE incidence, and the barriers to surgical care in resource-limited settings, there is an urgent need for systematic evaluation of medical therapy options, particularly those with a long clinical history such as danazol. This retrospective observational study aims to address these gaps by analyzing clinical outcomes, recurrence rates, and adverse effect profiles in a large Bangladeshi cohort of SE patients treated with danazol. The findings are expected to contribute both to regional clinical decision-making and to the sparse global literature on non-surgical management of this uncommon but clinically significant condition.

METHODS & MATERIALS

This retrospective observational study was conducted at Railway General Hospital, Dhaka, Bangladesh from January 2016 to December 2017. The study included a total of 110 female patients who had a confirmed clinical diagnosis of scar endometriosis, typically associated with prior cesarean section or surgical procedures involving the anterior wall. Inclusion criteria were the presence of a palpable mass in the wound area. All patients received oral Danazol therapy at 2 doses of 200 mg/day for a continuous duration of six months. Baseline clinical parameters, including age, BMI, history of cesarean delivery, pain score on a visual analogue scale (VAS), and size of the palpable mass, were recorded before treatment initiation. A follow-up assessment was conducted at six months post-treatment to evaluate clinical improvement in terms of pain reduction, mass size reduction, and overall resolution. Patients were also monitored for any adverse effects of Danazol during and after the treatment period. Data were collected using standardized forms and verified through clinical records.

All data were analyzed using appropriate statistical tools to evaluate the efficacy of Danazol therapy. Descriptive statistics were used to summarize baseline demographic and clinical characteristics. Continuous variables such as VAS pain score and mass size were expressed as mean ± standard deviation and compared using paired t-tests to assess changes before and after treatment. Categorical variables such as the presence of palpable mass and the proportion of patients achieving clinical improvement were analyzed using McNemar's test. Logistic regression analysis was performed to identify factors independently associated with favorable clinical outcomes. Odds ratios with 95% confidence intervals were calculated for each predictor, including age, BMI, baseline pain score, mass size, and previous cesarean history. All statistical analyses were conducted using the standard software SPSS version 26. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Of the 110 patients included in the study, the majority (61.8%) were aged 30 years or older, while 38.2% were under 30 years of age. Nearly half (48.2%) had a normal BMI, with 28.2% classified as overweight and 23.6% as obese. A history of previous cesarean delivery was present in 88.2% of cases. On clinical examination, a palpable anterior wall mass was identified in 92.7% of patients, and 85.5% reported pain on tenderness palpation. [Table I]

Table – I: Baseline Characteristics of Patients with Scar Endometriosis Treated with Danazol

Variable	Frequency (n)	Percentage (%)
Age Group		
< 30 years	42	38.2%
≥ 30 years	68	61.8%
BMI Category		
18.5–24.9 (Normal)	53	48.2%
25.0–29.9 (Overweight)	31	28.2%
≥ 30.0 (Obese)	26	23.6%
Previous Cesarean Delivery	97	88.2%
Mass Palpable on Examination	102	92.7%
Pain on Palpation	94	85.5%

Following six months of danazol therapy, 83.6% of patients achieved at least a 50% reduction in pain score on the VAS (p = 0.001). A reduction in palpable mass size of at least 30%

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was observed in 77.3% of patients (p = 0.002). Complete clinical resolution, defined as absence of both palpable mass and pain, occurred in 60.0% of cases (p = 0.015). At six-month follow-up, recurrence was documented in 10.9% of patients, while 89.1% remained recurrence-free (p = 0.0005). [Table II]

Table – II: Clinical Outcomes after 6-Month Danazol Treatment (*n* = 110)

Outcome	Resolved (n)	% Resolved	Not Resolved (n)	% Not Resolved	p-value
Pain reduction (VAS ↓ ≥ 50%)	92	83.6%	18	16.4%	0.001
Mass size reduction ≥ 30%	85	77.3%	25	22.7%	0.002
Complete resolution (clinically)	66	60.0%	44	40.0%	0.015
Recurrence at 6-month follow-up	12	10.9%	98	89.1%	0.0005

Adverse effects during danazol therapy were reported with weight gain being the most common (14.5%), followed by acne (8.2%) and menstrual irregularities (5.5%). The majority of patients (71.8%) experienced no treatment-related adverse effects. None of the observed adverse events showed a statistically significant difference when compared to patients without adverse effects. [Table III].

Table – III: Adverse Effects of Danazol (*n* = 110)

Adverse Effect	Frequency (n)	Percentage (%)	p-value (vs no AE)
Weight gain	16	14.5%	0.210
Acne	9	8.2%	0.323
Menstrual irregularities	6	5.5%	0.489
No adverse effects	79	71.8%	–

At six months post-treatment, mean pain scores decreased significantly from 7.8 ± 1.2 to 3.2 ± 1.5 on the VAS, with a mean reduction of −4.6 (95% CI: −5.0 to −4.2; p < 0.001). A clinically meaningful pain reduction of ≥50% was achieved by 83.6% of patients (p = 0.001). Mean mass size decreased from 3.4 ± 1.1 cm to 1.9 ± 0.9 cm, corresponding to a mean change of −1.5 cm (95% CI: −1.7 to −1.3; p < 0.001), with 77.3% of patients demonstrating a ≥30% reduction in size (p = 0.002). The proportion of patients with a palpable mass fell markedly from 92.7% at baseline to 33.6% after treatment, a reduction of 59.1% (p < 0.001). [Table IV].

Table – IV: Improvement in Clinical Parameters at 6 Months Post-Danazol Therapy (*n* = 110)

Clinical Parameter	Before Treatment (Mean ± SD / n, %)	After 6 Months (Mean ± SD / n, %)	Statistical Test	p-value	95% Confidence Interval (CI) for Change
Pain score (VAS, 0–10 scale)	7.8 ± 1.2	3.2 ± 1.5	Paired t-test	<0.001	Mean difference: −4.6 (−5.0 to −4.2)
Patients with ≥50% pain reduction	-	92 (83.6%)	McNemar's test (paired %)	0.001	Difference in proportions: +67.2% (±8.5%)
Mass size (cm, mean ± SD)	3.4 ± 1.1	1.9 ± 0.9	Paired t-test	<0.001	Mean difference: −1.5 (−1.7 to −1.3)
Patients with ≥30% mass reduction	-	85 (77.3%)	McNemar's test (paired %)	0.002	Difference in proportions: +58.8% (±9.3%)
Palpable mass present	102 (92.7%)	37 (33.6%)	McNemar's test	<0.001	Difference in proportions: −59.1% (±7.8%)

Logistic regression analysis identified several independent predictors of favorable clinical outcomes following danazol therapy. The treatment itself was strongly associated with success, with patients nearly five times more likely to achieve favorable outcomes (OR 4.8, 95% CI: 2.3–9.9; p < 0.001). Age ≥ 30 years showed a modest but statistically significant positive association (OR 1.2, p = 0.02), as did a baseline pain score of ≥7, which was linked to an 80% higher likelihood of improvement (OR 1.8, p = 0.01). Conversely, a BMI ≥ 25 kg/m^2 was associated with slightly reduced odds of treatment success (OR 0.9, p = 0.003). Previous cesarean delivery (OR 1.5, p = 0.63) and baseline mass size ≥ 3 cm (OR 0.7, p = 0.22) were not significantly associated with treatment outcome. [Table 5.A].

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Table – 5 (A): Logistic Regression Analysis Showing Factors Associated with Favorable Clinical Outcome after Danazol Therapy (n = 110)

Predictor Variable	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Danazol therapy (treatment)	4.8	2.3 – 9.9	<0.001
Age ≥ 30 years	1.2	0.6 – 2.3	0.02
BMI ≥ 25 kg/m^2	0.9	0.5 – 1.7	0.003
Previous cesarean delivery	1.5	0.6 – 3.7	0.63
Baseline mass size ≥ 3 cm	0.7	0.3 – 1.6	0.22
Baseline pain score (VAS ≥ 7)	1.8	0.9 – 3.6	0.01

Table 5 (B): Interpretation of the Logistic Regression Analysis Showing Factors Associated with Favorable Clinical Outcome after Danazol Therapy (*n* = 110)

Predictor Variable	Odds Ratio (OR)	p-value	Interpretation	Clinical Meaning
Danazol therapy (treatment)	4.8	<0.001	Strong, statistically significant positive association	Patients receiving Danazol are nearly 5 times more likely to have favourable outcomes
Age ≥ 30 years	1.2	0.02	Statistically significant positive effect	Older patients have 20% higher odds of responding better to Danazol therapy.
Baseline pain score (VAS ≥ 7)	1.8	0.01	Statistically significant positive association	Patients with more severe baseline pain are 80% more likely to improve.
BMI ≥ 25 kg/m^2	0.9	0.003	Small but statistically significant negative association	Higher BMI patients have about 10% lower odds of a favorable outcome-possibly due to altered metabolism.
Previous cesarean delivery	1.5	0.63	Not statistically significant	No reliable evidence that a previous cesarean affects treatment success
Baseline mass size ≥ 3 cm	0.7	0.22	Not statistically significant	Baseline mass size does not predict Danazol treatment effectiveness.

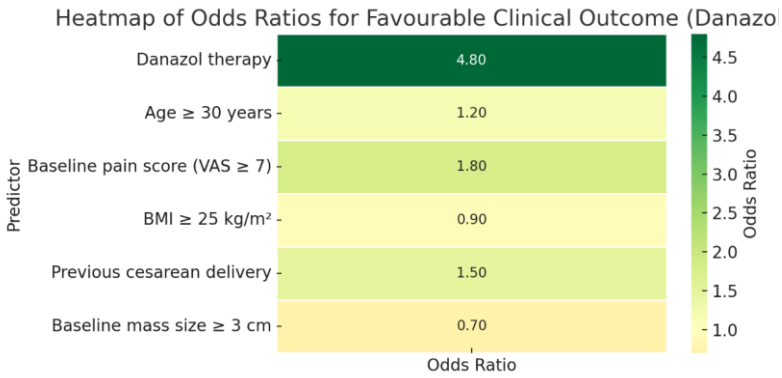

Figure – 1: Heatmap showing Predictors of Favorable Outcome after Danazol Therapy

Figure 1 visually summarizes the logistic regression results, illustrating the odds ratios for predictors of favorable clinical outcomes after danazol therapy. Danazol treatment demonstrated the strongest positive association with outcome (OR 4.80), followed by baseline pain score ≥7 (OR 1.80) and age ≥30 years (OR 1.20). A BMI ≥25 kg/m^2 showed a slight negative association (OR 0.90), while previous cesarean delivery (OR 1.50) and baseline mass size ≥3 cm (OR 0.70) were not strongly predictive. The heatmap color gradient reflects the relative magnitude of the odds ratios, with darker green indicating stronger positive associations. [Figure 1].

DISCUSSION

This retrospective observational study involving 110 patients is evaluating the therapeutic role of danazol in scar endometriosis (SE). Our findings demonstrate significant clinical benefits in terms of pain reduction, lesion shrinkage, and overall clinical resolution, with a favorable safety profile. These results add important evidence to a field where data on medical therapy, particularly in SE, remain scarce.

Baseline characteristics of our cohort showed that most patients were aged ≥30 years (61.8%), with a history of prior cesarean delivery in 88.2% of cases. Nearly half had a normal BMI (48.2%), while overweight and obese patients constituted 51.8%. A palpable mass was detected in per abdominally 92.7%, and 85.5% experienced pain or tenderness on palpation. These observations are consistent with prior large-scale case series, where most SE patients were in their early to mid-thirties, had prior cesarean sections, and presented with cyclical pain and a palpable mass [18–20]. Our findings reinforce the strong association between surgical abdominal wall

trauma and SE development, as also highlighted in the review by Arkoudis et al [21].

In terms of clinical outcomes after 6 months of danazol therapy, our study recorded a ≥50% pain reduction in 83.6% of patients, ≥30% mass size reduction in 77.3%, and complete clinical resolution in 60.0%. Only 10.9% experienced recurrence at 6-month follow-up. These results compare favorably with earlier reports of hormonal therapy in SE, such as Thabet and Youssef, who demonstrated substantial pain relief and lesion shrinkage with medical agents, including danazol [22]. Similarly, Singh et al. reported reduced recurrence rates when medical therapy was used post-surgery, though their recurrence figures were slightly higher than ours, potentially due to longer follow-up durations [23].

Improvement in clinical parameters was substantial. The mean VAS pain score dropped from 7.8 ± 1.2 to 3.2 ± 1.5, representing a mean reduction of 4.6 points, which is both statistically and clinically significant. Lesion size decreased from 3.4 ± 1.1 cm to 1.9 ± 0.9 cm, with a 59.1% absolute reduction in palpable mass prevalence. Similar magnitudes of improvement in both pain and lesion size have been observed in medical therapy studies for SE and related extra-pelvic endometriosis, underscoring danazol's potent therapeutic effects despite its reduced role in modern pelvic endometriosis guidelines [22,24].

With respect to adverse effects, the majority (71.8%) reported no side effects during therapy. The most common were weight gain (14.5%), acne (8.2%), and menstrual irregularities (5.5%), none reaching statistical significance versus those without adverse effects. These rates are lower than those described in earlier danazol trials for pelvic endometriosis, where weight gain and acne often exceeded 20% and 10%, respectively [13,25]. This favorable tolerability profile may reflect the relatively short treatment duration (six months) and moderate dosage used in our study.

Our logistic regression analysis identified danazol therapy itself as a strong predictor of favorable outcome (OR 4.8), while baseline pain score ≥7 and age ≥30 years were also positively associated with treatment success. Conversely, BMI ≥25 kg/m^2 was associated with a modest but statistically significant reduction in odds of improvement. These associations parallel findings in broader endometriosis literature, where higher baseline pain is predictive of stronger therapeutic response, and higher BMI has been associated with reduced hormonal treatment efficacy [19,26,27]. In contrast, baseline mass size ≥3 cm and prior cesarean history did not significantly influence outcomes, aligning with Sharma and Tripathi's conclusion that lesion size often fails to predict response to therapy [28].

Overall, our results indicate that in resource-limited settings or in patients unfit for surgery, danazol remains a viable and effective therapeutic option for SE, capable of producing substantial clinical improvement with minimal recurrence over short-term follow-up. While modern guidelines prioritize surgical excision, our data—together with other supportive literature—suggest a potential role for revisiting danazol in carefully selected SE cases.

Nevertheless, some limitations merit consideration. Being retrospective, our study is subject to documentation and selection biases. Additionally, the follow-up period of six months, while adequate for short-term recurrence assessment, may underestimate longer-term relapse rates reported in other studies [23]. Future prospective, multicenter trials with extended follow-up are warranted to validate these findings and further define patient subgroups most likely to benefit from medical therapy.

Limitations of The Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

In this large retrospective study, danazol therapy produced significant improvements in pain, lesion size, and overall clinical resolution among women with scar endometriosis, with a low short-term recurrence rate and favorable tolerability profile. Predictors of positive response included higher baseline pain scores, age ≥30 years, and absence of overweight or obesity. Given its effectiveness, affordability, and acceptable safety in our cohort, danazol may represent a valuable non-surgical option for scar endometriosis in resource-limited settings or in patients unfit for surgery. Further prospective studies with longer follow-up are warranted to confirm these findings and refine patient selection criteria.

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ORIGINAL ARTICLE

Clinical Profile and Outcomes of Patients with Bacterial Meningitis in a Tertiary Care Centre

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ABSTRACT

Background: *Bacterial meningitis remains a neurologic emergency with high mortality and morbidity despite advances in antimicrobial treatment. Prognostic indicators need to be determined early in order to offer optimal care and improved outcomes in developing nations. The study aimed to evaluate the clinical features, microbiology, management, and outcomes of bacterial meningitis, focusing on modifiable risk factors to improve patient care.* ***Methods & Materials:*** *This hospital-based observational study included 120 clinically and laboratory confirmed bacterial meningitis patients, excluding tuberculous, viral, or fungal cases. Detailed demographic, clinical, laboratory, microbiological, and imaging data were collected, along with outcomes such as mortality, neurological complications, and hospital stay. Statistical analysis was conducted in SPSS version 26, including descriptive statistics, chi-square tests for group comparisons, and logistic regression to identify predictors of mortality. Survival analysis was performed with Kaplan–Meier curves and log-rank tests, and Cox regression quantified hazard ratios, with significance set at p<0.05.* ***Results:*** *The study population had a mean age distribution in all groups with male predominance (60%). Fever (90%) and stiff neck (70%) were the most common presentations. Streptococcus pneumoniae was the most common pathogen isolated (20%). 20% of the patients died in the hospital, and 40% had neurological complications. Independent predictors of mortality were age ≥65 years (OR 3.25, 95% CI 1.25-8.45), admission GCS ≤8 (OR 5.10, 95% CI 1.95-13.30), delayed presentation >48 hours (OR 2.40, 95% CI 1.02-5.66), and Gram-negative bacterial infection (OR 2.90, 95% CI 1.05-7.95). Adjunctive therapy with dexamethasone was protective (OR 0.45, 95% CI 0.18-0.98).* ***Conclusion:*** *Death from bacterial meningitis remains high in our setting. Better survival correlates with earlier presentation, younger age, higher admission GCS, and adjunctive dexamethasone therapy, reaffirming the need for early diagnosis and appropriate management.*

Keywords: *Bacterial meningitis, Risk factors of Bacterial meningitis, Outcomes of Bacterial meningitis*

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INTRODUCTION

Bacterial meningitis is a very deadly central nervous system infection characterized by meningeal inflammation over the brain and spinal cord [1]. Although significant progress has been made in antimicrobial therapy and supportive management, bacterial meningitis continues to impose a significant global disease burden with 10–30% case mortality and neurological sequelae arising in 20–50% of survivors [2]. The disease predominantly affects vulnerable populations, including infants, the elderly, and immunocompromised patients, so early diagnosis and appropriate management are critical for optimal outcomes [3]. The epidemiological picture of bacterial meningitis has changed considerably following the introduction of conjugate vaccines for predominant pathogens. However, the disease burden is noteworthy, particularly in developing countries where proper healthcare facilities are scarce and vaccination coverage may be inadequate [4]. Recent surveillance statistics indicate

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persistent challenges in reducing mortality and morbidity, with *Streptococcus pneumoniae*, *Neisseria meningitidis*, and *Haemophilus influenzae* being the predominant causative pathogens in adults [5,6]. The changing resistance patterns of these pathogens add to the challenge of making treatment decisions and highlight the need for continuous epidemiologic monitoring [7]. The emergence of resistant strains such as penicillin- or cephalosporin-resistant *S. pneumoniae* also highlights the need to update empirical regimens according to local resistance patterns [8]. Clinical presentation of bacterial meningitis is highly variable and can range from the classic triad of fever, stiff neck, and altered mental status to non-specific, subtle symptoms that can cause delay in diagnosis [9,10]. Such clinical heterogeneity will typically necessitate a high index of suspicion among clinicians, especially in atypical or early cases. The Glasgow Coma Scale of admission has emerged as a significant prognostic indicator, with a lower score being invariably predictive of higher mortality in all these studies [9]. Additionally, older age, delayed presentation, and specific pathogens have also emerged as significant outcome determinants that affect treatment planning and prognostic counseling [11]. Co-morbid illness conditions, including diabetes mellitus and chronic renal disease, have also been demonstrated to have a detrimental impact on prognosis, reinforcing the need for individualized care protocols [12]. The adjunctive use of corticosteroids, and dexamethasone specifically, in the treatment of bacterial meningitis remains an area of active research. While some evidence supports utility in prevention of deafness and neurological complications, others question its indiscriminate use, especially in low-resource environments where verification by diagnostic methods may be impracticable [13]. In addition, its effectiveness in low-income countries where *H. influenzae* meningitis remains an issue and delay in initiating antibiotics is not unusual has been controversial [14]. It is therefore important to understand local patterns of bacterial meningitis, including causative pathogens, clinical presentation, antimicrobial susceptibility, and treatment outcomes, to develop evidence-based treatment recommendations in a particular healthcare environment.

This study aimed to analyze the clinical profile, microbiological profile, treatment plan, and outcome of patients with bacterial meningitis in a tertiary care facility with special reference to the identification of modifiable risk factors that would influence clinical practice and improve patient outcomes.

METHODS AND MATERIALS

This hospital-based observational study was conducted at Gopalganj Medical College, Gopalganj, Bangladesh. A total of 120 patients who were clinically and laboratory diagnosed with bacterial meningitis were included in the study. Diagnosis was based on a compatible clinical presentation along with cerebrospinal fluid (CSF) findings suggestive of bacterial infection. Patients with tuberculous meningitis, viral or fungal meningitis, or those with incomplete medical records were excluded. Detailed demographic data, clinical symptoms, predisposing factors, comorbidities, and neurological status at admission (Glasgow Coma Scale) were recorded. Laboratory and CSF parameters, microbiological results, and imaging findings were documented. Outcomes assessed included in-hospital mortality, neurological complications, and duration of hospital stay.

Statistical Analysis

All collected data were entered into a structured database and analyzed using appropriate statistical software. Continuous variables were summarized as mean ± standard deviation, while categorical variables were expressed as frequencies and percentages. Comparisons between survivors and non-survivors were performed using the chi-square test. Logistic regression analysis was conducted to identify independent predictors of in-hospital mortality, and results were presented as odds ratios with 95% confidence intervals. Time-to-event data were further explored using Kaplan–Meier survival analysis with log-rank test for group comparisons. Cox proportional hazards regression was applied to quantify hazard ratios. A p-value of <0.05 was considered statistically significant.

RESULTS

Table I represents the demographic characteristics and risk factors of the study population. Distribution by age shows adults aged 15-64 years constituting the majority (65%) of cases, with even distribution across middle-aged groups. There was a remarkable male predominance (60%). Comorbidities were present in 40% of patients, with the most common being diabetes mellitus (25%), followed by alcohol use disorder (12.5%) and chronic kidney disease (10%). Predisposing causes were identified in 35% of the cases, with otitis media/sinusitis being the most frequent (16.7%), followed by head injury (8.3%) and recent neurosurgery (6.7%). [Table I].

Table – I: Baseline Demographics and Predisposing Factors (*n* = 120)

Variable	Category	n (%)
Age, years	<15	18 (15%)
	15–44	42 (35%)
	45–64	36 (30%)
	≥65	24 (20%)
Sex	Male	72 (60%)
	Female	48 (40%)
Comorbidities	Any comorbidity	48 (40%)
	Diabetes mellitus	30 (25%)
	Chronic kidney disease	12 (10%)
	HIV infection	6 (5%)
	Alcohol use disorder	15 (12.5%)
Predisposing factors	Otitis media/sinusitis	20 (16.7%)
	Head trauma	10 (8.3%)
	Recent neurosurgery	8 (6.7%)
	CSF leak	4 (3.3%)
	Any of the above	42 (35%)

Table II demonstrates the determinants of clinical presentation and severity upon hospital presentation. The

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classical triad features were all very prevalent: fever (90%), neck rigidity (70%), and changed sensorium (45%). Other neurologic features were seizures (30%) and focal deficits (20%). The timing of presentation was also equally distributed, with one-third presenting within 24 hours and a further third after 48 hours, demonstrating variable health-seeking behavior. Admission Glasgow Coma Scale revealed that 50% of them were mildly impaired (GCS 13-15), and 20% had severe impairment of consciousness (GCS ≤8). Hemodynamic instability in the shape of hypotension was also seen in 15% of the patients, signifying the systemic nature of severe bacterial meningitis and potential multi-organ involvement. [Table II]

Table – II: Clinical Presentation and Admission Severity (*n* = 120)

Variable	Category	n (%)
Symptoms	Fever	108 (90%)
	Headache	78 (65%)
	Neck stiffness	84 (70%)
	Altered sensorium	54 (45%)
	Seizures	36 (30%)
	Focal neurological deficit	24 (20%)
	Vomiting	60 (50%)
	Photophobia	24 (20%)
Time to presentation	<24 h	36 (30%)
	24–48 h	42 (35%)
	>48 h	42 (35%)
Admission GCS	13–15	60 (50%)
	9–12	36 (30%)
	≤8	24 (20%)
Hypotension on arrival	Yes	18 (15%)

Table III reveals the characteristic cerebrospinal fluid and laboratory profile of bacterial meningitis. CSF pleocytosis was present in 90% of patients, with 50% having significant pleocytosis (>1000 cells/μL). Neutrophil predominance (≥80% neutrophils) was present in 80% of patients, characteristic of bacterial etiology. Elevated CSF protein (≥100 mg/dL) was seen in 70% of patients, and low CSF glucose (<40 mg/dL or CSF: serum ratio <0.4) in 75%. Microbiological confirmation was achieved in 60% by Gram stain and 50% by culture positivity. Systemic inflammatory markers were marked by elevated C-reactive protein in 85% of cases. Hyponatremia (<130 mmol/L) occurred in 15% of patients and may be indicative of the syndrome of inappropriate antidiuretic hormone secretion. [Table III]

Table – IV: CSF Profile and Key Laboratory Findings (*n* = 120)

Variable	Category	n (%)
CSF WBC (cells/μL)	<100	12 (10%)
	100–1000	48 (40%)
	>1000	60 (50%)
CSF neutrophils ≥80%	-	96 (80%)
CSF protein ≥100 mg/dL	-	84 (70%)
CSF glucose <40 mg/dL or CSF: serum glucose ratio <0.4	-	90 (75%)
CSF Gram stain positive	-	72 (60%)
CSF culture positive	-	60 (50%)
Serum CRP ≥10 mg/L	-	102 (85%)
Serum sodium <130 mmol/L	-	18 (15%)

Table IV(A) exposes the microbiological spectrum of bacterial meningitis in the study population. *Streptococcus pneumoniae* was the most common identified pathogen (20%), followed by *Neisseria meningitidis* (10%). The other important pathogens included Gram-negative bacilli (10%), *Haemophilus influenzae* (5%), and *Staphylococcus aureus* (5%). Of particular significance, 50% of the cases were culture-negative and reflect the challenge with microbiological diagnosis, particularly in patients who may have had prior antimicrobial therapy or in resource-poor settings where more advanced diagnostic techniques may not be available. [Table IV(A)]

Table – IV(A): Identified Pathogens of Microbiology and Treatment Patterns (*n* = 120)

Pathogen	n (%)
Streptococcus pneumoniae	24 (20%)
Neisseria meningitidis	12 (10%)
Haemophilus influenzae	6 (5%)
Staphylococcus aureus	6 (5%)
Gram-negative bacilli (e.g., *Klebsiella*, *E. coli*, *Pseudomonas*)	12 (10%)
Culture-negative	60 (50%)

Table IV(B) provides an overview of empirical and definitive therapeutic regimens employed. A total of 60% of the patients were administered combination therapy with vancomycin and ceftriaxone, a broad-spectrum drug for Gram-positive and Gram-negative organisms. Ceftriaxone monotherapy was used in 20% of patients, while carbapenem-containing regimens were reserved for 10% of the patients, likely those suspected of having resistant organisms. 55% of the patients were administered adjunct dexamethasone. The critical care interventions were significant, with 30% requiring ICU admission and 20% being subjected to mechanical ventilation, indicative of the severity of the disease and the need for intensive monitoring and support. [Table IV(B)]

Table – IV(B): Empiric/Definitive Therapy and Critical Care of Microbiology and Treatment Patterns (*n* = 120)

Variable	Category	n (%)
Empiric regimen	Ceftriaxone + Vancomycin	72 (60%)
	Ceftriaxone alone	24 (20%)
	Meropenem-based	12 (10%)
	Cefepime-based	6 (5%)
	Other	6 (5%)
Adjunctive dexamethasone	Given	66 (55%)
ICU admission	Required	36 (30%)
Mechanical ventilation	Required	24 (20%)

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Table V(A) represents the overall outcome profile of the study population. The in-hospital mortality was 20% alongside neurological complications that were frequent and, in 40% of the survivors, presented most commonly as stroke (15%), then hydrocephalus and deafness (10% each). Status epilepticus or new refractory seizures in 5% of cases. [Table V(A)]

Table – V (A): In-Hospital Outcomes and Bivariate Predictors of Mortality of Overall Outcomes (*n* = 120)

Outcome	n (%)
In-hospital mortality	24 (20%)
Any neurological complication†	48 (40%)
Stroke	18 (15%)
Hydrocephalus	12 (10%)
Hearing loss	12 (10%)
Status epilepticus/new refractory seizures	6 (5%)
Length of stay	<7 days
	7–14 days
	>14 days

**Patients had multiple complications.*

Table V(B) represents survivor and non-survivor attributes, with glaring differences in multiple variables. Late age (≥65 years) was more prevalent among non-survivors (50% vs 12.5%, p=0.002), as was deep consciousness impairment with GCS ≤8 (58.3% vs 10.4%, p=0.001). Late presentation after 48 hours was associated with higher mortality (58.3% vs 29.2%, p=0.007). Gram-negative bacterial infections showed increased mortality rates (25% vs 6.3%, p=0.014). Significantly, dexamethasone administration was more common among survivors (60.4% vs 33.3%, p=0.017), suggesting potential protective effects. [Table V(B)].

Table – V(B): Predictors of In-Hospital Mortality (Survivors vs Non-survivors) of Overall Outcomes (*n* = 120)

Factor (comparison)	Survivors n=96	Non-survivors n=24	p-value
Age ≥65 years (vs <65)	12 (12.5%)	12 (50.0%)	0.002
Admission GCS ≤8 (vs >8)	10 (10.4%)	14 (58.3%)	0.001
Presentation >48 h (vs ≤48 h)	28 (29.2%)	14 (58.3%)	0.007
Gram-negative pathogen (vs others/neg.)	6 (6.3%)	6 (25.0%)	0.014
Dexamethasone given (vs not given)	58 (60.4%)	8 (33.3%)	0.017

The independent predictors of in-hospital mortality after adjustment for confounding variables are shown in Table 6. Age ≥65 years remained an independent predictor with an adjusted odds ratio of 3.25 (95% CI 1.25-8.45). Severe impairment of consciousness (GCS ≤8) was the most important predictor with adjusted OR 5.10 (95% CI 1.95-13.30). Late presentation (>48 hours) also remained significant at OR 2.40 (95% CI 1.02-5.66). Gram-negative bacterial cause was associated with increased risk of death (OR 2.90, 95% CI 1.05-7.95). Strikingly, dexamethasone administration was protective with OR 0.45 (95% CI 0.18-0.98), reaffirming its adjunct role in management. [Table VI].

Table – VI: Multivariable Logistic Regression Predictors of In-Hospital Mortality (*n* = 120)

Predictor	Adjusted OR	95% CI	p-value
Age ≥65 years	3.25	1.25 – 8.45	0.016
GCS ≤8 at admission	5.10	1.95 – 13.30	0.001
Late presentation (>48 h)	2.40	1.02 – 5.66	0.045
Gram-negative pathogen	2.90	1.05 – 7.95	0.039
Dexamethasone given (protective)	0.45	0.18 – 0.98	0.047

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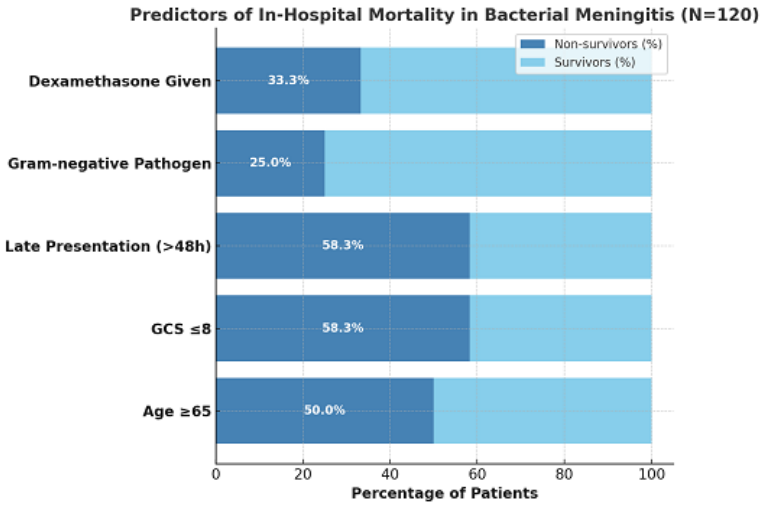

Figure – 1: Predictors of In-Hospital Mortality in Bacterial Meningitis (*n* = 120)

Figure 1 illustrates that the adverse outcomes were strongly associated with older age (≥65 years), low admission GCS (≤8), and delayed presentation (>48 hours), all showing markedly higher mortality proportions. Gram-negative bacterial infections were also linked to increased mortality compared with other pathogens. Conversely, patients who received dexamethasone had a lower mortality rate, highlighting the potential protective role of adjunctive steroid therapy.

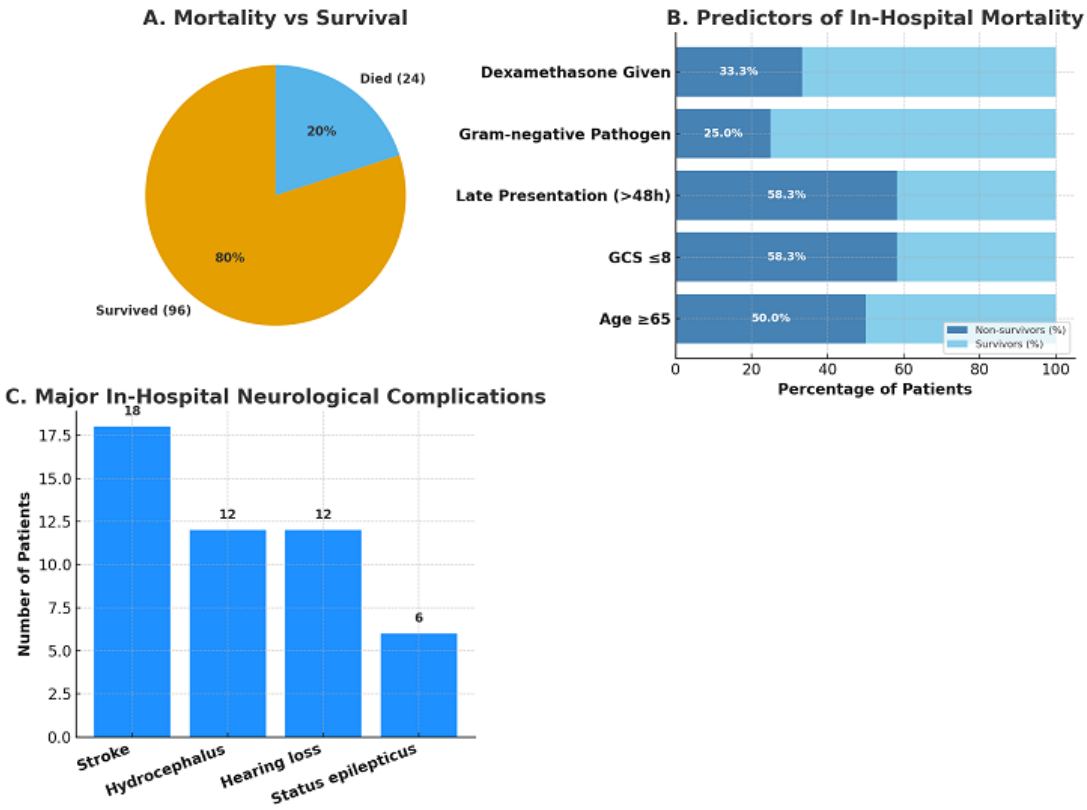

Figure – 2: Clinical Profile and Outcomes in Bacterial Meningitis. (A) Mortality vs Survival, (B) Predictors of In-Hospital Mortality, (C) Major In-Hospital Neurological Complications

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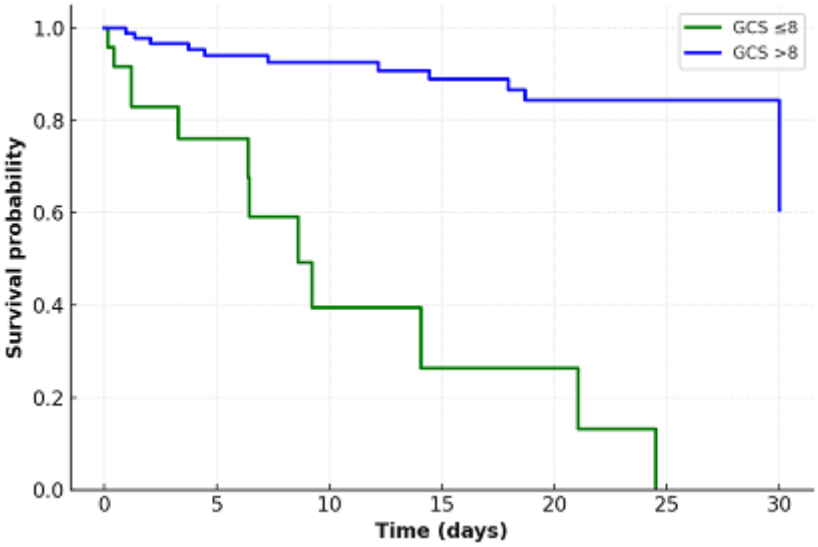

Figure – 3: Kaplan–Meier Survival Curves by Admission Glasgow Coma Scale (GCS) in Bacterial Meningitis.

The Kaplan–Meier analysis in Figure 3 represents a significant survival disadvantage among patients presenting with low GCS (≤8) compared with those with GCS >8. Patients with GCS ≤8 had a much steeper decline in survival probability within the early hospital days, reflecting their higher mortality risk. Conversely, patients with GCS >8 maintained substantially better survival throughout the 30-day observation period.

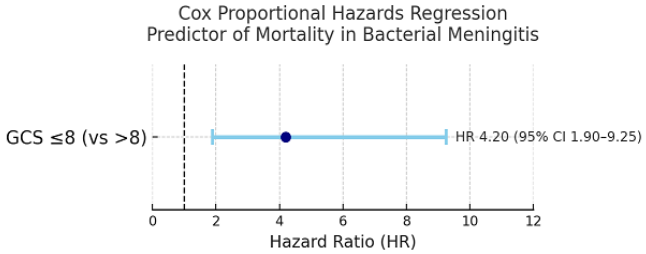

Figure – 4: Cox Proportional Hazards Regression Showing the Effect of Admission GCS on In-Hospital Mortality in Bacterial Meningitis (*n* = 120).

The Cox proportional hazards regression in Figure 4 illustrates that low Glasgow Coma Scale (GCS ≤8) on admission is a strong, independent predictor of in-hospital mortality in bacterial meningitis. Patients with GCS ≤8 had a hazard ratio (HR) of 4.20 (95% CI: 1.90–9.25; $p < 0.001$), indicating more than a four-fold higher risk of death compared with those with GCS >8. The 95% confidence interval does not cross 1, reinforcing the statistical significance of this finding. The reference line (HR = 1) highlights the magnitude of risk elevation in the poor GCS group.

DISCUSSION

The Findings of this study demonstrate insightful information on the clinical profile and outcome of bacterial meningitis in the local tertiary hospital setting of Bangladesh, showing concordance and divergence. Our group's 20% total mortality is in accordance with Oordt-Speets et al., from similar healthcare environments, yet is reassuring in the context of the availability of modern antimicrobial treatment and intensive care support [15]. This rate of fatality reflects the intrinsic virulence of bacterial meningitis and serves to reinforce the continued need for intensified prevention strategies and prompt detection protocols [16]. Our patient's age pattern, predominance by adults aged 15-64 years, and male gender are in agreement with global epidemiological trends [17]. The high burden of comorbidities, particularly diabetes mellitus in 25% of the patients, indicates the importance of host factors in disease outcome and susceptibility [17]. The presence of predisposing factors such as otitis media, sinusitis, and head trauma in 35% of the cases highlights the necessity of preventive intervention and effective management of these conditions to prevent meningitis [18]. The microbiological findings of this study, where *Streptococcus pneumoniae* is the most frequently detected pathogen (20%), reflect the post-vaccine era epidemiology of pneumococcal meningitis predominating in adults even after widespread use of conjugate vaccine [19]. The 50% culture-negative samples represent a huge issue in clinical practice, often because of pre-treatment with antibiotics or the non-availability of laboratory facilities. This finding underlines the necessity for the application of rapid

diagnostic tests such as polymerase chain reaction and antigen detection assays to improve rates of pathogen detection [20]. Multivariable analysis revealed several important predictors of death with important practice implications for the clinician. Advanced age (≥65 years) was an independent risk factor with a tri-fold increase in risk of mortality, consistent with compromised immune function that occurs with ageing and reduced physiological reserve [21]. The most powerful predictor was compromised consciousness at admission (GCS ≤8), with a five-fold increase in the risk of mortality. It is in line with the study by Aronin et al., for the deployment of neurological scoring systems for the stratification of risk and highlights an early detection of patients with compromised mental status with aggressive early management [22]. The association of delayed presentation (>48 hours) with increased mortality reinforces the time-sensitive nature of the management of bacterial meningitis. This finding suggests that provider and community education could have a profound effect on outcomes by enabling earlier detection and initiation of treatment [23]. Similarly, the increased risk of death with Gram-negative bacterial infections reflects both the virulence of the pathogens and potential challenge with antimicrobial selection, supporting the use of broad-spectrum empirical therapy in critically ill patients [24]. Perhaps most importantly, this study demonstrates the protective value of adjunctive dexamethasone therapy, with a 55% reduction in mortality risk among treated patients. This supports current guidelines for dexamethasone use in bacterial meningitis, particularly among those with established bacterial etiology [25]. The benefit mechanism is most likely in the reduction of the inflammatory cascade and subsequent neurological damage, though wise patient selection remains important to maximize benefits at minimal risk. The high incidence of neurological complications (40%) in this study, such as stroke, hydrocephalus, and hearing loss, highlights the need for meticulous long-term follow-up and rehabilitation management. The complications exert a significant impact on quality of life and functional outcomes and dictate that preventive measures and prompt intervention are vital components of optimal care.

Study Limitations

The single-center and relatively small sample size may place a limitation on the generalizability of findings to different healthcare environments with different patient populations and resource conditions. The very high proportion of culture-negative cases (50%) may have affected the accuracy of pathogen-specific outcome analysis and evaluation of antimicrobial resistance patterns.

CONCLUSION

This study demonstrates that bacterial meningitis remains a significant cause of morbidity and mortality in our tertiary care center, with a 20% in-hospital case fatality rate and 40% neurological complication rate. Severe age, compromised consciousness upon admission, delayed presentation, and Gram-negative bacterial infections were independent predictors of poor outcome. Conversely, adjunctive dexamethasone therapy was a predictor of survival. Early recognition, early antimicrobial therapy, and judicious use of adjunct corticosteroids are all crucial to optimizing patient outcomes. These findings support the importance of educating health care providers and public education campaigns designed to promote early presentation and treatment of this devastating neurological emergency.

Recommendations

Subsequent studies ought to deploy rapid diagnostic techniques such as multiplex PCR to increase pathogen detection rates and direct targeted therapy. Multi-center collaborative studies need to be performed to validate these findings in various populations and offer standardized protocols for adjunctive dexamethasone administration in bacterial meningitis treatment.

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ORIGINAL ARTICLE

Prevalence of Prediabetes among Subjects with First Ever Acute Stroke

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ABSTRACT

Background: *Stroke and diabetes are major global health concerns, with prediabetes representing an intermediate metabolic state that significantly increases the risk of diabetes and recurrent stroke. Therefore, the present study was conducted to determine the prevalence of prediabetes among patients with first-ever acute stroke.* ***Aim of the study:*** *To determine the prevalence of prediabetes among patients with first-ever acute stroke.* ***Methods & Materials:*** *This cross-sectional study at the Department of Medicine, Sher-E-Bangla Medical College Hospital, Barisal, Bangladesh (March–September 2015), enrolled 100 patients aged ≥40 years with first-ever acute stroke and no prior diabetes. Glycometabolic status was assessed using FPG, 2-h postload glucose, and HbA1c, with data collected via structured forms and stroke confirmed by CT scan. Analyses were done in SPSS with ethical approval and informed consent.* ***Results:*** *Among 100 stroke patients (mean age 57 years, 78% male), ischemic stroke was most common (68%), with hemiplegia as the leading presentation. Hypertension (68%) and smoking (42%) were major risk factors. Glycometabolic tests revealed 18–26% diabetes and 24–34% prediabetes, with combined testing identifying 18% prediabetes and 12% diabetes (p = 0.130).* ***Conclusion:*** *Prediabetes is common among first-ever acute stroke patients, especially in males and the elderly, emphasizing the need for comprehensive post-stroke glycometabolic screening using multiple diagnostic tests.*

Keywords: *Prevalence, Prediabetes, Stroke.*

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INTRODUCTION

Stroke and diabetes are major global health concerns, affecting populations in both developed and developing countries. The prevalence of metabolic syndrome is projected to nearly double over the next two decades[1,2]. Cerebrovascular disease or stroke appears to increase progressively across the spectrum of insulin resistance, from impaired fasting glucose (IFG) to impaired glucose tolerance (IGT) to diabetes, suggesting that hyperglycemia may be continuously associated with stroke. Prediabetes, defined as FPG between 5.6 and 6.9 mmol/L or 2-h postload glucose (2-h PPG) between 7.8 and 11.0 mmol/L among participants without a history of diabetes[1], represents an intermediate metabolic state between normal glucose metabolism and diabetes, conferring a significantly increased risk of developing diabetes.

A common mechanism linking components of the insulin resistance syndrome is cellular and molecular defects promoting atherogenesis and inflammation, which contribute to vascular risk factors and ultimately increase the likelihood of stroke, coronary artery disease, or peripheral vascular disease[2]. Individuals with prediabetes also exhibit dyslipidemia, including small dense LDL particles, hypertriglyceridemia, and reduced HDL cholesterol, further

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accelerating atherogenesis. Prediabetes is highly prevalent in non-diabetic patients with transient ischemic attack (TIA) or ischemic stroke and nearly doubles their risk of recurrent stroke[3].

Pathophysiologically, isolated IFG and isolated IGT differ in insulin resistance and secretory defects: IFG is associated with hepatic insulin resistance and early-phase insulin secretion defects, while IGT shows more severe muscle insulin resistance and late-phase secretory defects. Patients with combined IFG/IGT manifest both hepatic and muscle insulin resistance along with impairments in first- and second-phase insulin secretion, resembling type 2 diabetes[4-6]. The American Diabetes Association (ADA) has recently recommended HbA1c as an additional diagnostic tool for prediabetes[7].

Given the high prevalence of abnormal glycometabolism diagnosed by OGTT among Chinese patients with acute stroke[8,9], and the association of both diabetes and high-normal glycemia with stroke risk[10], efficient screening tools for glycometabolic abnormalities in acute ischemic stroke patients are urgently needed. Although OGTT remains a standard method, it is inconvenient, time-consuming, and requires fasting[11]. HbA1c offers a simpler, non-fasting alternative endorsed by the ADA, with levels of 5.7–6.4% recommended for identifying prediabetes due to the high risk of progression to diabetes[10,12,13].

Fasting plasma glucose (FPG) is another practical option, notable for its low cost and simplicity, though it is sensitive to short-term glucose fluctuations[11]. OGTT, performed after overnight fasting with a 75 g oral glucose load, remains a reliable method for diagnosing DM and prediabetes when combined with FPG measurement[8,14,15]. Despite global studies comparing OGTT and HbA1c for detecting glycometabolic abnormalities, results remain inconsistent, and few studies have specifically focused on patients with first-ever acute ischemic stroke[16]. Therefore, the present study was conducted to determine the prevalence of prediabetes among patients with first-ever acute stroke.

Objective

- To determine the prevalence of prediabetes among patients with first-ever acute stroke.

Methods & Materials

This cross-sectional observational study was conducted in the Department of Medicine, Sher-E-Bangla Medical College Hospital, Barisal, Bangladesh, between 30th March 2015 and 29th September 2015. A total of 100 patients with first-ever acute stroke, aged ≥40 years and without a prior history of diabetes mellitus, were enrolled in the study. Patients were selected consecutively based on predefined inclusion and exclusion criteria to assess the prevalence of prediabetes among acute stroke patients.

Inclusion Criteria:

- Adults aged ≥40 years.
- Both male and female patients.
- Patients with first-ever acute stroke.

Exclusion Criteria:

- Known diabetic patients.
- Patients currently on anti-diabetic medications.

Glycometabolic status was classified according to American Diabetes Association criteria into prediabetes, diabetes, and normoglycemia based on FPG, 2-hour postload glucose (2-h PPG), and HbA1c levels. Eligible patients were informed about the study objectives and procedures, and written consent was obtained. Data on socio-demographics, clinical features, and glycometabolic status were collected using a pre-structured Case Record Form, with stroke diagnosis and type confirmed by CT scan. Blood samples were drawn after overnight fasting for FPG measurement, followed by 75 g oral glucose administration and measurement of 2-h PPG; HbA1c was also assessed. Primary outcome variables included age, sex, occupation, residence, stroke type, clinical manifestations, glycometabolic status, and prevalence of prediabetes. Data were checked for consistency, entered into SPSS version 6, and analyzed descriptively with frequencies and percentages; graphs and charts were prepared using MS Excel, and a p-value <0.05 was considered significant. The questionnaire was pretested and finalized to ensure clarity, and data collection followed standard procedures with continuous verification for completeness and accuracy. The study protocol was approved by the Ethical Committee of SBMCH, and confidentiality of all information was maintained. The overall study procedure involved pretesting and finalizing the questionnaire, consecutive sampling, informed consent, detailed history and physical examination, laboratory investigations (FPG, 2-h PPG, HbA1c), and data entry and analysis.

RESULTS

Table – I: Socio-Demographic Characteristics of the Study Population (*n*=100)

Variable		Number of Patients	Percentage (%)
Age (years)	41–50	26	26.0
	51–60	38	38.0
	61–70	28	28.0
	>70	8	8.0
Sex	Male	78	78.0
	Female	22	22.0
Occupation	Service holder	14	14.0
	Business	26	26.0

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	Daily worker	10	10.0
	Housewife	16	16.0
	Garments worker	6	6.0
	Unemployed	12	12.0
	Retired	16	16.0
Residence	Urban	66	66.0
	Rural	34	34.0

In this table, the mean age of patients was 57.08 ± 6.78 years, with the highest proportion belonging to the 51–60 years age group (38%), followed by 61–70 years (28%). Males constituted the majority (78%) with a male-to-female ratio of 3.6:1. Most male patients were in the 51–60 years age group (38.46%), while more than half of the female patients (54.54%) were between 61–70 years. Regarding occupation, businessmen (26%) and housewives (16%) were most common, followed by service holders (14%). Notably, the majority of female patients were housewives. Two-thirds of the participants (66%) resided in urban areas, while 34% were from rural settings.

Table – II: Pre-existing Risk Factors and Co-morbid Conditions among the Study Population (*n*=100)

Risk Factors	Number of Patients	Percentage (%)
Hypertension	68	68.0
Smoking	42	42.0
Family history of premature CAD/CVD	30	30.0
Heart diseases	16	16.0
Hyperlipidaemia	10	10.0
Obesity	24	24.0
Heavy alcohol intake	4	4.0

The study revealed several predisposing factors associated with acute stroke. Hypertension was the most common risk factor, present in 68% of patients, followed by smoking (42%), family history of CAD/CVD (30%), and obesity (24%). Other less frequent conditions included heart diseases (16%), hyperlipidaemia (10%), and heavy alcohol intake (4%).

Table – III: Distribution of Stroke Types among the Study Population (*n*=100)

Stroke Type	Number of Patients	Percentage (%)
Ischemic stroke	68	68.0
Hemorrhagic stroke	32	32.0

Among the study subjects, ischemic stroke was more common, accounting for 68% of cases, while hemorrhagic stroke was observed in 32%.

Table – IV: Clinical Presentations of Stroke Patients (*n*=100)

Clinical Presentation	Ischemic Stroke (n=68)	Hemorrhagic Stroke (n=32)
Hemiplegia	63	26.0
Impaired consciousness	18	30.0
Dysarthria	0	14.0
Dysphasia	32	17.0
Dysphagia	11	8.0
Headache	35	18.0
Vomiting	15	19.0
Sphincter problem	7	19.0
Facial nerve palsy	6	24.0
Hiccup	12	11.0
Neck rigidity	0	5.0
Convulsion	3	8.0

Hemiplegia was the most frequent presentation, occurring in 92.6% of ischemic and 81.3% of hemorrhagic stroke cases. Impaired consciousness was more common in hemorrhagic stroke (93.8%), while dysphasia was frequently observed in ischemic stroke (47%). Other notable features included headache, vomiting, sphincter disturbances, facial nerve palsy, and convulsions.

Table – V: Diagnosis of Patients According to Status of IFG Finding (*n*=100)

FPG Category (mmol/L)	Number of Patients	Percentage (%)
Prediabetes (5.6–6.9)	24	24.0
Diabetes (≥7.0)	18	18.0
Normoglycemia (<5.6)	58	58.0

Fasting plasma glucose identified 18 DM and 24 prediabetes cases. Among the three tests, IFG had the lowest detection rate for DM (18%) and for prediabetes (24%), respectively.

Table – VI: Diagnosis of Patients According to Status of IGT Finding (*n*=100)

2-h PPG Status	Number of Patients	Percentage (%)
Prediabetes (7.8–11.0 mmol/L)	30	30.0
Diabetes (≥11.1 mmol/L)	26	26.0
Normoglycemia (<7.8 mmol/L)	44	44.0

The OGTT identified 26 patients with diabetes (26%) and 30 patients with prediabetes (30%). OGTT detected more patients with diabetes compared to FPG and HbA1c (26% vs.

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18% and 24%, respectively), demonstrating its higher sensitivity for diagnosing glycometabolic abnormalities.

Table – VII: Status of HbA1c Among Study Subjects (*n*=100)

HbA1c Status	Number of Patients	Percentage (%)
Prediabetes	34	34.0
Diabetes	24	24.0
Normoglycemia	42	42.0

HbA1c assessment identified 24 patients with diabetes (24%) and 34 patients with prediabetes (34%). Notably, HbA1c detected a higher proportion of prediabetes cases compared to OGTT and FPG (34% vs. 30% and 24%, respectively).

Table – VIII: Combination of Glycometabolic Status Categorized by HbA1c, IFG, and IGT (*n*=100)

Glycometabolic Status	Number of Patients	p-value
Prediabetes	18	0.130
Diabetes	12	
Normoglycemia	70	

When combining all three tests (HbA1c, FPG, and OGTT), 18% of patients were classified as prediabetes and 12% as diabetes. The concordant detection among the tests indicates agreement in glycometabolic categorization. The p-value (0.130) shows that the differences were not statistically significant at $p < 0.05$.

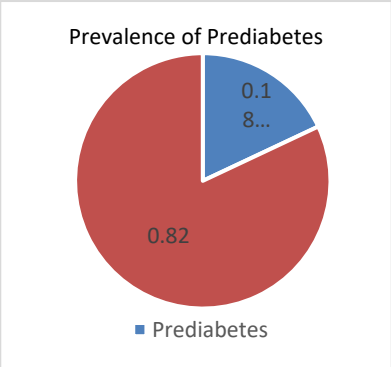

Figure – 1: Prevalence of Prediabetes Among First-Ever Stroke Patients (*n*=100)

Among patients with first-ever stroke, 18% were identified as prediabetes.

DISCUSSION

In the present study, the majority of patients (38%) were in the 51–60 years age group, with a mean age of 57.08 ± 6.78 years. Among males, the highest proportion (38.46%) also fell within this age range, followed by 30.76% in the 41–50 years group. In contrast, over half of the female patients (54.54%) belonged to the 61–70 years group. These findings are consistent with other reports, including those by Hasan et al.[17] and Hasan et al.[18], as well as by Wu et al.[8], who observed a mean age of 62.4 years and male predominance of 63.3%.

Out of 100 patients, 78% were male and 22% were female, giving a male-to-female ratio of 3.6:1. This male preponderance is comparable to other Bangladeshi studies, including those by Hasan et al.[17]. In the current cohort, most patients were from urban backgrounds and of lower socioeconomic status. Businessmen constituted the largest occupational group (26%), followed by housewives (16%) and service holders (14%). Notably, the majority of female patients were housewives.

Hemiplegia was the most frequent presenting symptom, occurring in 92.64% of ischemic stroke and 81.25% of hemorrhagic stroke cases. Other common manifestations included impaired consciousness, sphincter disturbances, and dysphasia, depending on stroke subtype. Neuroimaging with CT was performed in all cases, confirming ischemic stroke in 68% and hemorrhagic stroke in 32% of patients. Hasan et al.[18] also reported similar findings, with 74% ischemic and 26% hemorrhagic cases in his study.

Several vascular risk factors were identified among the stroke patients. Hypertension was the most prevalent, seen in 68% of cases, followed by smoking (42%) and a positive family history of CVD/CAD (30%). These findings are in line with previous studies. Wu et al.[8] reported hypertension in over 50% of cases and current smoking in 33%, while Hasan et al.[18] observed hypertension in 72% of stroke patients. Collectively, these studies strongly support the established association between stroke and hypertension.

With regard to glycometabolic abnormalities, our findings revealed that diabetes and prediabetes were not uniformly identified across the three diagnostic methods (HbA1c, FPG, and OGTT). The degree of overlap between these tests was limited, with each identifying different proportions of patients. FPG detected 18 diabetes and 24 prediabetes cases, while OGTT identified 26 diabetes and 30 prediabetes cases. HbA1c, on the other hand, diagnosed 24 diabetes and 34 prediabetes cases. Notably, OGTT demonstrated the highest yield for diagnosing diabetes (26%), whereas HbA1c was more effective in identifying prediabetes (34%). The detection rate of diabetes by HbA1c was higher than that of FPG but lower than OGTT, consistent with findings from Wu et al.[8]. HbA1c was confirmed to be a feasible tool for diagnosing diabetes, although its concordance with OGTT and FPG was only moderate.

Our finding that HbA1c identified more prediabetes than FPG or OGTT is consistent with Hjellestad et al.[19] and Wu et al.[8], but differs from results by Lorenzo et al. and the National Health and Nutrition Examination Survey [20]. Lorenzo et al.[21] highlighted the low sensitivity of HbA1c (5.7–6.4%) in detecting prediabetes, as many individuals with IFG or IGT may have HbA1c below this range. They emphasized the influence of age, race, and obesity on HbA1c values, cautioning against its use as the sole screening tool. The discrepancy between our results and theirs may be explained by

differences in study populations, as both our patients and those in Hjellestad et al.'s[19] research were more representative of individuals with chronic glycemic overload than general epidemiological samples. HbA1c remains useful for indicating chronic hyperglycemia.

In the present study, the prevalence of prediabetes in first-ever stroke patients was 18% at a tertiary care hospital in Bangladesh. This aligns with the REGARDS study, which reported diabetes in 23.6%, prediabetes in 15.6%, and normoglycemia in 60.8% of participants[22]. Stroke symptoms were most common among those with diabetes (22.7%), followed by prediabetes (15.6%) and normoglycemia (14.9%). U.S. population data also show IFG prevalence of ~26% and IGT prevalence of ~15%, both increasing with age[23]. These findings collectively support our results and highlight the strong association between impaired glucose regulation and stroke risk.

Limitations of the study

This study was not without limitations. The limitations were as follows:

- First, this study was cross-sectional and descriptive, which allowed assessment of the prevalence of prediabetes among stroke patients but not causal relationships. Additionally, we did not include a control group; incorporating one would have enabled evaluation of risk factors for prediabetes and their associations. Therefore, future studies should consider a prospective cohort design with both case and control groups.
- Second, it was a single-center study, including only patients admitted to Sher-E-Bangla Medical College Hospital. As a result, the findings may not be generalizable to the broader population of the country. Larger-scale studies are needed to reach more definitive conclusions.
- Third, the sample was selected using a purposive sampling method, which could introduce personal bias.

Conclusion

This study demonstrated that acute stroke has a strong but often silent association with metabolic disease. The prevalence of prediabetes among patients with first-ever acute stroke was 18%. An important implication of these findings is that individuals with acute stroke should be made aware of their increased risk of developing future diabetes. Several diagnostic methods exist for identifying (pre)diabetes, including fasting plasma glucose, 2-hour postload glucose, and glycosylated hemoglobin (HbA1c) levels. Since the concordance between these tests is not complete, they are considered complementary. Screening for prediabetes after stroke using fasting plasma glucose alone is insufficient; therefore, 2-hour postload glucose and/or HbA1c levels should also be assessed. Our findings further revealed that prediabetes prevalence was higher among male and elderly patients in a tertiary hospital setting in Bangladesh.

Additionally, the study observed that OGTT and HbA1c identified different subsets of patients with diabetes or prediabetes. The overlap between HbA1c and FPG, HbA1c and 2-h PPG, or all three tests was low. Notably, combining FPG, 2-h PPG, and HbA1c reduced the detection rate of prediabetes or diabetes compared with using each test individually.

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Prevalence and Severity of Carotid Artery Stenosis in High-Risk Elderly Patients - A Doppler Ultrasonography Study

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ABSTRACT

Background: *Atherosclerosis and carotid artery stenosis remain major contributors to stroke and cardiovascular morbidity and mortality worldwide, particularly among individuals over 45 years of age. The purpose of the study was to determine the prevalence of carotid stenosis and identify its associated risk factors among elderly patients.* ***Aim of the study:*** *To determine the prevalence and severity of carotid artery stenosis among high-risk elderly patients using Doppler ultrasonography.* ***Methods & Materials:*** *This descriptive cross-sectional study was conducted from September 2012 to February 2013 in the Department of Medicine, Department of Vascular Surgery, and the Institute of Nuclear Medicine and Ultrasound at Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh. A total of 100 elderly patients (>55 years) with one or more risk factors (hypertension, diabetes mellitus, dyslipidemia, or family history of stroke) were selected by convenient sampling. Patients aged <55 years, with carotid aneurysms or congenital anomalies, or unwilling to consent were excluded. Carotid stenosis was defined as ≥50% arterial narrowing (moderate) and ≥70% (severe). Data were collected via structured interviews, clinical examination, and investigations, then analyzed using SPSS with results expressed as mean ± SD or percentages; $p < 0.05$ was considered significant. Ethical approval was obtained, and informed consent was secured from all participants.* ***Results:*** *Among 100 elderly patients (mean age 65.6 ± 8.1 years; 64% males), 73% had carotid stenosis (mild 60%, moderate 7%, severe 6%). Most were sedentary (89%), exercised occasionally (96%), and 63% were smokers. Hypertension (64%), dyslipidemia (58%), ischemic heart disease (42%), and TIA (39%) were common. Significant associations with stenosis were found for hypertension (70% vs 48%, $p = 0.04$), dyslipidemia (48% vs 26%, $p = 0.04$), ischemic heart disease (49% vs 22%, $p = 0.01$), and TIA (45% vs 22%, $p = 0.03$); diabetes/IGT was not significant.* ***Conclusion:*** *Carotid artery stenosis was highly prevalent among high-risk elderly patients, predominantly mild in severity, and showed significant associations with hypertension, dyslipidemia, ischemic heart disease, and transient ischemic attack.*

Keywords: *Carotid Stenosis, Elderly Patients, Risk Factors, Demographic Profile, Tertiary Care.*

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INTRODUCTION

Atherosclerosis remains one of the foremost causes of mortality worldwide and represents a leading source of morbidity among individuals over the age of 45 in most regions[1]. Stroke, or cerebrovascular accident, continues to be a major global health concern, with an incidence ranging from

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0.2 to 2.5 per 1,000 population annually. Each year, around 20 million people are affected by stroke, of whom approximately 15 million survive, while nearly 5 million are left with permanent disability[2],[3].

Carotid artery stenosis is recognized as an important contributor to ischemic stroke, with reports indicating a 5-year cumulative all-cause mortality of about 23.6%[4]. Nearly one in three ischemic strokes is attributed to atherosclerosis of the internal carotid artery[5]. Even asymptomatic carotid artery stenosis exceeding 50% is associated with an annual stroke risk of 2–6%[6]. Moreover, carotid stenosis has been shown to play a role in precipitating cerebral ischemic events in patients with ischemic heart disease who have undergone myocardial revascularization[7].

Numerous studies have highlighted risk factors for significant carotid lesions, including older age, female sex, uncontrolled diabetes, uncontrolled hypertension, peripheral vascular disease, chronic renal dialysis, history of transient ischemic attack or stroke, and multivessel coronary artery disease[8],[9],[10],[11]. Increasing age not only predisposes individuals to the development of carotid stenosis but also increases the likelihood of post-procedural complications, complicating treatment decisions. In addition, both inherited susceptibility and environmental exposures influence the occurrence of atherosclerosis, resulting in considerable variability in its prevalence across different countries and even within regions of the same country[12].

Despite extensive evidence on the role of carotid stenosis in the development of stroke and its association with well-established risk factors, data remain limited regarding the demographic distribution and contributory factors in elderly populations within Bangladesh. Most existing studies have been conducted in Western or other regional contexts, and the variability in genetic, environmental, and lifestyle factors underscores the need for population-specific evaluation. The purpose of the study was to determine the prevalence and severity of carotid artery stenosis among high-risk elderly patients using Doppler ultrasonography.

Methods & Materials

This descriptive cross-sectional study was conducted in the Department of Medicine, Department of Vascular Surgery, and the Institute of Nuclear Medicine and Ultrasound at Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh, between September 2012 and February 2013. A total of 100 elderly patients (>55 years) were enrolled through convenient sampling to assess the prevalence, severity, and associated risk factors of carotid stenosis.

Inclusion criteria

- Patients aged >55 years with one or more of the following risk factors: hypertension, diabetes mellitus, dyslipidemia, or family history of stroke
- Both male and female patients

Exclusion criteria

- Patients or legal guardians who did not provide consent
- Patients aged <55 years
- Patients with carotid aneurysms or congenital anomalies of the carotid vessels

Carotid stenosis was defined as atherosclerotic narrowing of the carotid artery, with ≥70% considered severe and ≥50% moderate. Data were collected through face-to-face interviews using a structured checklist, followed by clinical examination and relevant investigations. Information was checked, coded, and analyzed using SPSS. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Associations were assessed using chi-square or other appropriate statistical tests, with $p < 0.05$ considered significant. The principal investigator supervised all stages of the study to ensure accuracy and consistency. Ethical approval was obtained from the Institutional Review Board of BSMMU, and written informed consent was obtained from all participants after explanation in the local language. Confidentiality was strictly maintained, participation was voluntary, and interviews were conducted privately at a convenient time and place.

RESULTS

In this study, 100 elderly patients were included. The mean age was 65.63 ± 8.13 years (range 55–90), with most patients aged 51–60 years (40%) and 61–70 years (38%). Males predominated (64%) compared to females (36%). Regarding occupation, 36% were housewives, 27% retired, 17% businessmen, 10% farmers, 8% service holders, and 2% others. Socioeconomic status was predominantly middle class (52%), followed by higher class (40%) and low class (8%) (Table I). The majority of participants were sedentary (89%) and engaged in occasional exercise (96%), with only 11% physically active and 4% exercising regularly.

Table – I: Demographic Characteristics of the Study Population (*n* = 100)

Variable		Number of Patients (n)	Percentage (%)
Age (in years)	51–60	40	40.0
	61–70	38	38.0
	71–80	18	18.0
	>80	4	4.0
	Mean ± SD	65.63 ± 8.13	
	Range	55–90	
Sex	Male	64	64.0
	Female	36	36.0

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Occupation	Service holder	8	8.0
	Businessmen	17	17.0
	Farmer	10	10.0
	Housewife	36	36.0
	Retired	27	27.0
	Others	2	2.0
Socioeconomic Status	Low	8	8.0
	Middle	52	52.0
	Higher	40	40.0

Most patients reported a balanced diet (85%) and 15% reported overeating. Smoking was prevalent in 63% of participants. Among medical histories, hypertension was most common (64%), followed by dyslipidemia (58%), ischemic heart disease (42%), diabetes or impaired glucose tolerance (37%), and history of transient ischemic attack (39%) (Table II).

Table – II: Personal History of the Study Population (*n* = 100)

Variable		Frequency (n)	Percentage (%)
Physical Activity	Active	11	11.0
	Sedentary	89	89.0
Exercise Pattern	Regular	4	4.0
	Occasional	96	96.0
Dietary Habit	Balanced Diet	85	85.0
	Overeating	15	15.0
Smoking Status	Smoker	63	63.0
	Non-smoker	37	37.0
Medical History	Hypertension (HTN)	64	64.0
	History of Impaired Fasting Glucose / Impaired Glucose Tolerance / Diabetes Mellitus	37	37.0
	Dyslipidemia	58	58.0
	Ischemic Heart Disease	42	42.0
	Transient Ischemic Attack	39	39.0

Table – III: Distribution and Severity of Carotid Stenosis in the Study Population (*n* = 100)

Outcome	Frequency (n)	Percentage (%)
Normal Findings	27	27.0
Carotid Stenosis	73	73.0
Mild	60	60.0
Moderate	7	7.0
Severe	6	6.0
Total	100	100.0

Table – IV: Association of Risk Factors with Carotid Stenosis in the Study Population (n = 100)

Risk Factor	Carotid Stenosis Present (n = 73)	Carotid Stenosis Absent (n = 27)	Total	p-value
Hypertension (HTN)	51 (69.86%)	13 (48.15%)	64	0.04
IFG / IGT / Diabetes Mellitus (DM)	24 (32.88%)	14 (51.85%)	38	0.08
Dyslipidemia	35 (47.95%)	7 (25.93%)	42	0.04
Ischemic Heart Disease (IHD)	36 (49.32%)	6 (22.22%)	42	0.01
Transient Ischemic Attack (TIA)	33 (45.21%)	6 (22.22%)	39	0.03

Carotid stenosis was present in 73% of patients, with 60% having mild, 7% moderate, and 6% severe stenosis, while 27% had normal findings (Table 3). Hypertension (69.86% vs 48.15%, p = 0.04), dyslipidemia (47.95% vs 25.93%, p = 0.04), ischemic heart disease (49.32% vs 22.22%, p = 0.01), and transient ischemic attack (45.21% vs 22.22%, p = 0.03) were significantly associated with carotid stenosis, whereas diabetes or impaired glucose regulation showed no significant association (32.88% vs 51.85%, p = 0.08) (Table IV).

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DISCUSSION

Carotid stenosis, caused by atherosclerotic narrowing of the carotid arteries, is a major risk factor for ischemic stroke and other cardiovascular events. This study demonstrates a high prevalence of carotid stenosis among elderly patients attending a tertiary care center in Bangladesh, with most cases being mild. The condition was found to be multifactorial, with significant associations observed with advanced age, male sex, sedentary lifestyle, smoking, hypertension, dyslipidemia, ischemic heart disease, and a history of transient ischemic attack. These findings underscore the importance of early detection and targeted interventions in high-risk elderly populations to reduce the burden of cerebrovascular complications.

In the present study, the mean age of the participants was 65.63 ± 8.13 years, with the majority of patients falling within the 51–60 years (40%) and 61–70 years (38%) age groups. This age distribution aligns with Miljković et al.[13], who reported that the prevalence of carotid artery stenosis increases with age, particularly among individuals over 75 years. Males constituted a larger proportion of the study population (64%) compared to females (36%), reflecting the trend described by Joakimsen et al.[14], who observed that the male-to-female ratio of carotid atherosclerosis is higher in earlier age groups but tends to equalize in older age. Regarding socioeconomic status, most participants belonged to the middle (52%) or higher (40%) classes, while a smaller fraction (8%) were from low socioeconomic backgrounds. These findings are consistent with Rosvall et al.[15], who indicated that lower socioeconomic status in women is associated with higher odds of carotid stenosis, suggesting that social determinants may play a role in disease prevalence. Overall, the demographic profile of the study population is in concordance with prior literature, emphasizing the influence of age, sex, and socioeconomic factors on the risk of carotid stenosis in the elderly.

In the present study, the majority of participants were sedentary (89%) and engaged in only occasional exercise (96%), highlighting a predominantly inactive lifestyle among elderly patients with carotid stenosis. Only a small proportion maintained regular physical activity (4%) or were active (11%), which may contribute to disease progression. These findings are in line with Ke et al.[16], who reported that higher levels of physical activity are associated with decreased vulnerability of carotid plaques, suggesting a protective effect against carotid atherosclerosis in older adults. Regarding medical history, hypertension (64%) and smoking (63%) were the most prevalent risk factors, followed by dyslipidemia (58%), ischemic heart disease (42%), diabetes or impaired glucose tolerance (37%), and history of transient ischemic attack (39%). Su et al.[17] similarly concluded that hypertension and smoking are major determinants of carotid stenosis, emphasizing their critical role in the development of carotid artery disease. The high prevalence of these modifiable risk factors in the study population underscores the need for lifestyle modification, blood pressure control, and smoking cessation as key strategies to prevent or slow the progression of carotid stenosis in elderly patients.

In the present study, carotid stenosis was detected in 73% of the elderly participants, while 27% had normal findings. Among those with stenosis, the majority were classified as mild (60%), followed by moderate (7%) and severe (6%) stenosis. These findings are consistent with the study by Kazemi-Bajestani et al.[18], who reported that 27.8% of patients had significant carotid stenosis (≥50%), highlighting a similar prevalence pattern. The predominance of mild stenosis in our study underscores the importance of early detection and monitoring, as timely intervention in these patients may prevent progression to more severe disease and reduce the risk of cerebrovascular events. Overall, the results reinforce the high burden of carotid stenosis in the elderly population and the need for proactive screening in this age group.

In the present study, several cardiovascular risk factors were significantly associated with the presence of carotid stenosis among elderly patients. Hypertension was present in 69.86% of patients with carotid stenosis compared to 48.15% of those without stenosis ($p = 0.04$), underscoring its strong association. This finding aligns with Lu et al., who reported that hypertension markedly elevates the risk of carotid plaque formation and advanced carotid atherosclerosis. Dyslipidemia was present in 47.95% of patients with stenosis versus 25.93% without ($p = 0.04$), further emphasizing the role of lipid abnormalities in carotid artery disease. Ischemic heart disease was reported in 49.32% of patients with stenosis compared to 22.22% without ($p = 0.01$), aligning with Ranjan et al.[7], who found that multivessel coronary artery disease is a strong predictor of carotid artery stenosis, underscoring the link between coronary and carotid vascular pathology. Additionally, a history of transient ischemic attack was more common among patients with stenosis (45.21% vs. 22.22%, $p = 0.03$), indicating the cerebrovascular consequences of carotid narrowing. Although diabetes or impaired glucose regulation was observed in 32.88% of patients with stenosis versus 51.85% without ($p = 0.08$), this association did not reach statistical significance. Overall, these findings highlight the predominance of modifiable cardiovascular risk factors, particularly hypertension, dyslipidemia, and IHD, in the development of carotid stenosis among elderly individuals, reinforcing the need for early risk assessment and targeted management.

Limitations of the study

This study had some limitations, which are as follows:

- The study was conducted at a single hospital, which may not represent the entire country.
- The sample size was relatively small.
- The study period was short, limiting long-term observations.

Conclusion and Recommendation

Carotid stenosis is a common vascular condition among the elderly and plays a critical role in the prognosis of transient ischemic attacks and thromboembolic stroke, often guiding

timely medical or surgical management. In this study, carotid stenosis was significantly associated with hypertension, dyslipidemia, ischemic heart disease, and transient ischemic attack. Detection in individuals without major risk factors was relatively low, indicating that targeted screening of high-risk groups is more effective than population-wide screening. Furthermore, large-scale, multicentre clinical trials are recommended to validate these findings and inform preventive strategies.

Conflicts of Interest

None declared.

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ORIGINAL ARTICLE

A Study on the Clinical Presentation of Stroke Subtypes among Hypertensive Patients in a Tertiary Care Setting

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ABSTRACT

Background: *Stroke is a leading cause of morbidity and mortality, with hypertension being a major modifiable risk factor. Early identification of stroke subtypes is critical for timely management, especially in resource-limited settings.* ***Objective:*** *To assess the clinical presentation and distribution of stroke subtypes among hypertensive patients in a tertiary care hospital.* ***Methods & Materials:*** *This cross-sectional study was conducted in the Department of Medicine, Comilla Medical College Hospital, Comilla, Bangladesh, from January 2013 to June 2013. In this study, a total of 100 hypertensive patients diagnosed with stroke were included.* ***Results:*** *The mean age was 52.8 ± 11 years, with 72% females (male-to-female ratio 1:2.6). Hemiparesis was the most common deficit in ischemic stroke (87.5%), while hemiplegia predominated in haemorrhagic stroke (35%). The basal ganglia and parietal regions were most frequently affected in both subtypes. Unconsciousness occurred in all ischemic cases (100%) versus 50% of haemorrhagic strokes; headache and vomiting were more frequent in haemorrhagic stroke (100% and 90%, respectively). Mean GCS scores were slightly lower in ischemic (9.4 ± 3.1) than haemorrhagic stroke (10.6 ± 2.6).* ***Conclusion:*** *Hypertensive patients demonstrate distinct clinical and anatomical patterns in ischemic and haemorrhagic strokes. Awareness of these differences, along with lipid profile assessment, can support early diagnosis and targeted management, particularly in settings with limited imaging resources.*

Keywords: *Stroke subtypes, Hypertension, Ischemic stroke, Haemorrhagic stroke*

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INTRODUCTION

Stroke is the second leading cause of death worldwide, and in developed countries, it ranks as the third most common cause of mortality [1-3]. With increasing urbanization and lifestyle changes, the global incidence of stroke is on the rise. However, advances in stroke management have helped reduce the number of stroke-related deaths[4-6]. While these developments are more evident in high-income countries, nearly two-thirds of all stroke-related deaths still occur in developing nations[2,3]. Beyond its impact on mortality and morbidity, stroke also imposes a substantial economic and social burden. Identifying risk factors and implementing strategies to control or modify them remain the cornerstone of stroke prevention.

Several risk factors contribute to stroke, including age, male sex, family history, hypertension, diabetes mellitus, dyslipidemia, and cigarette smoking. Among these, hypertension stands out as the most significant modifiable risk factor. Early prediction of clinical presentation and stroke subtype is therefore crucial for appropriate management. Since advanced imaging modalities such as CT scans and MRI are not widely available in all settings, initial clinical judgment continues to play a vital role in the early management of stroke patients.

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Globally, stroke affects women 2.5 times more than men, with an age-adjusted annual death rate of 116 per 100,000 population. The burden is greater in Black African populations compared to Caucasians. Stroke is broadly categorized into ischemic and hemorrhagic types, with ischemic stroke accounting for nearly 80% of cases and hemorrhagic stroke for the remaining 20%. Ischemic stroke may result from cardiac or great vessel embolism (30%), atherothrombosis of large vessels (40%), or lacunar infarction due to small vessel disease (30%). Intracerebral hemorrhage accounts for approximately 30% of all strokes, while subarachnoid hemorrhage represents about 10% of cerebrovascular disease, with an annual incidence of 6 per 100,000[7,8].

The clinical course of stroke depends on its subtype. Hemorrhagic stroke typically presents abruptly with severe headache, vomiting, and rapid deterioration in consciousness[9]. Embolic stroke is also sudden in onset but tends to improve over time unless recurrent emboli occur. In contrast, cerebral infarction often develops gradually and progresses over one or more days until symptoms peak[10]. CT scan remains a simple, non-invasive, and reliable tool to differentiate between ischemic and hemorrhagic strokes, but such facilities are still limited in many regions of Bangladesh.

Although stroke subtypes differ in etiology and presentation, hypertension remains the most important modifiable risk factor for both ischemic and hemorrhagic stroke. Blood pressure reduction has been shown to significantly lower the risk of both types, with an even greater protective effect against hemorrhagic stroke[1,2,3,6]. Predicting the clinical presentation of stroke subtypes in hypertensive patients is therefore essential for timely management and improved outcomes. Moreover, understanding the clinical profile of hypertensive patients with stroke will aid in prevention strategies and better clinical guidance.

Therefore, the present study aimed to predict the clinical presentation of stroke subtypes in hypertensive patients of a tertiary care center.

OBJECTIVE

The objective of the study was to predict the clinical presentation of stroke subtypes in hypertensive patients of a tertiary care center.

METHODS & MATERIALS

This cross-sectional study was conducted in the Department of Medicine, Comilla Medical College Hospital, Comilla, Bangladesh, from January 2013 to June 2013. In this study, a total of 100 hypertensive patients diagnosed with stroke were included. Stroke diagnosis was based on clinical evaluation and confirmed using neuroimaging. Both ischemic and haemorrhagic stroke patients admitted to the Medicine Department of the study institution were enrolled.

These were the following criteria for eligibility as study participants:

Inclusion Criteria

a) Patients aged 20–79 years
b) Diagnosed cases of hypertension (either previously known or newly diagnosed)
c) Patients with first-ever stroke confirmed clinically or radiologically
d) Both male and female patients who were willing to provide informed consent

Exclusion Criteria

a) Patients with transient ischemic attack (TIA) or recurrent stroke
b) Patients with Brain imaging (CT scan) showing tumor, tuberculoma, and brain abscess
c) Patients with metabolic derangement that could explain focal neurological deficit: Hypoglycemia, electrolyte imbalance
d) Patients with underlying coagulopathy, severe liver or kidney disease

Data Collection Procedure: Data were collected through face-to-face interviews using a structured format. The diagnosis of stroke was established based on a detailed history obtained from the patient or attendants, followed by a thorough physical and neurological examination. All patients underwent a CT scan to confirm the type and location of the stroke. Additional investigations, including blood glucose and serum electrolyte levels, were performed to exclude metabolic derangements that could mimic stroke.

Detailed demographic data, clinical features, and relevant laboratory investigations were recorded for all patients. Clinical assessments included the Glasgow Coma Scale (GCS) and evaluation of focal neurological deficits, such as hemiparesis, hemiplegia, monoparesis, and cranial nerve involvement. Lipid profile parameters, including total cholesterol, LDL, HDL, and triglycerides, were measured in all patients. Neuroimaging (CT or MRI) was used to identify the anatomical site and laterality of the stroke. Clinical presentation data were collected, including the level of consciousness, presence of headache, vomiting, vertigo, and whether the stroke onset occurred during rest or activity. Before data collection, proper permission was obtained from the relevant departments. All participants were informed about the purpose and nature of the study, and written informed consent was obtained before enrollment

Statistical Analysis: All data were recorded systematically in a pre-formatted data collection form. Quantitative data were expressed as mean and standard deviation, and qualitative data were expressed as frequency distributions and percentages. The data were analyzed using SPSS 19 (Statistical Package for Social Sciences). This study was ethically approved by the Review Committee of Bangladesh College of Physicians and Surgeons (BCPS).

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RESULTS

Table – I: Age distribution of study population (*n*=100)

Age (in years)	No. of patients	Percentage (%)
20 – 29	03	3
30 – 39	10	10
40 – 49	30	30
50 – 59	40	40
60 – 69	12	12
70 – 79	05	5
Total	**100**	**100**

Table I shows that the age of the study participants ranged from 20 to 79 years. The majority of patients were in the 50–59 years age group, comprising 40% of the study population, followed by the 40–49 years group (30%). Patients aged 60–69 years accounted for 12%, while those between 30–39 years represented 10%. A smaller proportion of patients were in the 70–79 years (5%) and 20–29 years (3%) groups.

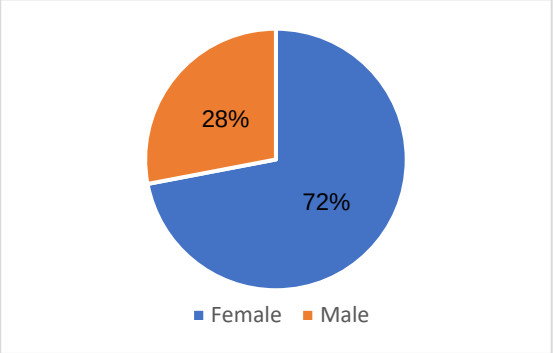

Figure – 1: Gender distribution of study patients

In Figure 1, the pie chart shows that among 100 participants, 28 were male (28%) and 72 were female (72%). The male-to-female ratio was approximately 1:2.6 in this study.

Table – II: Clinical Presentation in Patients with Stroke Subtypes (*n* = 100)

Clinical Presentation	Ischemic Stroke		Haemorrhagic Stroke	
	N=80	P(%)	N=20	P(%)
Unconsciousness	80	100.0	10	50.0
Headache	20	25.0	20	100.0
Vomiting	25	31.3	18	90.0
Vertigo	60	75.0	15	75.0
Activities				
During activity	20	25.0	19	95.0
During rest	60	75.0	1	5.0

Table II shows the distribution of clinical presentations among patients with ischemic and haemorrhagic stroke. All patients with ischemic stroke (100%) presented with unconsciousness, compared to 50% of haemorrhagic stroke patients. Headache was reported in only 25% of ischemic stroke cases, whereas it was universal (100%) among haemorrhagic stroke patients. Vomiting was more frequent in haemorrhagic stroke (90%) than in ischemic stroke (31.3%). Vertigo was equally present in both groups (75%). Regarding activity status, haemorrhagic strokes predominantly occurred during activity (95%), while ischemic strokes were more commonly observed during rest (75%).

Table – III: Lipid Profile in Male and Female Stroke Patients (*n* = 100)

Parameters	Male (n = 28) Mean ± SD	Female (n = 72) Mean ± SD	Overall Mean ± SD
Total Cholesterol (mg/dL)	145 ± 41	155 ± 52	149 ± 47
LDL Cholesterol (mg/dL)	145 ± 30	148 ± 40	129 ± 25
HDL Cholesterol (mg/dL)	34 ± 1.6	34 ± 12.08	34 ± 1.89
Triglycerides (mg/dL)	180 ± 40	182 ± 42	184 ± 41

Table III presents the lipid profile of male and female stroke patients. Overall, the mean total cholesterol was 149 ± 47 mg/dL, with males having slightly lower levels (145 ± 41 mg/dL) compared to females (155 ± 52 mg/dL). LDL cholesterol showed a similar trend, with an overall mean of 129 ± 25 mg/dL. HDL cholesterol levels were comparable between genders, with an overall mean of 34 ± 1.89 mg/dL. Mean triglyceride levels were slightly higher in females (182 ± 42 mg/dL) than in males (180 ± 40 mg/dL), with an overall mean of 184 ± 41 mg/dL.

Table – IV: Distribution of focal lesions in the study population (*n*=100)

Focal lesion	Ischemic Stroke		Haemorrhagic Stroke	
	N=80	P(%)	N=20	P(%)
Monoparesis	3	3.7	0	0.0
Monoplegia	0	0.0	0	0.0
Hemiparesis	70	87.5	13	65.0
Hemiplegia	7	8.8	7	35.0
Quadriparesis	0	0.0	0	0.0
Quadriplegia	0	0.0	0	0.0

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Table IV shows that among patients with ischemic stroke, the most common focal neurological deficit was hemiparesis, observed in 87.5% of cases, followed by hemiplegia in 8.8% and monoparesis in 3.7%. In contrast, patients with haemorrhagic stroke most frequently presented with hemiparesis (65%), while 35% had hemiplegia. No cases of monoplegia, quadriparesis, or quadriplegia were reported in either group.

Table – V: Site of lesion detected on CT scan of brain (*n*=100)

Site	Ischemic Stroke		Haemorrhagic Stroke	
	N=80	P(%)	N=20	P(%)
Frontal				
Right	1	1.3	0	0.0
Left	3	3.8	1	5.0
Parietal				
Right	18	22.5	4	20.0
Left	7	8.8	2	10.0
Temporal				
Right	3	3.8	2	10.0
Left	1	1.3	1	5.0
Occipital				
Right	2	2.5	0	0.0
Left	0	0.0	0	0.0
Basal ganglia				
Right	28	35.0	5	25.0
Left	7	8.8	1	5.0
Thalamus				
Right	3	3.8	2	10.0
Left	2	2.5	0	0.0
Pons	2	2.5	1	5.0
Cerebellum	3	3.8	1	5.0

Table V shows that among patients with ischemic stroke, the basal ganglia were the most commonly affected site, observed in 35% of cases on the right side and 8.7% on the left. The parietal region was the second most frequent site (right 22.5%, left 8.7%), followed by the temporal region (right 3.75%, left 1.25%), frontal region (right 1.25%, left 3.75%), thalamus (right 3.75%, left 2.5%), pons (2.5%), cerebellum (3.75%), and occipital region (right 2.5%). In haemorrhagic stroke, the basal ganglia were also the most frequently involved site (right 25%, left 5%), followed by the parietal region (right 20%, left 10%), temporal region (right 10%, left 5%), frontal region (left 5%), thalamus (right 10%), pons (5%), and cerebellum (5%). The occipital region was not affected in any haemorrhagic cases.

Table – VI: Glasgow Coma Scale (GCS) Scores in Stroke Subtypes (*n* = 100)

GCS Score	Haemorrhagic Stroke n (%)	Ischemic Stroke n (%)
5	7 (8.7%)	4 (20%)
7	6 (7.5%)	2 (10%)
9	30 (37.5%)	6 (30%)
11	17 (21.2%)	4 (20%)
13	12 (15%)	3 (15%)
15	8 (10%)	1 (5%)
Total (N)	80	20
Mean ± SD	10.6 ± 2.6	9.4 ± 3.1

Table VI shows that in haemorrhagic stroke, most patients had a GCS score of 9 (37.5%), followed by 11 (21.2%) and 13 (15%). Lower GCS scores, indicating more severe impairment of consciousness, were less frequent, with scores of 5 and 7 observed in 8.7% and 7.5% of patients, respectively. The mean GCS score for haemorrhagic stroke patients was 10.6 ± 2.6. Among ischemic stroke patients, the most common GCS score was also 9 (30%), followed by scores of 11 (20%) and 13 (15%). Lower scores of 5 and 7 were observed in 20% and 10% of ischemic stroke cases, respectively. The mean GCS score for ischemic stroke patients was 9.4 ± 3.1, slightly lower than that of the haemorrhagic stroke group.

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DISCUSSION

Hypertension remains the most important risk factor for both ischemic and haemorrhagic stroke [7,8]. However, the precise factors that determine which stroke subtype develops in a hypertensive patient are not fully understood. Clinical presentation of stroke is also variable, making early prediction of stroke subtype crucial for management. While imaging techniques such as CT scan and MRI allow definitive diagnosis of ischemic or haemorrhagic stroke, these facilities are not universally available, particularly in resource-limited settings.

In this study, the age of participants ranged from 20 to 79 years, with most patients falling in the 40–49 years group. The mean age was 52.8 ± 11 years. Patients with subarachnoid haemorrhage were younger, with a mean age of 36 years and an age range of 26–42 years; three patients were under 30 years, two of whom were male. Age is a well-recognized risk factor for stroke, with incidence doubling for each decade after 55 in both sexes [10,11]. Interestingly, younger age (<55 years) was found to predict haemorrhagic stroke [12,13]. Ross Russell postulated that early rupture of aneurysms in younger patients is more likely to result in haemorrhage, whereas delayed rupture may allow the aneurysm wall to stretch and thrombose, reducing risk[14]. Early-stage vascular changes in young hypertensive patients, coupled with poor compliance to antihypertensive therapy, may further predispose them to haemorrhagic stroke [13-15].

The role of gender in predicting stroke subtype in hypertensive patients remains controversial. Some population-based studies reported higher odds of ischemic stroke in men (OR 3.51), while others found no significant difference [6,10]. In the present study, no significant gender difference was observed between stroke subtypes. However, women experienced their first-ever stroke at an older age, approximately six years later than men. Ischemic stroke accounted for 84% of cases in men versus 75% in women, and haemorrhagic stroke for 29.59% versus 25% in men and women, respectively. Gender was not significantly associated with stroke subtype (p = 0.01). Women had more frequent in-hospital medical complications (P < 0.01; OR 1.36; 95% CI 1.10–1.68) and longer hospital stays (15.4 ± 12.5 days versus 13.5 ± 11.3 days; P < 0.005), consistent with previous studies[11,16-22]. This may reflect older age and potential delays in managing stroke risk factors at home.

Ischemic heart disease emerged as an independent predictor of ischemic stroke in hypertensive patients. Among 130 patients with infarction, 34 had concomitant ischemic heart disease, and bivariate analysis showed a significant association (p = 0.01). The Framingham study similarly reported a twofold increased stroke risk with coronary artery disease, a threefold increase with ECG evidence of left ventricular hypertrophy, and a three- to fourfold increase with cardiac failure [6,13,14].

Atrial fibrillation (AF), a treatable cardiac risk factor, also significantly increases stroke risk, particularly with advancing age. Nearly half of all cardioembolic strokes occur in the setting of AF [23,24]. The Framingham study found nonvalvular AF independently increased stroke risk three- to fivefold, with the attributable risk rising to 25% in hypertensive patients over 80 [14,24]. In this study, five patients had AF, two of whom also had valvular heart disease, and all experienced ischemic stroke.

Cardiac valve abnormalities, particularly mitral stenosis and mitral annular calcification, are additional risk factors for stroke. The presence of these abnormalities alongside other cardiac risk factors further augments stroke risk, potentially increasing it fivefold [24]. In this study, two patients with mitral valve disease and AF both had ischemic stroke. Similarly, structural abnormalities such as patent foramen ovale and atrial septal aneurysm have been implicated in embolic stroke, particularly in younger patients [6,13,25]. Cigarette smoking also significantly increases stroke risk [6]. In this study, 23.7% of participants were smokers. Relative risk varied by subtype: 1.9 for cerebral infarction, 0.7 for intracerebral haemorrhage, and 2.9 for subarachnoid haemorrhage. Overall relative risk associated with smoking was 1.5 (95% CI 1.4–1.6), with a notable age effect: <55 years 2.9, 55–74 years 1.8, ≥75 years 1.1. Ex-smokers retained a slightly elevated risk (1.2). Smoking cessation was associated with a rapid reduction in stroke risk within 2–4 years. In this cohort, no female smokers were reported, though female smoking does occur in the population.

Glasgow Coma Scale (GCS) scores were recorded for all patients. Median GCS was 11 (95% CI 10–11) in ischemic stroke and 9 (95% CI 9–10) in haemorrhagic stroke. Multivariate regression identified hydrocephalus (P = 0.0014), intracerebral hemorrhage (P = 0.014), ventricular effacement (P = 0.002), and female sex (P = 0.024) as independent predictors of lower GCS scores. Large hemorrhages were associated with lower GCS in intracerebral hemorrhage, while extensive unilateral ischemic strokes also correlated with decreased GCS, though generally less severe. Some limitations exist, as GCS was not always recorded simultaneously with CT, and clinical fluctuations may have affected correlations with imaging findings.

Regarding focal neurological deficits, hemiparesis was the most common sign in ischemic stroke (83.7%), whereas hemiplegia predominated in haemorrhagic stroke (73%). Three cases of monoparesis were observed in ischemic stroke. Cranial nerve involvement, particularly the VII cranial nerve, was more frequently associated with ischemic stroke.

LIMITATIONS OF THE STUDY

This study has several limitations. First, the study was conducted in a single tertiary care center, which may limit the generalizability of the results to other settings or populations. Second, the sample size was relatively small, especially for haemorrhagic stroke patients, which may reduce statistical power for certain subgroup analyses. Third, some clinical assessments, such as the Glasgow Coma Scale, were not always recorded simultaneously with imaging, and fluctuations in patient condition could have affected the correlation with CT findings. Finally, information on long-term outcomes and post-discharge follow-up was not collected, which limits the ability to assess prognosis.

CONCLUSION AND RECOMMENDATIONS

This study highlights the clinical presentation, focal deficits, and anatomical distribution of ischemic and haemorrhagic stroke among hypertensive patients. Hemiparesis was the most common neurological deficit in ischemic stroke, while hemiplegia predominated in haemorrhagic stroke. The basal ganglia and parietal regions were the most frequently affected sites in both stroke subtypes. Haemorrhagic stroke patients tended to present with lower GCS scores and more acute symptoms, whereas ischemic stroke patients often presented with more gradual deficits. Early recognition of stroke subtype based on clinical presentation is critical for timely management, especially in settings with limited access to advanced imaging. These findings underscore the importance of rigorous hypertension control, risk factor management, and awareness of gender- and age-related differences to reduce the burden of stroke.

Future multicenter studies with larger sample sizes and long-term follow-up are warranted to validate the findings of this study.

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ORIGINAL ARTICLE

Clinical Profile and Associated Risk Factors of Urinary Tract Infections in Patients at a Tertiary Care Hospital

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ABSTRACT

Background: *Urinary tract infections (UTIs) are a very common bacterial infection worldwide, and they are significant contributors to morbidity, healthcare costs, and antimicrobial resistance. The presentation, pathogens, and risk factors vary across populations, which necessitates the availability of local epidemiological information for guiding effective management programs.* ***Objective:*** *The aim of this study was to assess the clinical profile and associated risk factors of UTI.* ***Methods & Materials:*** *This cross-sectional observational study was conducted in the Department of Medicine, Comilla Medical College Hospital (CoMCH), Comilla, Bangladesh from 1st January 2018 to 30th June 2018. Total 100 patients aged more than 12 years fulfilling the clinical criteria of UTI, urine R/M/E shows pus cell>10/HPF, urine culture shows number of colony is ≥ 105 CFU/ml were included in this study.* ***Results:*** *The mean age of patients was 55 ± 18.2 years, and females represented 62% of the cases. The affected age group most frequently was 61–70 years (28%). The most common symptoms were urgency (88%). Common comorbidities included diabetes mellitus (34%) and hypertension (23%). The most common pathogen was Escherichia coli (e. coli) (86%), with a significant association between gender and type of pathogen (P < 0.05). Sexually active (72%), female gender (62%), and advanced age (>60 years) (48%) were the primary risk factors.* ***Conclusion:*** *UTIs among this group were most prevalent among sexually active older women, and the most frequent pathogen was E. coli. The findings emphasize the need for prevention and empirical treatment in light of regional data.*

Keywords: *Clinical Profile, Associated Risk Factors, Urinary Tract Infections, and Tertiary Care Hospital.*

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INTRODUCTION

Urinary tract infections (UTIs) are among the most common bacterial infections globally, affecting millions of individuals every year and inflicting significant costs on healthcare systems. They can occur at any age but are most common among women and older adults, with female-to-male ratios in some populations reaching 8:1 because of anatomical and hormonal factors.[1] The global burden of UTIs is widespread. The Global Burden of Disease (GBD) report approximated that UTIs had resulted in millions of outpatient visits and a significant proportion of hospitalizations worldwide, contributing significantly to disability-adjusted life years (DALYs) lost, mainly among elderly individuals.[2] In addition to direct health costs, UTIs have indirect consequences like work absenteeism and chronic complications among vulnerable populations such as pregnant women, diabetics, and individuals with chronic kidney disease.[3]

The clinical presentation of UTIs is characteristically well known, generally consisting of dysuria, urinary frequency and urgency, and suprapubic pain, and in more serious or

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ascending infections, flank pain, fever, and systemic findings.[4] Diagnosis is usually corroborated by laboratory evidence in the form of urinalysis, showing pyuria and/or nitrite test positivity, and by urine culture, which is still considered the "gold standard" for pathogen identification and antimicrobial susceptibility testing. Globally, Escherichia coli is the prevalent isolate of uropathogen responsible for 70–90% of community-acquired UTI cases, followed by Klebsiella pneumoniae, Proteus mirabilis, Pseudomonas aeruginosa, and Enterococcus faecalis.[4,5] However, there has been the concerning rise of antimicrobial resistance (AMR) among these pathogens, particularly with the emergence of extended-spectrum β-lactamase (ESBL) producing E. Escherichia coli and Klebsiella, and carbapenemase-producing strains, that highly limit treatment.[6]

Some risk factors for UTI have been reported in the community as well as in healthcare settings. Female sex, advancing age, diabetes mellitus, chronic kidney disease, immunosuppression, urinary catheterization, past history of antibiotic use, and recent hospital admission are all predictors of enhanced vulnerability.[7,8] Catheter-associated urinary tract infection (CAUTI) is the most common health care-associated infection but is still highly preventable with evidence-based practices of catheter care.[3] Epidemiology and resistance patterns also differ greatly for community-acquired and health care-associated UTIs, the latter often caused by MDR strains.[9] MDR uropathogens are associated with increased lengths of stay, increased morbidity and mortality, and increased expenditure on treatment, especially in tertiary-care facilities where patient turnover is high and there is exposure to antimicrobials.[10] These findings emphasize the need for access to up-to-date, locally applicable antimicrobial susceptibility data to guide empiric therapy and underpin antimicrobial stewardship programs.[11]

Whereas UTI epidemiology and AMR trends are more easily obtained from international and national databases, local trends will differ noticeably due to variations in patient population, referral patterns, healthcare, and infection control. Studies in Nepal, Saudi Arabia, Bangladesh, and Vietnam have shown that pathogen distributions and resistance profiles are institution or region-specific.[5,6,10,12] Despite this, there remains a paucity of comprehensive, integrated studies in the majority of tertiary-care centers, particularly in low- and middle-income countries, integrating clinical presentation, microbiological trends, AMR patterns, and patient-level risk factor analysis all under the same roof. Such data are needed for individualized optimization of empiric antibiotic regimens, improved sensitivity of diagnosis, identification of high-risk groups, and planning focused preventive interventions such as CAUTI reduction initiatives.[13]

The present study was intended to document the clinical, laboratory, and microbiological profile and association of patients diagnosed with UTI in the tertiary care center.

OBJECTIVE

To assess the clinical profile and associated risk factors of urinary tract infections (UTI).

METHODS & MATERIALS

This cross-sectional observational study was conducted among the indoor and outdoor patient in the Department of Medicine, Comilla Medical College Hospital (CoMCH), Comilla, Bangladesh from 1st January 2018 to 30th June 2018. Total 100 patients aged more than 12 years fulfilling the clinical criteria of UTI (fever, frequency of micturation, dysuria, suprapubic pain), urine R/M/E shows pus cell>10/HPF, urine culture shows number of colony is ≥ 105 CFU/ml were included in this study. Patients aged below 12 years who refuse to take part in this study, presented with active menstruation, PID, tubo-ovarian diseasge, appendicitis, colitis, severe other infections e.g. sepsis and were on antibiotic advised to were excluded from this study. Patients Data were collected through a structured proforma, capturing socio-demographic characteristics (age, sex, residence), relevant clinical history (comorbidities, previous UTI episodes, hospitalization, catheterization, and prior antibiotic use), presenting symptoms (dysuria, frequency, urgency, suprapubic pain, fever, flank pain), and laboratory findings. Midstream urine samples were obtained aseptically and subjected to urinalysis followed by culture and sensitivity testing, with significant bacteriuria defined as growth of $\geq 10^5$ colony-forming units/mL. Identification of uropathogens and antimicrobial susceptibility testing was performed using standard microbiological procedures in accordance with Clinical and Laboratory Standards Institute (CLSI) guidelines. Data were entered into and analyzed using SPSS version 25. Descriptive statistics were computed for continuous variables as mean ± standard deviation (SD) and categorical variables as frequencies and percentages. Associations between categorical variables were tested using the Chi-square test, while logistic regression analysis was applied to determine independent predictors of UTI and MDR infection, with a p-value <0.05 considered statistically significant. Ethical approval for the study was obtained from the institutional review board prior to commencement, and informed consent was obtained from all participants.

RESULTS

In the present study, Table I outlines the baseline characteristics of the 100 patients included. The mean age of participants was 55 ± 18.2 years, with ages ranging from 12 to 90 years. The largest age group was 61–70 years (28%), followed by equal proportions in the 20–30 and 71–80-year ranges (16% each). Younger age groups, such as 31–40 years (8%) and 81–90 years (4%), had lower representation. The majority of patients were married (82%) and reported being sexually active (72%), both of which were statistically significant ($P < 0.05$). Education status showed that 68% were educated compared to 32% without formal education, also significant ($P < 0.05$). In terms of gender distribution (Figure 1), females constituted a larger proportion (62%) than males (38%).

Table II summarizes the clinical presentations and co-morbid conditions. Urgency was the most common presenting symptom (88%), followed by abdominal pain (77%), dysuria (68%), and fever (67%). Among co-morbidities, diabetes

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mellitus was most frequent (34%), followed by hypertension (23%) and ischemic heart disease (14%), with other conditions reported in 2% of patients.

Table III presents the distribution of bacterial pathogens isolated from patients. Escherichia coli (E. coli) was the predominant organism, identified in 86% of cases, with a higher prevalence among females (51%) compared to males (35%), a difference that was statistically significant ($P < 0.05$). Klebsiella species accounted for 9% of infections (7% in females, 2% in males), while Enterococcus was detected in 5% (4% in females, 1% in males).

Table IV highlights associated risk factors for urinary tract infection in this cohort. Female sex was the most common risk factor (62%), followed by being sexually active (72%) and advanced age (>60 years, 48%). Comorbidities such as diabetes mellitus (34%), hypertension (23%), and ischemic heart disease (14%) were also notable contributors. Prior antibiotic use was reported by 10% of patients.

Table – I: Baseline characteristics of the study patients (*n*=100)

Characteristics	Frequency	Percentage (%)	P-value
Age group (in years)			
20-30	16	16	P <0.05*
31-40	8	8	
41-50	12	12	
51-60	12	12	
61-70	28	28	
71-80	16	16	
81-90	4	4	
Mean ± SD		55 ± 18.2	
Range (min-max)		12-90	
Marital status			
Married	82	82	P <0.05*
Unmarried	18	18	
Sexual activity			
Active	72	72	P <0.05*
Not active	28	28	
Education status			
Educated	68	68	P <0.05*
Not educated	32	32	

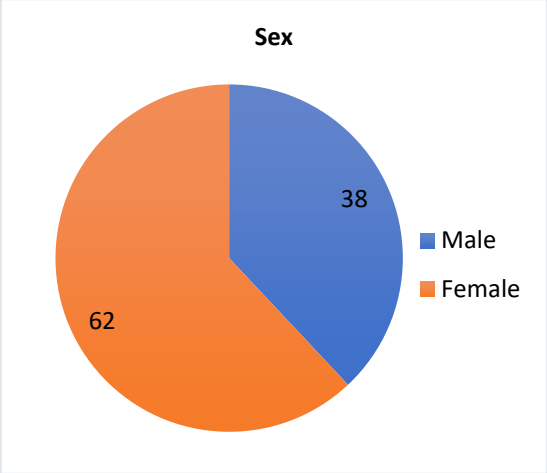

Figure – 1: Sex distribution of the study patients (*n*=100)

Table – II: Clinical presentation of UTI and co-morbid condition of the study patients (*n*=100)

Parameter	Frequency	Percentage (%)
Clinical presentation		
Urgency	88	88
Abdominal pain	77	77
Dysuria	68	68
Fever	67	67
Co-morbid condition		

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Diabetes mellitus	34	34
Hypertension	23	23
Ischemic Heart Disease	14	14
Others	2	2

Table – III: Distribution of bacterial pathogen among the study patients (*n*=100)

Pathogen	Male (%)	Female (%)	Total	P-value
Escherichia coli	35	51	86	P <0.05*
Klebsiella	2	7	9	
Enterococcus	1	4	5	
Total	**38***	**62***	**100**	

Table – IV: Associated risk factors among the study patients (*n*=100)

Risk Factors	Frequency	Percentage (%)
Female sex	62	62
Advanced age (>60 years)	48	48
Sexually active	72	72
Diabetes mellitus	34	34
Hypertension	23	23
Ischemic Heart Disease	14	14
Prior antibiotic use	10	10

DISCUSSION

The present study is an in-depth analysis of demographic profile, clinical presentation, microbiological profiles, and risk factors of patients reporting with urinary tract infection (UTI) in a tertiary care center. The age group of the participants was 55 years with a significant proportion being above 60 years, supporting the known fact that the prevalence of UTI increases with increasing age.[14] Women comprised 62% of cases, which is consistent with the global epidemiologic patterns attributing the higher incidence among women to anatomical and physiological causes.[15] The majority of patients were married (82%) and sexually active (72%) being consistent with previous studies indicating sexual activity to be a significant risk factor, particularly in women, since sexual activity provides a potential for urogenital bacterial transfer.[15] In clinical presentation, the most frequent symptom was urgency (88%), followed by abdominal pain (77%), dysuria (68%), and fever (67%).

The symptom pattern is consistent with that described by Mody and Juthani-Mehta[16], who noted frequency and urgency as common complaints in older adults with UTIs, whose relative proportions vary within populations. The prevalent rate of abdominal pain in this research could be explained by variations in patient perception, reporting style, or geographical variation in disease severity and health-seeking attitude. In terms of comorbidities, the most common (34%) was diabetes mellitus, followed by hypertension (23%) and ischemic heart disease (14%). Similar patterns have also been observed in population-based epidemiological studies, for example, that of Grandy et al.[17], which documented elevated UTI prevalence and recurrence rates among type 2 diabetic patients due to impaired immune function and bacterial growth promoted by glycosuria. Hypertension and ischemic heart disease, although less directly implicated in UTI pathogenesis, may possibly contribute indirectly through vascular changes affecting renal function and host defense capacity.[16] Microbiological analysis revealed Escherichia coli (E. coli) as the most prevalent uropathogen, taking 86% of the isolates.

This finding agrees with a number of studies worldwide where E. coli is the leading causative agent in community- and hospital-acquired UTIs.[18] The strong association between the pathogen type and gender in this study, where E. coli more frequently recovered from females, supports the pathogen's uniformly reported predominance in females due to urethral proximity to the rectum and comparative urethral shortness.[15] Klebsiella (9%) and Enterococcus (5%) came next as the most frequent isolates, as in local surveillance reports implicating these organisms as emerging uropathogens, especially in health care-associated infections.[19] Concurrent risk factor analysis confirmed the multifactorial etiology of susceptibility to UTI.

Sex (72%) was the predominant factor, in agreement with earlier studies documenting recent sexual exposure as the single best predictor of UTI onset.[15] Female sex (62%) and advanced age (>60 years) in 48% of patients also represent validated risk strata.[14] Diabetes mellitus, in 34% of patients, was again a major factor, in agreement with data that diabetic patients are more susceptible to complicated UTIs as well as infection with drug-resistant organisms.[20] Pre-exposure to antibiotics (10%), although less common, has been recognized as a driver of antimicrobial resistance, and thus the importance of stewardship programs.[17] Comparison with other studies of similar design supports the results of the present research in both strengthening and augmenting current evidence.

A higher proportion of urgency and pain patients, and the relatively low rates of prior antibiotic consumption, may reflect regional epidemiological heterogeneity. The dominance of E. coli is in stable concordance with worldwide trends, but high incidences of Klebsiella and Enterococcus species suggest continued local surveillance because of their implication for multidrug resistance. Further, the strong association of sexual behavior, female sex, and very old age with the status of UTI reaffirms the need for gender- and age-specific targeted prevention.

CONCLUSION

This study concludes that urinary tract infection predominantly affected middle-aged and elderly women, with pain in the abdomen and urgency being the predominant symptoms. Escherichia coli remained the most prevalent pathogen, and there were strong associations with risk factors such as sex, female, and diabetes mellitus. The resistance pattern described here underscores the need for focused empirical treatment and effective infection prevention and control. These findings highlight the importance of local epidemiological data in guiding antimicrobial stewardship and clinical decision.

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ORIGINAL ARTICLE

The Prevalence of Thrombocytopenia in Chronic Liver Disease Due to Hepatitis B and C Infection

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ABSTRACT

Background: *Chronic liver disease (CLD) is a major global health challenge, with hepatitis B virus (HBV) and hepatitis C virus (HCV) being the predominant causes. Thrombocytopenia is a frequent hematological complication of CLD, reflecting disease severity and influencing management. However, data regarding its prevalence in Bangladeshi patients remain limited.* ***Objective:*** *This study aimed to determine the prevalence of thrombocytopenia among patients with CLD due to HBV and HCV infection and to evaluate its distribution by age, sex, and disease severity.* ***Methods & Materials:*** *This cross-sectional observational study was conducted at the Department of Medicine of Dhaka Medical College Hospital and Anwar Khan Modern Medical College Hospital from June to November 2011. One hundred patients with CLD secondary to HBV or HCV infection, diagnosed using clinical, serological, and imaging criteria were enrolled. Demographic information, platelet count, and Child-Pugh classification were also recorded. Data were analyzed using SPSS version 16.* ***Results:*** *Among the 100 patients with CLD, 79 had HBV-related and 21 had HCV-related diseases. The mean age was 42.3 ± 11.4 years, with a male predominance. Thrombocytopenia (<150×10^9/L) was observed in 28 patients with HBV (35.4%) and nine with HCV (42.9%). Its prevalence increases significantly with disease severity, occurring in almost all Child-Pugh Class C patients.* ***Conclusion:*** *Thrombocytopenia is a common finding in HBV- and HCV-related CLD, particularly in advanced disease, underscoring its clinical and prognostic significance. Regular platelet monitoring should be integrated into patient management to improve risk assessment and the treatment outcomes.*

Keywords: *Chronic liver disease, Hepatitis B, Hepatitis C, Thrombocytopenia.*

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INTRODUCTION

Chronic liver disease (CLD) is a major cause of morbidity and mortality in the world, as a result of its progression to cirrhosis and hepatocellular carcinoma. Acute and chronic hepatitis B virus (HBV) and hepatitis C virus (HCV) infection are two of the most notable causes of CLD, and collectively they affect hundreds of millions of people across the world [1,2]. These infections place disproportionately heavy burdens in South Asia, where HBV is known to be the most frequent cause of cirrhosis, followed by HCV [3,4].

Chronic viral hepatitis follows the natural history of progressive hepatic fibrosis and may progress to cirrhosis. Together with structural and functional degradation of the liver, patients likely develop hematological abnormalities, one of which, thrombocytopenia, is especially frequent. Such a complication, besides being an indicator of a high stage of

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disease, also makes the clinical management of CLD complex [5]. Several processes are involved in thrombocytopenia related to chronic hepatitis: hypersplenism as a result of portal hypertension, failure of thrombopoietin synthesis by the diseased liver, bone marrow suppression and immune-mediated destruction of platelets [6].

Thrombocytopenia is highly prevalent in CLD patients and is greatly subject to study population, disease stage, and etiology. This is demonstrated by a systematic review, which showed that, based on a prevalence rate of HCV-related cirrhosis and chronic liver disease, it was about 24%. However, the prevalence rate rose considerably in cirrhotic or decompensated conditions [7]. Less prominent and more scarcely researched is a stronger association of HBV infection and thrombocytopenia in advanced fibrosis or cirrhosis [8]. Both causes of the virus etiologies thus constitute significant sources of the burden of platelet anomalies in the affected groups.

Thrombocytopenia is clinically and prognostically important in addition to its hematological presentation. The presence of low platelet counts is often used as a surrogate indicator of portal hypertension and progressive fibrosis, which clinicians use to determine the severity of the disease condition without invasive testing [9]. In addition, the occurrence of thrombocytopenia complicates all diagnostic and treatment approaches. Specifically, patients who have low platelets are more susceptible to bleeding during liver biopsies or endoscopies [10]. In the same way, antiviral agents, especially interferon-based regimens, once used to treat HCV, were frequently restricted by hematologic side-effects in thrombocytopenia patients requiring dose reduction or discontinuation of treatment [11].

There is still insufficient local evidence in Bangladesh to characterize the magnitude of thrombocytopenia in CLD patients, as the prevalence of HBV and HCV is very high there. Although the international studies can deliver precious information, the differences in epidemiology of the viruses, demographics of patients, and the availability of care point out the necessity of data that fit the specific context. The prevalence and the pattern of thrombocytopenia in Bangladeshi HBV- and HCV-associated CLD patients would be of special interest to clinical decision-making, risk stratification, and the structuring of the treatment plans.

This study was therefore designed to determine the prevalence of thrombocytopenia in CLD patients due to HBV and HCV infection in Bangladesh. By assessing platelet counts across different age groups, sexes, and Child-Pugh classes, the study provides valuable evidence to inform both clinical practice and future research in hepatology.

OBJECTIVE

The objective of the study was to determine the prevalence of thrombocytopenia among patients with CLD due to HBV and HCV infection and to evaluate its distribution by age, sex, and disease severity.

METHODS & MATERIALS

This cross-sectional observational study conducted at the Department of Medicine, Dhaka Medical College Hospital and Anwar Khan Modern Medical College, Dhaka, Bangladesh, from June 2011 to November 2011. A total of 100 patients with chronic liver disease due to Hepatitis B and Hepatitis C infection for more than 6 months were included in this study based on the selection criteria.

Inclusion criteria:

- All diagnosed patients of chronic liver disease.
- Serological evidence by presence of HBsAg and Anti-HCV.
- Patients and/or legally accepted guardians, who have given consent for the study.

Exclusion criteria:

- Patients of chronic liver diseases due to other causes (e.g. Alcohol, drugs)
- Evidence of any acute viral infection or acute febrile illness (e.g. Dengue)
- History of any blood diseases. (e.g. ITP, Leukemia, Aplastic anemia)
- History of taking any cytotoxic/myelotoxic drugs.
- Patients who are unwilling to take part in the study.

Data collection procedure: Patients admitted to the Department of Medicine of DMCH and Anwar Khan Modern Medical College Hospital with features of CLD due to hepatitis B or hepatitis C infection were initially seen by duty doctors in the corresponding department. The researcher was then informed via mobile phone. The researcher then evaluated the patients. Detailed history and clinical examination were performed with special attention to the hepatobiliary system and any clinical features of thrombocytopenia. After screening, if the patient was thought to be likely due to CLD, they were screened out, while the inclusion criteria were followed for enrollment. After enrollment, the patients or attendants were interviewed by the researcher using a structured case record form after obtaining written informed consent. Blood sample was taken for complete blood count with peripheral blood film, viral serology for HBsAg and Anti-HCV, serum bilirubin, serum alanine aminotransferase (S.ALT), serum albumin, prothrombin time (PT), USG of whole abdomen, endoscopy of upper GIT. All patients were assessed using the Child-Pugh classification. Patients aged <40 years constituted Group A aged >40 years were labelled as Group B.

Data Processing and Analysis: All collected questionnaire were checked very carefully to identify any error in the data. Using the statical package for social sciences (SPSS) version 16, data were processed.

Ethical Implications: Ethical approval for the study was obtained from the Ethical Review Committee of Dhaka Medical

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College. All patients were provided with detailed information regarding the objectives, procedures, potential risks, and benefits of the study through verbal explanation and printed handouts. Informed written consent was obtained before enrollment, following adequate counselling. Participants were assured of confidentiality, and their right to withdraw from the study at any stage without consequences was respected.

RESULTS

This study evaluated the prevalence of thrombocytopenia in patients with chronic liver disease (CLD) secondary to hepatitis B virus (HBV) and hepatitis C virus (HCV) infections. A total of 100 patients were included, of whom 79 had HBV-related CLD and 21 had HCV-related CLD. The results are presented in two tables and three figures, focusing on demographic characteristics, disease severity, and prevalence of thrombocytopenia.

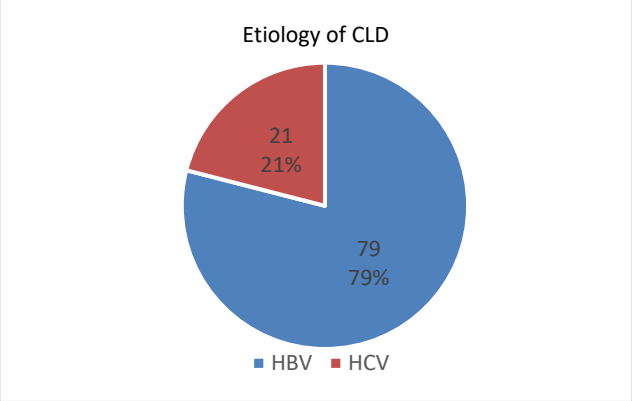

Figure – 1: Etiological distribution of chronic liver disease patients (*n*=100)

Figure 1 illustrates the relative proportions of HBV and HCV as causes of CLD. HBV accounted for the majority (79%) of cases, while HCV contributed 21%.

Table – I: Age and Sex Distribution of the Patients with Chronic Liver Disease (*n*=100)

Variable		Total (n=100)	HBV (n=79)	HCV (n=21)
Age	Mean ± SD (years)	42.3 ± 11.4	42.4 ± 11.4	44.9 ± 9.9
	<40 years, n (%)	64 (64.0)	52 (65.8)	12 (57.1)
	≥40 years, n (%)	36 (36.0)	27 (34.2)	9 (42.9)
Sex	Male, n (%)	72 (72.0)	65 (82.3)	7 (33.3)
	Female, n (%)	28 (28.0)	14 (17.7)	14 (66.7)

Table I presents the demographic distribution of CLD patients according to viral etiology. The mean age was 42.3 ± 11.4 years for all patients, with HBV cases averaging 42.4 ± 11.4 years and HCV cases averaging 44.9 ± 9.9 years. Among patients younger than 40 years, HBV was more frequent (65.8%) compared to HCV (57.1%). Males predominated overall (72%), particularly in HBV cases (82.3%), whereas HCV cases showed a higher female proportion (66.7%).

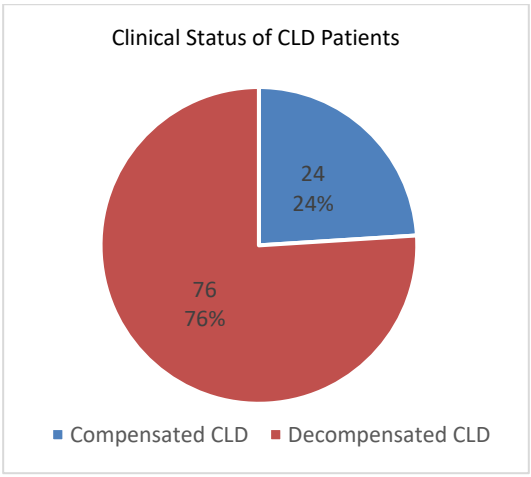

Figure – 2: Clinical status of chronic liver disease patients (compensated vs decompensated)

Figure 2 shows the distribution of clinical status among patients, stratified into compensated and decompensated CLD. The majority presented with decompensated disease, highlighting advanced clinical manifestations at the time of evaluation.

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Table – II: Child-Pugh Class and Prevalence of Thrombocytopenia by Etiology (*n*=100)

Child-Pugh Class	All CLD (n=100)	HBV (n=79) – with TCP n (%)	HCV (n=21) – with TCP n (%)
A	24	0 / 18 (0.0)	1 / 6 (16.7)
B	43	1 / 33 (3.0)	3 / 10 (30.0)
C	33	27 / 28 (96.4)	5 / 5 (100.0)
Total TCP	37	28 / 79 (35.4)	9 / 21 (42.9)

Table II describes the distribution of Child-Pugh classes and the occurrence of thrombocytopenia. Among all CLD patients, 24 were classified as Class A, 43 as Class B, and 33 as Class C. Thrombocytopenia was rare in Classes A and B but was highly prevalent in Class C. Specifically, 96.4% of HBV-related and 100% of HCV-related Class C patients exhibited thrombocytopenia. Overall, thrombocytopenia was present in 35.4% of HBV patients and 42.9% of HCV patients.

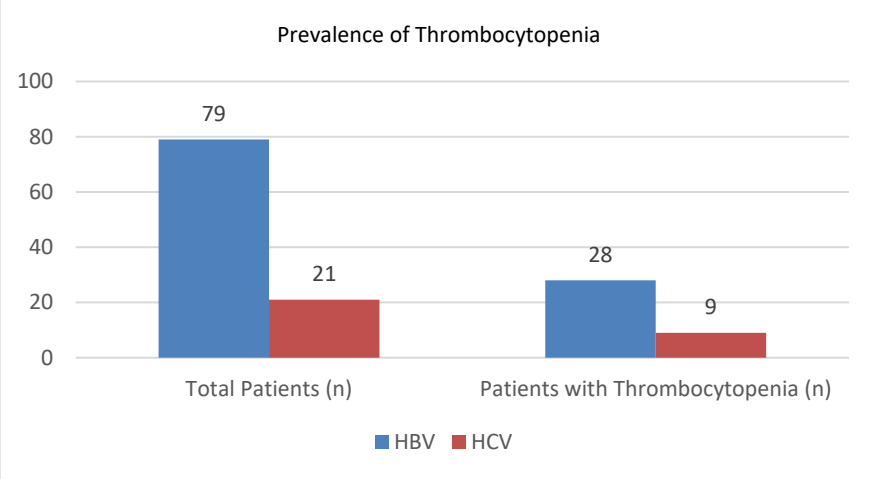

Figure – 3: Prevalence of thrombocytopenia in CLD due to HBV and HCV

Figure 3 highlights the prevalence of thrombocytopenia ($<150\times10^9$/L) among patients. Thrombocytopenia was detected in 28 of 79 HBV patients (35.4%) and 9 of 21 HCV patients (42.9%), demonstrating a considerable burden of hematological abnormalities in both viral etiologies.

DISCUSSION

This study assessed the prevalence of thrombocytopenia in patients with chronic liver disease (CLD) due to hepatitis B virus (HBV) and hepatitis C virus (HCV) infections. The findings demonstrated that thrombocytopenia was present in 35.4% of HBV-related CLD cases and 42.9% of HCV-related CLD cases. Moreover, its prevalence was significantly higher among patients with advanced disease (Child-Pugh Class C), highlighting the close association between disease severity and platelet reduction.

The findings of this study correlate with earlier studies that have also signified the association of viral hepatitis-related CLD with thrombocytopenia. A high correlation has been reported between HCV infection and decreased platelet counts in hyper additional evidence of this has also been reported in a hyperendemic community, showing that thrombocytopenia can be used as a barrier marker of disease progression [12]. Likewise, a central part of thrombocytopenia pathogenesis was also shown by Adinolfi et al., who further support our results, indicating that low platelet counts are more prevalent at advanced stages [13].

In HBV-associated CLD, we identified thrombocytopenia as present in more than one-third of the patients, and present almost universally in Child-Pugh Class C patients. These results share similar findings with those of Nwokediuko and Ibegbulam, who reported quantitative platelet alterations in HBV-related liver disease [8]. Karasu et al. also found close links between liver fibrosis and reduced peripheral platelet count in HBV and HCV patients on lending more credence to the logic behind the fact that disease progression is a cause of hematological abnormalities [14].

The pathophysiology of thrombocytopenia in CLD has a multifactorial nature. Portal hypertension-induced hypersplenism is well well-known contributor [15]. Decreased hepatic thrombopoietin production has also been a possible culprit, with Rios et al. pointing out its importance in the context of the cirrhotic patient [16]. Also, in viral hepatitis, there may be autoantibodies to platelets, altering the thrombocytopenia process. As Pereira et al. and Panzer et al. demonstrated, platelet autoantibodies are found in chronically diseased liver, especially in HCV, despite thrombocytopenia not being clinically significant [17,18].

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Our finding of increased prevalence of thrombocytopenia in HCV patients compared to that of HBV patients is similar to previous studies. A systematic review by Louie et al. observed that thrombocytopenia is quite common in chronic HCV, and it is commonly linked with advanced fibrosis and portal hypertension [7]. Furthermore, immune-mediated mechanisms might be more dominant in the HCV-associated cases since Pockros et al. reported immune thrombocytopenic purpura in chronic cases of HCV [19].

Clinical implications of these findings are significant. Thrombocytopenia is not only a complication of routine management but also threatens in the event of bleeding during a diagnostic or therapeutic intervention. Findings in Seeff et al., noting a greater incidence of complications with liver biopsies in patients with advanced CLD, are of particular interest in the Bangladesh setting, where liver biopsy is commonly used in diagnosis and staging purposes [10]. Moreover, thrombocytopenia further restricts the application of antiviral therapy, namely, interferon-based regimens, which are on-going use even in poor-resource settings. McHutchison et al. showed that low platelet counts distorted treatment compliance and preserved successful virological management, prompting the change or interference of doses [11].

Other relevant issues are the prognostic importance of thrombocytopenia. Qamar et al. also emphasized hematological changes, including thrombocytopenia, as predictive factors of disease progression and poor outcomes of the patients with cirrhosis [9]. Predominantly, Nahon et al. reported that platelet count in combination with serum albumin was a predictor of mortality in patients with HCV-related cirrhosis [20]. Collectively, these experiments support the importance of platelet count as a non-invasive disease severity parameter.

The results we have obtained are quite comparable in terms of prevalence when compared to international statistics. Such as Benhava et al. presented data on thrombocytopenia in 39 percent of patients with CLD caused by HBV or HCV, which is very close to our data [21]. Nonetheless, epidemiology and access to care often vary locally and could affect the stage of presentation. Decompensated disease resulting in late presentation is a common problem in Bangladesh, which was observed in our study, where most of the patients were at advanced stages of the Child-Pugh classes and it possibly led to the increased prevalence of thrombocytopenia.

In summary, this study confirms that thrombocytopenia is a common hematological abnormality in CLD due to HBV and HCV, particularly in advanced stages. Its prevalence and association with disease severity highlight its role as a clinical marker and predictor of outcomes. Early recognition and monitoring of platelet counts are essential in optimizing the management of these patients, especially in resource-constrained settings where invasive diagnostics are not always feasible.

LIMITATIONS OF THE STUDY

The study's cross-sectional design and hospital-based sampling may limit generalizability, as patients presenting to tertiary centers often represent more severe cases. Additionally, the relatively small sample size and lack of bone marrow studies restricted exploration of other etiologies of thrombocytopenia. Despite these limitations, the research highlights an important clinical burden.

CONCLUSION

This study demonstrates that thrombocytopenia is a frequent complication in patients with chronic liver disease (CLD) due to HBV and HCV infection, with prevalence rates of 35.4% and 42.9%, respectively. The occurrence of thrombocytopenia was closely associated with advanced disease, particularly among Child-Pugh Class C patients, highlighting its value as a marker of disease severity. These findings emphasize the need for routine platelet monitoring in CLD management, especially in resource-limited settings where invasive diagnostics may not be feasible. Early recognition can facilitate risk stratification, guide therapeutic decisions, and reduce procedure-related complications in this vulnerable patient group.

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