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Implication of DM on ICU Admitted Patients: A Study of 582 Cases

Mohammad Jakir Hossain[1*], Mohammad Niamul Kabir Khan Siddique[2], Mohammad Mahbub Ahsan[3], Niaz Mostafa[4], Sharmin Ahmed[5]

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*Corresponding Author

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ABSTRACT

Background: *Diabetes in Intensive Care Unit patients is linked to metabolic and organ complications and can affect clinical results. While overall death rates may not consistently be elevated in diabetics, they frequently face increased risks associated with glycemic issues and other health conditions. This study intends to assess the effects of diabetes on ICU results, such as mortality, duration of stay, complications, and to determine significant predictors of unfavorable prognosis in critically ill individuals.* ***Methods & Materials:*** *This cross-sectional research in a Bangladeshi ICU incorporated 582 patients to evaluate the effects of diabetes on ICU results, complications, and antibiotic usage. Medical records were used to gather data, analyzed through SPSS, and ethical approval along with patient confidentiality was maintained.* ***Results:*** *Out of 582 ICU patients, 55.3% were diagnosed with diabetes, with prevalence rising as age increased. ICU results were comparable, with 58.2% improved or discharged and 52.6% fatalities among diabetics. Complications were more frequent in diabetics: acute kidney injury 77.8% and metabolic crises 69.4%, whereas neurological emergencies occurred more often in non-diabetics 78.8%. The use of antibiotics was generally alike, although non-diabetics had higher use of cephalosporins and antifungals.* ***Conclusion:*** *Diabetes frequently occurred in ICU patients and was associated with complications; however, ICU duration, mortality rates, and antibiotic use were comparable to non-diabetics, highlighting the importance of vigilant monitoring and customized management.*

Keywords: *Intensive Care Unit, Diabetes mellitus, Antibiotics.*

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1. *Associate Professor, Department of Cardiology, Anwer Khan Modern Medical College Hospital, Dhaka, Bangladesh (ORCID: 0009-0004-0247-9315)*
2. *Assistant Professor, Consultant Department of ICU, Anwer Khan Modern Medical College Hospital, Dhaka, Bangladesh (ORCID: 0009-0003-2921-9030)*
3. *Assistant Professor, Department of Medicine, Manikgonj Medical College Hospital, Manikgonj, Bangladesh (ORCID: 0000-0002-0778-478X)*
4. *Classified Specialist, Department of Medicine, Combined Military Hospital, Chattogram, Bangladesh (ORCID: 0000-0003-1100-7884)*
5. *Junior Consultant, Department of Cardiology, Bangladesh Specialized Hospital, Dhaka, Bangladesh (ORCID: 0000-0002-3111-0849)*

INTRODUCTION

Diabetes mellitus refers to a collection of conditions characterized by elevated blood glucose levels due to inadequate insulin production or function, resulting in long-term hyperglycemia and possible harm to the eyes, kidneys, nerves, heart, and blood vessels [1]. Diabetes mellitus has been demonstrated to negatively affect outcomes in critically ill patients in the ICU, correlating with higher mortality rates in specific contexts like surgical critical care compared to non-diabetic individuals [2].

In critically ill patients, hyperglycemia, hypoglycemia, and increased glucose variability are each independently linked to higher ICU mortality [3]. The clinical significance of HbA1c in critically ill patients, especially those with undiagnosed diabetes, remains underexplored. Recent evidence shows admission HbA1c independently predicts ICU mortality in septic diabetic patients [4]. Hyperglycemia occurs in 50–85% of ICU patients and is associated with worse outcomes in myocardial infarction, surgery, stroke, and trauma. Its exact prevalence is unclear due to varying definitions, patient populations, and glucose measurement methods [5].

A large systematic review and meta-analysis of ICU admissions found that diabetes per se was not associated with increased overall ICU, in-hospital, mortality in general medical, mixed, or trauma ICUs. However, diabetic patients admitted after cardiac surgery had significantly higher mortality than non-diabetic patients — highlighting ICU-specific effects of DM on outcomes [6]. In a cohort of ICU patients, overall mortality and long-term quality of life did not differ significantly between diabetic and non-diabetic patients, although patients with diabetes-related comorbidities had a higher mortality risk after ICU admission [7].

Retrospective cohort data from ICU patients showed that hypoglycemia was significantly associated with higher ICU mortality in both diabetic and non-diabetic patients, while mean glucose and glucose variability were related to mortality mainly in non-diabetic patients, suggesting complex interactions between glycemic control and outcomes depending on diabetes status [3]. Several studies have found that hyperglycemia in critically ill patients (with or without DM) is associated with increased adverse outcomes, including higher mortality, emphasizing the importance of glucose management in ICU care [8]. In critically ill patients with COVID-19 pneumonia, diabetes was associated with significantly higher ICU mortality compared to non-diabetic and high-glycaemia groups, and glycemic variability further predicted worse outcomes [9].

A multicenter retrospective study of ICU COVID-19 patients in Bangladesh found that diabetes mellitus was the most common comorbidity, along with hypertension and heart disease, and

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that comorbid patients had worse clinical outcomes and higher ICU mortality during the study period [10]. A different study in Bangladesh revealed that numerous hospitalized COVID-19 patients had diabetes, with a significant percentage facing mortality and needing ICU treatment. Advanced age, reduced oxygen saturation, and heightened levels of inflammation and coagulopathy indicators were linked to poorer outcomes, highlighting the importance of prompt monitoring and intervention in diabetic individuals [11].

In Bangladesh, most studies on diabetes in ICU patients are single-center, retrospective, and COVID-19–focused, with limited data on non-COVID critically ill patients, glycemic control, ICU outcomes, and long-term prognosis. Large, multicenter prospective studies are lacking. The aim of this study was to evaluate the impact of diabetes mellitus on clinical outcomes, including ICU mortality, length of stay, and need for intensive care, and to identify key predictors of poor outcomes among ICU-admitted patients.

METHODS & MATERIALS

Study Design and Setting

This was a hospital-based observational cross-sectional study conducted to evaluate the implication of diabetes mellitus on patients admitted to the Intensive Care Unit (ICU). The study was carried out in the Intensive Care Unit of Anwer Khan Modern Medical College Hospital in Bangladesh, which provides critical care services to both medical and surgical patients. The study was conducted over a period of 12 months, from July 2024 to June 2025.

Study Population

The study population included all patients admitted to the ICU during the study period who fulfilled the inclusion criteria.

Inclusion Criteria

- Patients admitted to the ICU during the study period
- Patients with complete clinical and treatment records
- Patients who stayed in the ICU for more than 24 hours

Exclusion Criteria

- Patients admitted for observation only and discharged within 24 hours
- Patients with incomplete or missing medical records
- Readmissions during the same hospital stay (only the first ICU admission was included)

Sample Size and Sampling Technique

A total of 582 ICU-admitted patients meeting the inclusion criteria were included in the study using a consecutive sampling technique.

Data Collection Procedure

Data were collected using a pre-designed structured data collection form. Information was extracted from patient medical records, ICU charts, laboratory reports, and treatment sheets. The collected variables included demographic characteristics, comorbidities with particular focus on diabetes mellitus, duration of ICU stay, major complications during ICU stay, antibiotic usage patterns, and patient outcomes (improved/discharged, death, or discharged against medical advice). Diabetes mellitus status was determined based on documented prior diagnosis or ongoing treatment at the time of ICU admission. The data collection was performed by trained research personnel, ensuring accuracy and completeness, and all information was anonymized to maintain patient confidentiality.

Outcome Measures

The primary outcomes were ICU mortality and duration of ICU stay. Secondary outcomes included major ICU-related complications, and patterns of antibiotic use among diabetic and non-diabetic patients.

Statistical Analysis

Data were entered and analyzed using SPSS version 27. Categorical variables were expressed as frequency and percentage, while continuous variables were expressed as mean ± standard deviation. Associations between diabetes mellitus and categorical variables were assessed using the Chi-square test or Fisher's exact test, as appropriate. A p-value of <0.05 was considered statistically significant.

Ethical Considerations

Ethical approval was obtained from the Institutional Review Board (IRB) of Anwer Khan Modern Medical College Hospital. As this was a record-based observational study, informed consent was waived, and confidentiality was maintained by anonymizing all patient data and restricting access to the research team.

RESULTS

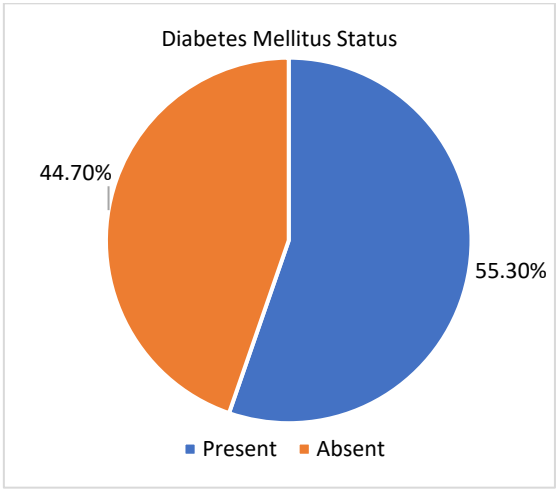

Figure I: Prevalence of Diabetes Mellitus Among ICU-Admitted Patients (*n* = 582)

Prevalence of Diabetes Mellitus

Figure I show A total of 582 patients admitted to the intensive care unit (ICU) were included in the analysis. Among patients admitted to the intensive care unit, 55.3% were found to have diabetes mellitus (DM).

Demographic Characteristics

Table I shows that the incidence of diabetes mellitus rises with age, remaining quite low in individuals younger than 30 and reaching its peak in those aged 50 and older, with a statistically significant correlation ($p = 0.001$). While there were marginally more females than males with diabetes, the difference lacked significance ($p = 0.348$).

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Table I Demographic Characteristics by DM Status

Characteristic	DM	Non-DM	Total	p-value
Age (in years)				
<30	1(2.0)	49(98.0)	50	0.001*
30–49	42(43.3)	55(56.7)	97	
50–69	184(64.3)	102(35.7)	286	
≥70	95(63.8)	54(36.2)	149	
Sex				
Male	167(53.5)	145(46.5)	312	0.348
Female	155(57.4)	115(42.6)	270	

Note: Statistical significance was assessed using Chi-square test. p < 0.05 was considered statistically significant and is indicated by an asterisk (*).

ICU Duration and Patient Outcomes by DM Status

Table II presents Diabetic individuals comprised 54–100% of ICU stays, with every patient remaining for over 14 days being diabetic (n = 5). In terms of outcomes, 58.2% of those improved/discharged and 52.6% of those who died had diabetes, yet the differences were not statistically significant (ICU duration p = 0.166; outcome p = 0.215), suggesting no strong link between diabetes and ICU stay or outcomes.

Table II ICU Duration and Outcomes by DM Status

Variable	DM	Non-DM	Total	p-value
ICU duration (days)				
0-3	207(54.0)	176(46.0)	383	0.166
4–7	83(58.5)	59(41.5)	142	
8–14	26(52.0)	24(48.0)	50	
>14	5(100.0)	0	5	
Outcome				
Improved / Discharged	196(58.2)	141(41.8)	337	0.215
Death	80(52.6)	72(47.4)	152	
DAMA / Others	45(48.9)	47(51.1)	92	

Note: Comparisons between diabetic and non-diabetic patients were performed using the Chi-square test or Fisher's exact test, as appropriate; DAMA = Discharge Against Medical Advice.

Major Complications by DM Status

Table III demonstrates the distribution of major complications among patients with and without diabetes. Among diabetic patients, acute kidney injury (AKI/Acute on CKD) was significantly more common (77.8% vs. 22.2%, p = 0.001), as was metabolic/electrolyte crises (69.4% vs. 30.6%, p = 0.010). Conversely, neurological emergencies occurred predominantly in non-diabetic patients (78.8% vs. 21.2%, p = 0.001).

Other complications, including acute respiratory failure, septic shock/severe sepsis, cardiac emergencies, aspiration pneumonia, hypovolemic/hemorrhagic shock, and trauma/surgical complications, did not differ significantly between diabetic and non-diabetic groups (all p > 0.05).

Table III Major Complications by DM Status

Complication	DM	Non-DM	Total	p-value
Acute respiratory failure	127(54.0)	108(46.0)	235	0.608
Septic shock / Severe sepsis	94(56.0)	74(44.0)	168	0.847
AKI / Acute on CKD	147(77.8)	42(22.2)	189	0.001*
Cardiac emergency	5(62.5)	3(37.5)	8	0.484
Neurological emergency	7(21.2)	26(78.8)	33	0.001*
Aspiration pneumonia	40(56.3)	31(43.7)	71	0.855
Metabolic / Electrolyte crisis	50(69.4)	22(30.6)	72	0.010*
Hypovolemic / Hemorrhagic shock	14(56.0)	11(44.0)	25	0.557
Trauma / Surgical complication	12(42.9)	16(57.1)	28	0.122

Note: Statistical significance was assessed using Chi-square test or Fisher's exact test, where applicable. p < 0.05 was considered statistically significant and is indicated by an asterisk (*). AHF = Acute Heart Failure; AKI = Acute Kidney Injury; CKD = chronic kidney disease.

Antibiotic Use by DM Status

Table IV shows Diabetic and non-diabetic patients received similar classes of antibiotics for most treatments, with no significant differences for carbapenems, BL-BLI combinations, polymyxins, fluoroquinolones, glycopeptides, lincosamides, aminoglycosides, tetracyclines, macrolides, oxazolidinones, penicillins, antivirals, anti-TB drugs, or other agents (p > 0.05). Cephalosporins were used more frequently in non-diabetics (p = 0.046), while antifungals were significantly more prescribed in non-diabetics than diabetics (p = 0.001), suggesting a differential pattern for these specific drug classes.

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Table IV Antibiotic Use by DM Status

Antibiotic Class	DM	Non-DM	Total	p-value
Carbapenems	131(55.5)	105(44.5)	236	0.942
BL-BLI combinations	71(59.2)	49(40.8)	120	0.335
Cephalosporins	52(46.8)	59(53.2)	111	0.046*
Polymyxins	23(53.5)	20(46.5)	43	0.801
Fluoroquinolones	83(59.3)	57(40.7)	140	0.280
Glycopeptides	27(54.0)	23(46.0)	50	0.832
Lincosamides	44(63.8)	25(36.2)	69	0.133
Aminoglycosides	12(60.0)	8(40.0)	20	0.424
Tetracyclines / Glycylcyclines	14(73.7)	5(26.3)	19	0.078
Macrolides	8(72.7)	3(27.3)	11	0.195
Anaerobe coverage	7(38.9)	11(61.1)	18	0.118
Oxazolidinones	9(52.9)	8(47.1)	17	0.515
Penicillins (Non-BL-BLI)	12(46.2)	14(53.8)	26	0.223
Antifungals	5(20.8)	19(79.2)	24	0.001*
Antivirals	19(50.0)	19(50.0)	38	0.302
Anti-TB drugs	0(0)	1(100.0)	1	0.447
Others	34(56.7)	26(43.3)	60	0.825

Note: p < 0.05 indicates statistical significance (*). Statistical comparisons were performed using Chi-square test or Fisher's exact test. BL-BLI = Beta-lactam/Beta-lactamase inhibitor.

Overall, diabetes mellitus was not associated with ICU mortality or length of ICU stay, but it was significantly associated with certain cardiovascular and shock-related complications and differences in antibiotic use patterns.

DISCUSSION

In this study, 55.3% of ICU patients were found to have diabetes, indicating a significant prevalence of this condition in critically ill individuals. This is consistent with earlier research indicating that ICU patients with known or undiagnosed diabetes frequently exhibit poorer glycemic control and increased mortality compared to non-diabetic patients (13.8% vs 11.4%, p < 0.01) [12].

The prevalence of diabetes worse with age, starting at 2% to 63.8% (p = 0.001). A marginally higher percentage of females had diabetes, but this difference was not significant (p = 0.348). These results align with a Bangladeshi study indicating that 61% of individuals over 50 had diabetes, showing no noteworthy gender disparity [13].

In our study Patients with diabetes comprised a significant portion of ICU admissions, including all prolonged stays, and the results for both diabetic and non-diabetic groups were comparable, showing no meaningful differences in ICU length of stay or discharge outcomes. A multicenter ICU study similarly found that a significant number of critically ill patients had diabetes; while these individuals needed more insulin and faced increased glucose variability, the overall ICU mortality and length of stay were comparable to those of non-diabetic patients [6].

Diabetes had a strong correlation with acute kidney injury and metabolic/electrolyte crises, whereas neurological emergencies were more prevalent in patients without diabetes. According to Kaur et al. (2023), ICU patients with diabetes faced a twofold increased risk of AKI compared to non-diabetic individuals, encountered greater metabolic disturbances, and had prolonged ICU stays, emphasizing the importance of early monitoring and intervention for this group [14].

Antibiotic utilization was generally comparable among diabetic and non-diabetic ICU patients, with no notable disparities in most antibiotic categories; however, cephalosporins and antifungals were prescribed more often in non-diabetics. This trend aligns with studies indicating that although diabetic patients frequently get broad-spectrum antibiotics in critical care, resistance trends and sensitivity can differ based on the infection and patient population, making tailored therapy based on susceptibility findings essential for improving outcomes [15].

Overall Diabetes was common among ICU patients and linked to a higher likelihood of complications, including acute kidney injury and metabolic issues. Although it did not notably impact ICU duration, results, or the majority of antibiotic consumption, these results underscore the importance of vigilant observation, prompt action, and tailored treatment in critically ill patients with diabetes.

CONCLUSION

Diabetes mellitus was very common among ICU patients, especially in older populations, and was strongly linked to complications like acute kidney injury and metabolic/electrolyte crises. While diabetic patients did not exhibit notable differences in ICU duration, death rates, or the majority of antibiotic utilization compared to non-diabetics, there were variations in particular drug categories and specific complications between the groups. These results emphasize the importance of careful observation, prompt action, and tailored management approaches for diabetes patients in intensive care environments.

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