

ORIGINAL ARTICLE

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 $\geq 50\%$ arterial narrowing (moderate) and $\geq 70\%$ (severe). Data were collected via structured interviews, clinical examination, and investigations, then analyzed using SPSS with results expressed as mean $\pm$ 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

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

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).

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 ($\geq 50\%$), 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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