



## Management Of Asymptomatic Carotid Artery Disease In Patients Undergoing CABG In A Tertiary Care Centre In Eastern India: A Retrospective Observational Study

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### ABSTRACT

**Background and aim:** Atherosclerosis is a systemic disease that typically affects multiple arterial beds of the same patient. The incidence of coexisting coronary and carotid artery disease varies between 2% and 14%, and 8% of patients undergoing coronary artery bypass grafting (CABG) have a significant stenosis in an extracranial carotid artery. In this study, we tried to compile current evidence to prepare some strategies for the best management of coexisting severe carotid disease in patients admitted for CABG. We also aim to reduce the risk of neurological complications following CABG.

**Material and methods:** Our study was a retrospective observational study. The results were prepared by statistical analysis of our collected demographic data. In the study, we observed 30 patients admitted to the CTVS department of IPGMER and SSKM Hospital who underwent CABG over a 1.5-year period.

**Results:** Individuals who had received preoperative treatment for coexisting extracranial carotid artery disease before CABG have a decreased occurrence of postoperative focal neurological deficits and a reduced history of postoperative CVA.

**Conclusions:** Patients with high-grade carotid stenosis who have undergone cardiac surgery are at increased risk for perioperative stroke. Carotid stenosis should only be surgically treated before coronary surgery in people who are at high risk for a stroke during surgery. In these patients, the risk of a cerebral embolism is likely to be mostly due to carotid atherosclerosis. A staged surgical approach is recommended. Stenting of carotid arteries represents a less invasive alternative for high-risk surgical patients.

### 1. Introduction

The incidence rate of cerebrovascular accidents after CABG ranged between 1.2% and 4.2%. The most common risk factors were advanced age, previous history of stroke, atrial fibrillation, carotid artery disease, and diabetes mellitus.<sup>[1]</sup> Song et al. established that male sex, tobacco addiction, diabetes and hypertension were significant risk factors for increased thickness of the carotid intima-media and formation of carotid plaque. They also revealed that older age was a risk factor for carotid stenosis.<sup>[2]</sup> Some studies reported that the prevalence of carotid stenosis varied according to race. They revealed that Native Americans and Caucasians had the highest prevalence of carotid stenosis, whereas African American males and Asian females appeared to have the lowest prevalence.<sup>[3]</sup> The risk of cardiovascular disease and carotid lesion-derived stroke increases manyfold in advanced carotid

atherosclerosis, which is defined as 50% or more stenosis. Therefore, it is recommended through guidelines that carotid revascularisation should be done in patients with 70% or more asymptomatic stenosis or 80% or higher according to their condition.<sup>[4]</sup> The stroke risk is highest among patients with previous strokes or ischaemic attacks. The risk also correlates with the severity of the underlying carotid atherosclerosis. A review of the literature shows a stroke rate of 3% in asymptomatic coronary artery bypass grafting (CABG) patients with unilateral 50–99% carotid stenosis, 5% in those with bilateral 50–99% stenosis, and 7–11% in individuals with carotid occlusion.<sup>[5]</sup> Therefore, the coexistence of severe carotid artery stenosis and symptomatic coronary artery disease represents a serious treatment dilemma. We can perform carotid revascularization using either carotid end-

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arterectomy (CEA) or CAS in conjunction with CABG. In asymptomatic patients undergoing CABG surgery, CAS with brain protection is feasible, safe, and could be an excellent alternative to CEA. Carotid angioplasty and stenting are evolving as valid alternatives to carotid endarterectomy. A few small studies have shown that the complication rate in patients who have undergone carotid angioplasty and stenting followed by CABG is significantly lower than in patients who have undergone combined carotid endarterectomy and open-heart surgery.<sup>[6]</sup> So, in this study, we tried to compile current evidence in CABG to prepare some strategies for optimal management of coexisting severe carotid and coronary disease. We also tried to reduce the risk of neurological complications following CABG.

## 2. Material and methods

In the department of cardiothoracic and vascular surgery (CTVS) at the IPGME&R and SSKM Hospital, Kolkata, West Bengal, India, we have conducted this retrospective observational hospital-based study from June 2021 to January 2023. We evaluated thirty patients with coronary artery disease admitted to the CTVS ward and who underwent CABG operation. All hemodynamically unstable patients were excluded from our study. All the participants included in the study had provided written informed consent for

the surgery. We analyzed the available hospital data in detail- the history, clinical examination, and investigations done, particularly regarding concomitant carotid artery disease in these patients. In our study, we evaluated the risk factors for carotid artery stenosis. We recorded the clinical characteristics such as age, sex, history of hypertension, history of dyslipidaemia, and history of type 2 diabetes (T2DM). We noted the presence of any signs of dyspnoea, bipedal oedema, or focal neurodeficiency from the available data. We assessed the effectiveness of the different investigations, such as ultrasound color Doppler study and CT-angiography of the bilateral carotid arteries. We also evaluated the patients based on their treatment, follow-up, and other factors. We expressed the data as frequency, percentage, and range depending on the distribution.

## 3. Results

We collected data from hospital records and identified 30 patients with asymptomatic carotid artery disease who had undergone CABG over the years. To evaluate parameters with superior classification accuracy, we used SPSS (version 24) for statistical analysis. Table 1 shows the clinical and biochemical parameters; thus, the distribution of carotid artery stenosis can be summarised.

Table 1. Clinical and biochemical characteristics expressed as frequency, percentage.

Clinical and Biochemical characteristics		Frequency (Percentage) (n = 30)
Age (In years)	40-50 years	6 (20.0%)
	51-60 years	12 (40.0%)
	61-70 years	9 (30.0%)
	>70 years	3 (10.0%)
Sex	Female	6 (20.0%)
	Male	24 (80.0%)
Involvement of coronary arteries	DVCAD	2 (6.7%)
	SVCAD	2 (6.7%)
	TVCAD	26 (86.7%)
	Both Involved	2 (6.7%)
Carotid involvement in Doppler	Mild	11 (36.7%)
	Moderate Involvement	2 (6.7%)
	Nil	15 (50.0%)
Type 2 Diabetes Mellitus	No	5 (16.7%)
	Yes	25 (83.3%)
Hypertension	No	13 (43.3%)
	Yes	17 (56.7%)

Dyslipidaemia	No	5 (16.7%)
	Yes	25 (83.3%)
Carotid angiogram	20% stenosis	2 (6.7%)
	50% stenosis	1 (3.3%)
	60% stenosis	1 (3.3%)
	70% stenosis	2 (6.7%)
	Minor plaque	9 (30.0%)
Pre-op carotid stenting	Nil	15 (50.0%)
	Done	4 (13.3%)
	Not done	26 (86.7%)
Involvement of lower limb arteries	Mild	7 (23.3%)
	Moderate	20 (66.7%)
Pre-op history of CVA	Severe	3 (10.0%)
	No	28 (93.3%)
	Yes	2 (6.7%)
Pre-op focal neuro deficit	No	28 (93.3%)
	Yes	2 (6.7%)

Our study found that six individuals (20%) belonged to the age category of 40–50 years, while 12 individuals (40%) belonged to the age range of 51–60 years, 9 (30%) of them belonged to 61–70 years of age, and the remaining three individuals (10%) were above 70 years of age. Out of the population, six individuals (20%) were female, while 24 individuals (80%) were male. In this study, the majority of participants (86.7%) had a diagnosis of triple vessel coronary artery disease (TVCAD). In comparison, 6.7% of each group had single or double-vessel coronary artery disease (SVCAD or DVCAD). Doppler showed no symptoms of carotid involvement in most individuals (50%) and mild involvement in 36.7% of individuals. In this study, we found that most of the individuals had Type 2 diabetes (T2DM) (83.3%), dyslipidaemia (83.3%), and hypertensive conditions (56.7%). In this study, interestingly, we found that 50% of them did not show any abnormality in the carotid angiogram. The carotid angiogram correctly revealed the site and extent of the carotid artery stenosis. Our study found 20% stenosis in the external carotid artery in 6.7% of patients, 50-60% stenosis in 3.3% of patients, 70% in 6.7% of patients, and minor plaque in 30% of patients. Involvement of the lower limb arteries showed symptoms that ranged from mild (23.3%), moderate (66.7%) or severe (10%). About 13.3% of patients underwent preoperative carotid stenting, while 86.7% did not. It is noteworthy that in our study, only 6.7% of patients had a preoperative history of cerebrovascular accident (CVA).

#### 4. Discussion

This is a retrospective observational research study in which we analyzed records of hospital patients and identified 30 patients with asymptomatic carotid artery disease who underwent CABG. Our study shows that Individuals who had received preoperative treatment for coexisting extracranial carotid artery disease, i.e., before CABG, have a decreased occurrence of postoperative focal neurological deficits and a reduced history of postoperative CVA. We frequently encounter coexisting carotid artery and coronary artery lesions, as the general literature points out. Over the years, researchers have identified significant carotid artery lesions in patients who have undergone bypass grafting of the humbled coronary arteries, with an estimated rate of 8–14 per 100 patients. Similarly, a patient with a clinical stigmata of carotid artery disease who has undergone CEA may exhibit a frank lesion of the coronary arteries in as many as 50 patients per 100. One of the previous studies stated that the risk of a postoperative stroke in patients who undergo bypass grafting of the coronary arteries with carotid stenosis would be as high as 7–11 out of 100 patients.<sup>[7]</sup> A case of a 55-year-old woman with insulin-dependent diabetes, hypertension, dyslipidaemia, and a deranged electrocardiogram.<sup>[8]</sup> Angiograms revealed a pathological vasculature with severe left anterior descending (LAD) stenosis, accompanied by high-grade left circumflex and right coronary artery lesions. A screening Doppler study revealed a staggering 90% stenosis of the right internal carotid artery (RICA)

and 50% of the left internal carotid artery (LICA). The surgeons initially planned to treat the coronary lesions with a graft for the LAD and stenting of the other arteries, as previously mentioned. They then stent only the RICA, which produced the best results; they generously avoided CEA. Therefore, this would further lay down the imminent problem of who must be screened, as a delineation would alleviate. The American Heart Association guideline for the CABG says that screening of the carotid vasculature is required for patients who meet the following criteria: they must be over 65 years old, have a carotid bruit heard on auscultation, have peripheral vascular diseases, be hypertensive, have smoked for more than 35 years, have had any cerebrovascular accident, or have had a carotid lesion in the cervical spine. The recommended screening tool for such a lesion would be a duplex sonogram with a sensitivity of 94% and a specificity of 92%. When additional anatomical detail is required, we can generously obtain CT and MR angiograms, but they are insufficient to delineate a total or subtotal occlusion. In these cases, catheter angiograms are the gold standard, but they come with the risk of invasiveness. When we discuss the treatment, the stenting or CREST trial generously yields results that favor carotid artery revascularization over endarterectomies.<sup>[9]</sup> Endarterectomies carry the risk of recurrent stenosis after the procedure, which can lead to a NYHA 3 heart failure with reduced ejection fraction (HFrEF), a contralateral carotid occlusion, and a contralateral carotid occlusion. If both lesions coexist, performing an endarterectomy would result in open heart surgery within 6 weeks. To support our claim, Fredman et al. said that Carotid Artery Stenting (CAS) and CABG had a better clinical outcome than CEA and CABG when it came to in-hospital deaths in a large cross-sectional study that took place from 2004 to 2012 and included 22,501 patients.<sup>[10]</sup> The coexistence of both carotid lesions and coronary lesions would render the treatment of both conditions unsuccessful without a well-designed strategy. We have observed adverse outcomes when performing endarterectomies on patients with carotid occlusions or stenosis. On the other hand, carotid stenting would be a better option after imaging the carotid arteries in patients who are suitable candidates for a CABG or have the risk factors mentioned in our discussion. However, carotid stenting carries a significant risk of 9%–11% for death, stroke, and new-onset myocardial infarction within 30 days, as reported by Naylor et al.<sup>[11]</sup> Based on the patient's clinical condition, it is crucial to consider the specific area that requires early revascularization. Suppose the patient presents with a cardiac condition that requires correction of the coronary vasculature and lesions, along with significant neuro deficits. In that case, it may be necessary to correct the carotid arteries. However, this situation poses a challenge and remains contentious. These specific clinical symptoms and the related findings necessitate the doctor taking appropriate measures. However, further research is necessary in a broader context that includes many circumstances to reach a firm and definitive conclusion.

## 5. Conclusion

Patients with coexisting carotid artery disease who undergo CABG for their coronary artery disease are at high risk for perioperative stroke or post-operative neurodeficit. The risk is related to the severity of stenosis and is highest among patients with previous stroke or ischemic attack. However, besides carotid atherosclerosis, other risk factors of perioperative neurological events are advanced cardiac and aortic atherosclerotic disease. Therefore, treatment of carotid stenosis before coronary surgery is indicated only in patients at high risk for perioperative stroke and in whom it is expected that the risk is predominantly related to carotid atherosclerosis: asymptomatic patients with high-grade carotid stenosis (>80%) and patients with previous stroke or ischemic attack. In patients with severe carotid atherosclerosis,

surgical treatment is indicated. In patients with severe coronary and carotid artery disease, an individualized surgical approach is recommended as the most appropriate management to get better post-operative outcomes. Stenting of carotid arteries represents a less invasive alternative in high-risk surgical patients than surgical carotid endarterectomy.

## Conflict of Interest

The authors declared that there is no conflict of interest.

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