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Original article

Outcomes of combined carotid endarterectomy with Coronary artery bypass grafting

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ABSTRACT

Introduction: The management of significant carotid artery stenosis in patients undergoing CABG is still debatable. We reviewed the clinical outcome of patients who underwent combined carotid endarterectomy with CABG in our institute.**Methods:** Data from 2008 to 2015 was reviewed. Along with demographic characteristics, history of diabetes mellitus, hypertension, smoking, previous myocardial infarction and stroke was noted. Post operatively ventilation time, average ICU stay, post-operative stroke and its type (ischemic or hemorrhagic), post-operative new atrial fibrillation and mortality was noted. Carotid duplex scanning was repeated after 3 months.**Results:** A total of 78 patients (average age 61.12 ± 14.94) underwent combined CABG with CEA (male 75.6% and female 24.3%). Of these 74% had hypertension, 92% had DM and 89% had history of smoking. History of stroke and myocardial infarction was present in 7% and 37% respectively. Post-operatively two patients had stroke and only one patient had residual paralysis. There was a single mortality unrelated to stroke. Follow up scan revealed mild narrowing with no flow limitation in 4 patients.**Conclusion:** Concomitant carotid artery endarterectomy with CABG can be performed safely with low risk of stroke and mortality.

KEYWORDS:CABG-coronary artery bypass grafting, CEA- carotid endarterectomy, DM- diabetes mellitus.

INTRODUCTION

Post-operative stroke after coronary artery bypass grafting (CABG) is a catastrophic complication causing significant morbidity and mortality [1, 2]. One of the important causes of stroke is disruption of atherosclerotic plaque form carotid artery [2, 3]. The management of significant carotid artery stenosis in patients undergoing CABG is still debatable. We reviewed the clinical outcome of patients who underwent combined carotid endarterectomy (CEA) with CABG in our institute

MATERIALS AND METHODS

Clinical data was retrospectively reviewed from 2008 to 2015. The indication of CEA was significant carotid stenosis defined as carotid artery stenosis (CAS)>70% detected on carotid duplex scanning. The pre-operative data included history of diabetes mellitus, hypertension, smoking, previous myocardial infarction (MI) and previous neurological event. Intra operatively the method of carotid artery closure, type of surgery (on pump versus off pump) and the overall duration of surgery was noted. Post-operatively the time to extubation, average ICU stay, post-operative stroke and its type (ischemic or hemorrhagic), post-operative new atrial fibrillation and mortality was noted. On three months follow up carotid artery duplex scanning was performed in all patients.

Surgical Technique: The carotid endarterectomy was performed before coronary grafting by a neck incision. Endarterectomy was performed by eversion technique and carotid artery was closed using a vein patch in all patients. The neck incision was kept open until protamine reversal. Trans cranial cerebral oximetry was used in all patients for monitoring during the procedure. CABG was performed via median sternotomy. On pump CABG was performed using mild hypothermia and cold sanguineous cardioplegia solution. Off pump CABG was performed with the use of octopus stabilizer and intracoronary shunts.

The conduits used were left internal mammary artery and saphaneous vein grafts in all patient.

RESULTS

Of the 857 patients who underwent CABG during the study period carotid artery stenosis was found in 405 patients (47%). Significant carotid artery stenosis was found in 108 patients (12%). A total of 78 patients underwent combined CEA with CABG. Of these 78 patients 59 were male (75.6%) and 19 (24.3%) were female. The average age was 61.12 ± 14.94 years (M ± 2SD). Hypertension was present in 58 (74%) patients, DM in 72 (92%) patients and history of smoking in 70 (89%) patients. Six patients (7%) had history of previous stroke and 29 (37%) had previous history of MI. The demographic data is presented in table 1.

Table 1: Demographic data of the study subjects

Characteristic	Number of patients (n)	Percentage (%)
Average Age: 61.12 ± 14.94 years (Mean ± 2SD)		
Male: Female: 59:19		
Hypertension	58	74
DM	72	92
Smoking	70	89
Previous stroke	6	7
Dyslipidemia	22	28
Previous MI	29	37

Forty one patients underwent right sided endarterectomy and 37 left sided. CABG was performed without the use of cardiopulmonary bypass (CPB) in 49 patients and 29 underwent on pump CABG. The average duration of surgery was 5.8 hours. On an average 3.17 grafts were inserted. The intraoperative data is summarized in table 2.

Table 2: Operative data

	Number of patients	Percentage (%)
CEA	(78)	
Right CEA	41	52.5
Left CEA	37	47.4
CABG		
On pump CABG	29	37
Off Pump CABG	49	63
Duration of Surgery (hours)	5.8 ± 1.23 (M ± 2SD)	
Average number of grafts	3.17	

Two patients (2.5%) suffered post-operative stroke. On CT brain scanning both the patients had hemorrhagic stroke with no midline shift. Both of them were managed conservatively. One patient had no residual hemiparesis at the time of discharge. One patient experienced TIA (transient ischemic attack) on post-operative D3. However CT brain did not reveal any infarction or hemorrhage. Average time to extubation was 7.34 ± 2.2 hours. Three patients (3.8%) had new onset atrial fibrillation which was managed medically. Mean ICU stay was 36.4 hours. There was single mortality on post-operative day 2 due to ventricular fibrillation secondary to acute myocardial infarction (AMI) and cardiogenic shock.

On three month follow up carotid artery duplex scanning was performed in all patients. Four patients revealed mild narrowing at the anastomotic site causing <30% stenosis.

Table 3: Post-operative results

Event	Number of patients	Percentage
Stroke	2	2.5%
Hemorrhagic stroke/Ischemic stroke	2/0	
Residual hemiparesis	1	1.3%
Transient ischemic attack	1	1.3%
Atrial fibrillation	3	3.8%
Mortality	1	1.3%
Re exploration	2	2.5%
Time to extubation	7.34 ± 2.2 hours	
ICU stay	36.4 ± 10.5 hours	

DISCUSSION

Stroke is a major post-operative complication for patients undergoing CABG [1]. It leads to significant morbidity and is also an important cause of mortality after CABG. One of the important causes of stroke is carotid artery stenosis [2, 3]. Carotid artery stenosis (CAS) is often co existent with multivessel coronary artery disease requiring CABG. The incidence of CAS in patients undergoing CABG has been reported to be 5% – 38% [4-7]. In the present study also, the incidence of significant CAS was 12%. This highlights the importance of pre-operative carotid artery duplex scanning in all patients undergoing CABG.

Currently the guidelines for management of CAS in patients requiring CABG are not clear. Early reports suggested that staged procedure (CEA followed by CABG) has better results with favorable long term results [8]. Sharma et al performed meta-analysis to compare early outcomes of synchronous and staged approach of carotid endarterectomy and coronary artery bypass grafting. They showed comparable outcomes in combined and staged approach for synchronous carotid and coronary artery disease [9]. However recent studies have shown encouraging results with the combined approach [9-11]. Huh et al in a meta-analysis advocated combined procedure for patients with critical stenosis [10]. A recent study by Yuan et al showed that for patients with combined carotid artery stenosis and coronary artery disease, the simultaneous surgical procedure, rather than the staged procedure, is recommended [11].

In Indian population the risk factors for carotid artery stenosis are similar to coronary artery disease [12]. In the present study a large number of patients were having history of DM, hypertension and smoking. Sait et al also demonstrated DM, hypertension and smoking as risk factors for CAS [13]. In addition, they also showed that past history of stroke and dyslipidemia as risk factors.

Our operative technique is the standard for CAS with neck incision, eversion technique and closure of carotid artery using vein patch. Rerkasem K et al suggested that carotid patch angioplasty may reduce the risk of perioperative arterial occlusion and restenosis [14]. They also showed that it reduces the risk of ipsilateral stroke. Cerebral oximetry used while CEA during this study has been shown to be a highly sensitive (100%) and noninvasive monitoring technique compared to EEG [15]. Transcranial Cerebral Oximetry is more sensitive to a drop in BP and responds earlier to these changes than EEG [15].

Cardiopulmonary bypass was used in 29 (37.1%) of patients in the present study. There was no adverse outcome by addition of CPB to the procedure. Overall 2 (2.5%) patients suffered from post-operative stroke both of whom had hemorrhagic stroke. Other studies have shown the stroke rate after the combined procedure to be between 2.5% to 9% [16-20]. In one study by Weimar et al showed that the stroke rate after combined procedure was 18.5% as against 9.7% in the isolated CABG group [21]. However they did not find any statistical significance in both the groups. The incidence of peri-operative stroke after CABG is low. Multiple meta-analysis studies have shown the stroke rate to be between 1.8% and 7.5% [22-24]. However the stroke rate in CABG alone in presence of significant CAS is 16.5% to 22% [25-27]. Studies have shown that carotid artery stenosis of more than 70% confers higher risk of stroke while performing CABG. Only one patient had residual hemiparesis in our study.

There was single mortality in our study which was unrelated to stroke. The patient died on post-operative day 2 due to cardiogenic shock. Kurtoğlu et al also showed mortality of 3.5 % in the combined approach [28]. Even lower mortality rate of 0.9% was reported by Aydin et al [29]. Two patients in the present study had to undergo re-exploration for mediastinal bleeding. There was no incidence of neck bleeding or hematoma formation.

On three month follow up duplex scanning only 4 patients had mild narrowing of the carotid artery at the anastomotic site. There was no flow limiting occlusion of the carotid artery in any patient. Long term followed up is needed to check the late patency of carotid endarterectomy. In a study by Babu et al the incidence of significant carotid artery stenosis after endarterectomy was only 0.4% [30].

Limitations of Study:

This is a single center retrospective study. The cohort size is small. The results demonstrated may differ with a study done in a larger population. We did not investigate noninvasive procedures like carotid artery stenting which can be done for such patients. Long term stenosis after carotid endarterectomy needs to be investigated. Furthermore a randomized trial to compare combined procedure with staged and reverse staged procedure needs to be done for a more through proof.

CONCLUSION

The present study demonstrates patients undergoing CABG have high incidence of severe carotid artery stenosis. Hence all patients undergoing CABG should undergo carotid artery duplex scanning. Our study also shows that history of DM, hypertension and smoking are risk factors for carotid artery stenosis. Patients undergoing with significant carotid artery stenosis undergoing isolated CABG were at higher risk of post-operative stroke. The present study shows that concomitant carotid artery endarterectomy with CABG does not confer additional risk to patients. It can be performed safely with low risk of stroke and mortality.

Competing interest: The authors declare that they have no competing interests.

REFERENCES

1. Charlotte Merrie, Lars Køber, Peter Skov Olsen, et al. Risk of Stroke After Coronary Artery Bypass Grafting Effect of Age and Comorbidities. Stroke Oct 2011;43:38–43
2. Eun-Jae Lee, Kyoung-Hyo Choi, Ju-SeokRyu, et al. Stroke Risk after Coronary Artery Bypass Graft Surgery and Extent of Cerebral Artery Atherosclerosis. Journal of the American College of Cardiology 2011 May;57(18):1811-1818
3. TullioPalmeriniCarloSaviniMarco Di Eusanio. Risks Of Stroke After Coronary Artery Bypass Graft - Recent Insights And Perspectives.Interventional Cardiology Review, 2014;9(2):77-83
4. Taneja S, Chauhan S, Kapoor PM, et al. Prevalence of carotid artery stenosis in neurologically asymptomatic patients undergoing coronary artery bypass grafting for

coronary artery disease: Role of anaesthesiologist in preoperative assessment and intraoperative management. Annals of Cardiac Anaesthesia. 2016; 19 (1):76-83.
5. Kiernan TJ1, Taqueti V, Crevensten G et al. Correlates of carotid stenosis in patients undergoing coronary artery bypass grafting--a case control study. Vasc Med. 2009 Aug; 14(3):233-7.
6. ShuzouTanimoto, Yuji Ikari, Kengo Tanabe et al. Prevalence of Carotid Artery Stenosis in Patients with Coronary Artery Disease in Japanese Population. Stroke. 2005;36:2094–2098
7. Abiodun M Adeoye, Ajit S Mullassari, SR Ramkumar et al. Prevalence of carotid artery disease in candidates undergoing coronary bypass graft seen at Madras Medical Mission. Sahel Med J 2013;16 (2): 43-47
8. NavidSadeghi, SarmadSadeghi, ZhoobinAbbasi Mood, et al. Determinants of operative mortality following primary coronary artery bypass surgery, European Journal of Cardio-Thoracic Surgery. 2002 Feb; 21(2):187–192,
9. Sharma V, Deo SV, Park SJ, et al Meta-analysis of staged versus combined carotid endarterectomy and coronary artery bypass grafting. Ann Thorac Surg. 2014 Jan;97(1):102-9
10. Huh J1, Wall MJ Jr, Soltero ER. Treatment of combined coronary and carotid artery disease. CurrOpinCardiol. 2003 Nov; 18(6):447-53.
11. Yuan SM1, Wu HW, Jing H. Treatment strategy for combined carotid artery stenosis and coronary artery disease: staged or simultaneous surgical procedure? Tohoku J Exp Med. 2009 Nov; 219(3):243-50.
12. Kaul S, Alladi S, Mridula K R, et al. Prevalence and risk factors of asymptomatic carotid artery stenosis in Indian population: An 8-year follow-up study. Neurol India 2017;65:279-85
13. Sait Alan, Mehmet S. Ulgen, OnderOzturk, et al. Relation Between Coronary Artery Disease, Risk Factors and Intima-Media Thickness of Carotid Artery, Arterial Distensibility, and Stiffness Index Angiology 2003;54:261-267
14. Rerkasem K1, Rothwell PM. Patch angioplasty versus primary closure for carotid endarterectomy. Cochrane Database Syst Rev. 2009 Oct ;(4):CD000160.
15. Botes K1, Le Roux DA, Van Marle J. Cerebral monitoring during carotid endarterectomy--a comparison between electroencephalography, transcranial cerebral oximetry and carotid stump pressure. S Afr J Surg. 2007 May; 45(2):43-6.
16. Mackey WC1, Khabbaz K, Bojar R, et al Simultaneous carotid endarterectomy and coronary bypass: perioperative risk and long-term survival. J Vasc Surg. 1996 Jul; 24(1):58-64.
17. Sohaib M. Khan, MunierNazzal, Gerald Zelenock, Simultaneous Carotid Endarterectomy and Coronary Artery Bypass Grafting Is Associated With Similar Clinical Outcomes With Lower Length of Stay and Hospital Charges. Journal of vascular Surgery 2015 Sept; 62 (3):831–832
18. N Evagelopoulos, M. T Trenz, A Beckmanna, et al Simultaneous carotid endarterectomy and coronary artery bypass grafting in 313 patients. Cardiovascular Surgery 2000 Jan; 8(1) :31-40
19. MárcioLuís Lucas; Telmo Pedro Bonamigo; Elton Luiz Schmidt Weber; et al. Combined carotid endarterectomy and coronary artery bypass grafting. Analysis of the results. ArquivosBrasileiros de Cardiologia. 2005 Dec; 85(6)
20. Garg A, Bansal AR, Singh D, et al. Combining carotid endarterectomy with off-pump coronary artery bypass graft surgery is safe and effective. Ann Indian AcadNeurol 2015;18:419-23
21. Christian Weimar, KonstantinosBilbilis, Jan Rekowski, et al. Safety of Simultaneous Coronary Artery Bypass Grafting and Carotid Endarterectomy versus Isolated Coronary Artery Bypass Grafting. Stroke. 2017;48:2769–2775
22. Roach GW, Kanchuger M, Mangano CM, et al., Adverse cerebral outcomes after coronary bypass surgery. Multicentre Study of Perioperative Ischemia Research Group and the Ischemia Research and Education Foundation Investigators, N Engl J Med, 1996; 335:1857–63.
23. Charlotte Mérie, Lars Køber, Peter Skov Olsen. Risk of Stroke after Coronary Artery Bypass Grafting, Effect of Age and Comorbidities. Stroke. 2011;43:38–43
24. ThomasSchachner, AnneZimmer, Georg Nagele et al. Risk factors for late stroke after coronary artery bypass grafting. The Journal of Thoracic and Cardiovascular Surgery 2005 Aug;130(2):485-490
25. Takashi Hirotani, Tadashi Kameda, Takayuki Kumamoto et al Stroke After Coronary Artery Bypass Grafting in Patients With Cerebrovascular Disease. The Society of Thoracic Surgeons. Nov 2000;70(5):1571-76.
26. Schwartz LB, Bridgman AH, Kieffer RW, Wilcox RA, McCann RL, Tawil MP et al. Asymptomatic carotid artery stenosis and stroke in patients undergoing cardiopulmonary bypass. J VascSurg 1995;21:146-53
27. Lynda L Mickleborough, Paul M.Walker, Yasushi Takagi et al. Risk factors for stroke in patients undergoing coronary artery bypass grafting. The Journal of Thoracic and Cardiovascular Surgery. 1996 Nov;112(5):1250-1259
28. Murat KURTOĞLU, Mehmet Şanser ATEŞ, İbrahim DUVAN et al. Concomitant carotid endarterectomy and off-pump coronary artery bypass grafting in coexistent carotid and coronary artery diseases. Turk J Med Sci 2012; 42 (1): 1247-1251
29. Ebuzer Aydin, YucelOzen, SabitSarikaya et al. Simultaneous coronary artery bypass grafting and carotid endarterectomy can be performed with low mortality rates. Cardiovascular Journal Of Africa 2014 May/Jun ;25 :3
30. Babu MA, Meissner I, Meyer FB.The durability of carotid endarterectomy: long-term results for restenosis and stroke. Neurosurgery. 2013 May;72(5):835-8.

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