Journal of Molecular Science

Journal of Molecular Science
Volume 35 Issue 4, Year of Publication 2025, Page 1641-1645
DoI-10.004687/1000-9035.2025.213

Journal of Molecular Science

www.jmolecularsci.com ISSN:1000-9035

Incidence and Severity of Carotid Artery Stenosis Among Patients Undergoing Coronary Artery Bypass Graft (CABG) Surgery A Hospital-Based Study

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Article Information
Received: 15-09-2025
Revised: 08-10-2025
Accepted: 17-11-2025
Published: 26-12-2025

Keywords
Carotid Artery Stenosis, Coronary Artery Bypass Graft (CABG) Surgery, Incidence

ABSTRACT

Background: Cardiovascular diseases, including coronary and carotid artery disease, are major causes of morbidity and mortality. Carotid artery stenosis (CAS), often due to atherosclerosis, increases stroke risk, particularly in patients undergoing coronary artery bypass graft (CABG) surgery. While CAS prevalence is low in the general population (~4%), it is substantially higher in patients with coronary artery disease, ranging from 30–70%, with severe CAS increasing perioperative stroke risk. Data from Bangladesh remain limited. **Methods:** A hospital-based cross-sectional study was conducted from March 2017 to February 2019 at Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh, including 112 adult elective CABG patients. Data on demographics and clinical variables were collected using a structured form. CAS was evaluated by duplex ultrasonography, classified by severity and laterality, and CAS burden scores were calculated. Descriptive statistics summarized the data, Chi-square tests assessed associations with laterality, and t-tests compared CAS burden scores. A p-value <0.05 was considered significant. **Results:** Among 112 patients undergoing CABG, 56.2% were ≥60 years, 78.6% were male, and BMI was nearly evenly distributed between normal (50.9%) and overweight (49.1%). Carotid artery stenosis (CAS) was present in 68% of patients. Among those with CAS, 55.3% had mild, 38.2% moderate, 5.3% severe stenosis, and 1.3% total occlusion. Unilateral CAS was observed in 61.8% and bilateral in 38.2% of cases. Bilateral involvement and higher CAS burden scores were significantly more common in older patients, while sex and BMI showed no significant association with CAS laterality or burden. **Conclusion:** CAS was common among CABG patients, predominantly mild to moderate and mostly unilateral. Older age was associated with bilateral disease and higher CAS burden, while sex and BMI had no significant impact. Routine preoperative carotid screening, especially in older patients, is important to reduce perioperative cerebrovascular risk.

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INTRODUCTION:

Cardiovascular diseases (CVDs) affect the heart, blood, and blood vessels, with common manifestations including coronary artery, carotid artery, and peripheral vascular diseases. Carotid artery stenosis (CAS), caused by atherosclerotic plaque formation, can lead to stroke, making early detection and treatment crucial. In 2013, stroke was the second leading cause of death globally, causing 6.5 million deaths (AHA).[1] CAS is the narrowing of the carotid arteries, usually due to atherosclerotic plaque buildup that reduces cerebral blood flow and increases stroke risk. It results from endothelial injury caused by factors such as hypertension, diabetes, smoking, and dyslipidemia. Diagnosis is primarily done through carotid duplex ultrasonography, with CTA or MRA for confirmation. Management includes medical therapy (antiplatelets, statins, risk control) and, in selected cases, revascularization by carotid endarterectomy or stenting.[2] Coronary artery bypass graft (CABG) surgery is a procedure that restores blood flow to the heart by creating a new pathway around blocked or narrowed coronary arteries using a vein or artery graft. It is mainly performed in patients with severe coronary artery disease to relieve angina, prevent heart attacks, and improve survival.[3]

In the general adult population, the prevalence of CAS is relatively low; however, in patients with CAD, the frequency is markedly higher due to systemic atherosclerosis. For instance, one review reported that while CAS in the general adult population approaches around 4 %, in patients with CAD it may reach between 30 % and 70 %.[4] Specifically, among patients undergoing CABG, the reported incidence of significant carotid stenosis (for example ≥50 % narrowing) ranges widely: some studies have found rates up to 36 %.[5] The clinical relevance of this overlap is underscored by the fact that CAS is an independent risk factor for peri-operative stroke and increased mortality in the setting of CABG, making its detection and severity assessment crucial in surgical risk stratification.[6] Despite this, there remains variability in reported prevalence, severity thresholds, and local data—especially in low- and middle-income settings—thus motivating hospital-based epidemiological assessment of CAS in the CABG population. A recent cross-sectional study in Bangladesh found a prevalence of 13.5 % of CAS among IHD patients scheduled for CABG, with multiple comorbidities significantly associated.[7]

Globally, studies show that carotid artery stenosis (CAS) is a common comorbidity among patients undergoing coronary artery bypass graft (CABG) surgery.[8] reported that severe CAS increases perioperative stroke risk fourfold, while[9] found an 8–14% prevalence of severe CAS in CABG patients.[7]noted significant CAS (≥50%) in 12–22% of cases, and observed a 13.5% prevalence with strong links to hypertension, diabetes, and dyslipidemia. [10] reported post-CABG stroke rates of 1.6–3%, confirming CAS as a major contributor. These studies highlight CAS as a frequent and clinically significant risk factor that warrants routine screening before CABG.

A single-center study involving 210 elderly CABG candidates (≥60 years) found bilateral carotid plaque in 12.2% of patients, with significant stenosis (>50%) present in 17.4% of the right carotid arteries and 33.3% of the left carotid arteries (PubMed ID: 37777895). These findings indicate that CAS is a notable comorbidity in Bangladeshi CABG patients and underscore the need for routine preoperative carotid evaluation to minimize perioperative cerebrovascular complications.[11] The aim of this study is to determine the prevalence and assess the severity of carotid artery stenosis among patients undergoing coronary artery bypass graft (CABG) surgery in a hospital-based setting in Bangladesh, and to identify associated risk factors to guide preoperative screening and perioperative management strategies.

MATERIALS AND METHODS:

Study design: This was a hospital-based, cross-sectional study conducted among patients scheduled for coronary artery bypass graft (CABG) surgery from March 2017 to February 2019 at the Department of Cardiac Surgery, Bangabandhu Sheikh Mujib Medical University, Shahbagh, Dhaka, Bangladesh.

Study population and size: A total of 112 adult patients undergoing elective CABG surgery were enrolled. Inclusion criteria included patients diagnosed with coronary artery disease requiring surgical revascularization. Patients with prior carotid interventions or incomplete clinical data were excluded.

Data collection tools and procedure: Data were collected using a structured form capturing demographic and clinical information, including age, sex, and BMI. Carotid artery stenosis (CAS) was assessed using duplex ultrasonography, with severity categorized as mild, moderate, severe, or total occlusion and laterality recorded as unilateral or bilateral. CAS burden scores were calculated for each patient. All measurements and entries were verified for accuracy.

Data analysis: Descriptive statistics summarized baseline characteristics and CAS data. Continuous variables were presented as mean ± SD, and categorical variables as frequency and percentage. Associations between categorical variables and CAS laterality were assessed using Chi-square tests, while differences in mean CAS burden scores were analyzed with independent t-tests. A p-value <0.05 was

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considered significant.

RESULTS:

Baseline Characteristics of the Participants

A total of 112 patients undergoing CABG surgery were included in this study. The mean age distribution showed that 49 patients (43.8%) were under 60 years, while 63 patients (56.2%) were 60 years or older. The majority were male (88, 78.6%), and 57 patients (50.9%) had a normal body mass index (BMI), whereas 55 patients (49.1%) were overweight (Table 1).

Table 1. Baseline Characteristics of the Participants (n = 112)

Variable	Category	Frequency (%)
Age	<60 years	49 (43.8%)
	≥60 years	63 (56.2%)
Sex	Male	88 (78.6%)
	Female	24 (21.4%)
BMI	Normal	57 (50.9%)
	Overweight	55 (49.1%)

Incidence of Carotid Artery Stenosis (CAS)

Out of 112 patients, 76 (68%) had CAS, while 36 (32%) had no stenosis (Figure 1).

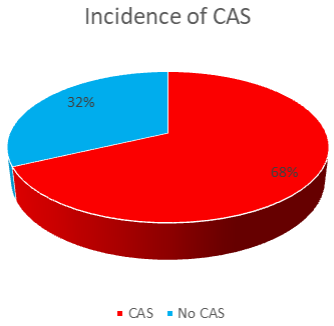

Figure 1. Incidence of CAS in patients undergoing CABG expressed as frequency and percentage.

Severity of CAS

Among the 76 patients with CAS, 42 (55.3%) had mild stenosis, 29 (38.2%) had moderate stenosis, 4 (5.3%) had severe stenosis, and 1 (1.3%) had total occlusion (Figure 2).

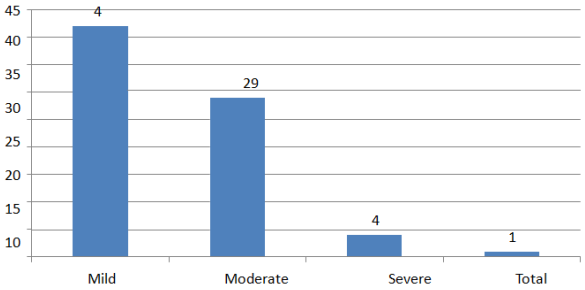

Figure 2. Distribution of CAS severity among CAS-positive patients.

Carotid Artery Involvement:

Of the 76 patients with CAS, 47 (61.8%) had unilateral involvement, while 29 (38.2%) had bilateral involvement (Figure 3).

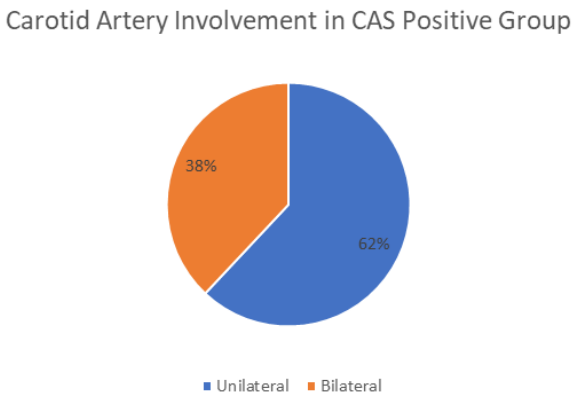

Figure 3. Laterality of carotid artery involvement in CAS-positive patients.

Carotid Artery Involvement (Laterality Analysis)

Bilateral CAS is more common in older patients, but sex and BMI do not significantly affect laterality. (Table 2)

Table 2: Laterality of CAS by Age, Sex, and BMI (n = 76 CAS-positive patients)

Variable	Category	Unilateral (n, %)	Bilateral (n, %)	Total (n)	p-value
Age	<60 years	20 (76.9%)	6 (23.1%)	26	0.03*
	≥60 years	27 (54.0%)	23 (46.0%)	50	
Sex	Male	35 (61.4%)	22 (38.6%)	57	0.48^{ns}
	Female	12 (63.2%)	7 (36.8%)	19	
BMI	Normal	28 (61.0%)	18 (39.0%)	46	0.62^{ns}
	Overweight	19 (63.3%)	11 (36.7%)	30	

***Chi-square test; ns = not significant**

CAS Burden Score Analysis:

CAS burden score is significantly higher in older patients, but there is no significant difference by sex or BMI.

Table 3: Mean CAS Burden Score by Age, Sex, and BMI (n = 76 CAS-positive patients)

Variable	Category	Mean CAS Burden Score ± SD	p-value
Age	<60 years	1.8 ± 1.2	0.002*
	≥60 years	3.1 ± 1.4	
Sex	Male	2.5 ± 1.5	0.72^{ns}
	Female	2.6 ± 1.6	
BMI	Normal	2.4 ± 1.3	0.52^{ns}
	Overweight	2.6 ± 1.6	

***t-test; ns = not significant**

DISCUSSION:

In table 1 of this study of 112 CABG patients, 56.2 % were ≥60 years, 78.6 % were male, and 21.4 % were female; BMI was nearly evenly split between normal (50.9 %) and overweight (49.1 %). These findings align with other CABG cohorts, which typically show older age and male predominance, while females are

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fewer and often older at surgery. BMI distributions vary regionally, with some Western studies reporting higher overweight/obesity prevalence.[12,13]

According to figure 1 In this study of 112 patients undergoing Coronary Artery Bypass Grafting (CABG), 76 patients (68 %) were found to have concomitant Carotid Artery Stenosis (CAS), while 36 patients (32 %) had no CAS. When compared with other published studies, the incidence of CAS in this cohort is notably higher. For example, a single-center study of 450 CABG candidates reported CAS ≥50 % in 18.7 % of patients.[18] while a retrospective study of 402 CABG patients found any carotid disease in 69 % and severe stenosis (>75 %) in 13.5 %.[14]

Among 76 CAS patients, 55.3% had mild, 38.2% moderate, 5.3% severe stenosis, and 1.3% total occlusion. Compared to other CABG cohorts, our study shows a higher proportion of mild CAS and fewer severe or occluded cases.[9,10][Figure 2]

Among 76 CAS patients, 61.8% had unilateral and 38.2% had bilateral involvement. Compared to other CABG cohorts, the rate of bilateral involvement is relatively higher, though differences may reflect variations in stenosis definitions and screening methods. [Figure 3][15]

In table 2 76 patients with carotid artery stenosis (CAS), bilateral involvement was significantly more common in older patients (46.0% in those ≥60 years vs 23.1% in <60 years; $p = 0.03$), while sex (male 38.6% vs female 36.8%; $p = 0.48$) and BMI (normal 39.0% vs overweight 36.7%; $p = 0.62$) showed no significant association with laterality. The CAS burden score was also higher in older patients but did not differ by sex or BMI. These findings are consistent with previous studies in CABG populations, which similarly identify advanced age as a key risk factor for bilateral carotid disease, while sex and BMI have limited or no significant influence. For example, studies have reported that age is strongly associated with bilateral CAS, whereas female gender and BMI do not consistently predict laterality or disease burden.[16]

In table 3 76 CAS patients, the mean CAS burden score was significantly higher in older patients (<60 y: 1.8 ± 1.2 vs ≥60 y: 3.1 ± 1.4; $p = 0.002$), while sex (male 2.5 ± 1.5 vs female 2.6 ± 1.6; $p = 0.72$) and BMI (normal 2.4 ± 1.3 vs overweight 2.6 ± 1.6; $p = 0.52$) showed no significant effect. These findings align with other CABG studies identifying age as a key determinant of CAS severity, with sex and BMI having limited influence [7,9].

CONCLUSION:

Carotid artery stenosis is a common and clinically significant comorbidity in patients undergoing coronary artery bypass graft (CABG) surgery, with most cases being mild to moderate and predominantly unilateral. Advanced age is a key determinant of both bilateral involvement and higher CAS burden, highlighting the increased vulnerability of older patients to perioperative cerebrovascular complications. In contrast, sex and BMI appear to have minimal influence on the presence, laterality, or severity of CAS. These findings underscore the importance of comprehensive preoperative carotid assessment in all CABG candidates to identify high-risk individuals, optimize surgical planning, guide individualized perioperative management, and implement strategies to minimize stroke and other serious cerebrovascular events.

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