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Concomitant carotid endarterectomy and off-pump coronary artery bypass grafting in coexistent carotid and coronary artery diseases

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Aim: To analyze the results of our experience with a combined procedure via off-pump coronary artery bypass (OPCABG) and carotid endarterectomy (CEA) retrospectively.

Materials and methods: Eighty-four patients underwent OPCABG and CEA concomitantly between 1998 and 2011. Thirty (35.7%) patients had a cardiac history of myocardial infarction (MI), 13 (15.6%) had unstable angina (USAP), and 27 (32.1%) had USAP together with MI, whereas 14 (16.6%) were asymptomatic. Forty-two (50%) patients showed no neurological symptoms, 20 (23.8%) had transient ischemic attacks (TIAs), 21 (25%) suffered from stroke, and 1 (1.2%) experienced both. CEA was performed before OPCABG in all of the patients.

Results: There were 84 patients (aged 68.05 ± 5.88; 77.3% male). Four (4.8%) had a perioperative stroke whereas 5 of them had TIAs (5.9%). Mean ICU stay was 30.3 h and patients were discharged in 6.4 days on average. There were 2 (2.38%) postoperative myocardial infarctions and 3 (3.5%) deaths in the early postoperative period.

Conclusion: A combined procedure via OPCABG and CEA seems to be safe and cost effective based on the acceptable results of morbidity and mortality rates and short ICU and hospital stays.

Key words: Carotid artery disease, coronary artery disease, coronary artery bypass grafting, carotid artery endarterectomy, concomitant surgery

Introduction

The indications and benefits of surgical revascularization of isolated coronary or carotid artery diseases are clear enough (1,2), whereas the most appropriate surgical option for coexistent coronary and carotid disease remains a subject of debate. According to studies in the literature, 8%–14% of coronary artery bypass grafting (CABG) patients have significant carotid stenosis (3,4) and 40%–50% of carotid endarterectomy (CEA) patients have coronary artery disease (5,6). Adverse neurologic events occurred in 6.1% of elective CABG patients who had carotid stenosis concomitantly (7). Moreover, when carotid surgery was performed in patients with symptomatic coronary artery disease, studies have suggested an incidence of postoperative myocardial infarction of approximately 7%, while its incidence was 1% if the CEA was done in asymptomatic patients (8,9). After recognizing that complete revascularization can be performed on the beating heart with minimal or no aortic manipulation, the popularity of using off-pump CABG (OPCABG) increased in these coexistent coronary/carotid patients because of their tendency to be at high risk for perioperative adverse neurologic events when compared with the conventional CABG procedure (10).

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In this study, we aimed to analyze the outcomes of our experience retrospectively in concomitant CEA and OPCABG.

Materials and methods

We reviewed the early follow-up data of 84 patients with coexistent carotid and coronary artery diseases who underwent combined CEA/OPCABG between 1998 and 2011. Pre-, intra-, and early postoperative variables were collected retrospectively. Hypertension (n = 63, 75%), smoking (n = 51, 61%), diabetes mellitus (n = 43, 51%), and peripheral vascular disease (n = 25, 30%) were the major atherosclerotic risk factors. Thirty (35.7%) patients had a cardiac history of myocardial infarction (MI), 13 (15.6%) had unstable angina (USAP), and 27 (32.1%) had USAP together with MI, whereas 14 (16.6%) were asymptomatic. Forty-two (50%) patients showed no neurological symptoms, 20 (23.8%) had transient ischemic attacks (TIAs), 21 (25%) suffered from stroke, and 1 (1.2%) experienced both. Ipsilateral stenosis was 86.5 ± 10.91% (Table 1); 13 patients had 50%–75%, 23 had 75%–90%, and 48 had ≥90% stenotic atherosclerotic carotid lesions. There were 5 patients with left main coronary artery lesions.

Operative techniques

Technique of carotid endarterectomy

Routine carotid artery duplex scanning to screen the bilateral carotid artery in both longitudinal and transverse planes was done as part of the preoperative evaluation in all patients and it was followed by carotid angiography in cases in which significant disease was indicated. Patients undergoing CEA had ≥50% carotid stenosis with one of the symptoms of TIAs or ischemic stroke with a history of cerebral accident or unilateral stenosis ≥75% with or without any symptoms. The CEA was done after a median sternotomy and harvesting the conduits; CABG followed thereafter. Carotid endarterectomy was performed by a vertical incision anterior to the sternocleidomastoid muscle, thus exposing the common, internal, and external carotid artery. The artery was opened through a transverse incision to the distal portion of the common carotid artery, followed by an endarterectomy.

The eversion technique of CEA was started to be performed with the ICA through the plane between the outer layers of media and the adventitia. The atheroma was withdrawn and detached circumferentially while the outer layer of the ICA was everted. The eversion progressed distally and gentle traction was used to completely remove the atheromatous plaque; then endarterectomy of the ECA and CCA was achieved in the same manner. The neck wound was left open until the heparin was reversed via protamine after CABG. The wound was closed after CABG and reversing the heparin, with or without drainage. The arteriotomy was closed directly by continuous sutures without using any type of patches.

Technique of OPCABG

The ascending aorta was evaluated by the surgeon manually just after the heart was exposed by a median sternotomy. When significant aortic atherosclerotic disease was found to exist, the aorta was not used as a source for proximal anastomoses. In cases in which the aorta was used, a side-biting clamp occluded the aorta partially in an area free from atherosclerosis. A 4-suture technique (11) was used for mechanical stabilization of the heart while performing all distal anastomosis in the procedure of OPCABG.

Results

There were 84 patients (aged 68.05 ± 5.88; 77.3% male). Thirty-seven patients experienced right (44%), whereas 44 (52.4%) underwent left and 3 (3.6%) had bilateral CEA. Four (4.8%) had a perioperative stroke whereas 5 had TIA (5.9%). Twenty-one patients (25%) underwent single, 29 (34.5%) double, and 34 (40.5%) triple or more bypasses (Table 2). Atrial fibrillation occurred in 17 patients (20.2%). The Society of Thoracic Surgeons database benchmark for this complication is 19.7%. There were 2 (2.38%) postoperative MIs documented by electrocardiogram and serum CK/MB with troponin levels. Nine (10.7%) patients demonstrated a revision; 6 (7.1%) of them were for hematoma. Mean ICU stay was 30.3 h and the patients were discharged in 6.4 days on average. There were 3 (3.5%) deaths in the early postoperative period (Table 3).

Table 1. Preoperative demographic data.

Variables	(n = 84)
Age	68.05 ± 5.88
Sex	
Male	65 (77.3%)
Female	19 (22.7%)
Major risk factors	
Hypertension	63 (75%)
Smoking	51 (61%)
Diabetes mellitus	43 (51%)
Peripheral vascular disease	25 (30%)
Cardiac symptoms	
MI	30 (35.7%)
USAP	13 (15.6%)
USAP + MI	27 (32.1%)
Asymptomatic	14 (16.6%)
Neurologic symptoms	
TIA	20 (23.8%)
Stroke	21 (25%)
TIA + stroke	1 (1.2%)
Asymptomatic	42 (50%)
Ipsilateral stenosis	86.5 ± 10.91%

Discussion

A continuing controversy exists about the most appropriate surgical option for patients with coronary artery disease requiring surgery who also have significant carotid artery disease. Approaches vary from totally ignoring carotid stenosis at the time of myocardial revascularization, to performing staged operations (12), or conducting the 2 operations during a single anesthesia. We think that when a surgeon operates on only one lesion at the time of surgery he or she will encounter the adverse effects of the other, perioperatively and/or postoperatively. Different authors have performed the combined approach like us as the procedure of choice in coexistent arterial disease to avoid MI and reduce neurologic deficits (13,14).

Borger et al. prepared a metaanalysis using the findings of 16 studies comparing combined and staged procedures. Even though the results of the staged procedures of this metaanalysis demonstrated significant decreases in the rates of the primary outcomes of these studies as they were stroke and death, there were also studies in the paper suggesting combined procedures to be the best choice in patients with coexistent carotid and coronary artery disease. There were 51 patients suffering stroke (6.0%) whereas 40 of them were dead (4.7%) from 844 patients that underwent a combined procedure. An important secondary end point of this paper was MI and 4.6% of the patients showed MI (13). The postoperative results of our experience were 2 (2.38%) MI, 4 (4.8%) stroke, and 5 (5.9%) TIA cases with 3 (3.5%) deaths.

Meharwal et al. stated that the advantages of combined CABG and CEA over the staged procedure were less exposure to anesthesia and cost-effectiveness depending on a shorter period of ventilatory support, and ICU and hospital stay. Mean intubation time was 18 h, intensive care unit stay was 22 h, and period of discharge time was 6.2 days in their study (14), whereas mean intubation time was about 6 h, ICU

Table 2. Operative results.

CEA	n = 84	%
Right	37	44
Left	44	52.4
Bilateral	3	3.6
CABG		
Number of bypasses		
Single	21	25
Double	29	34.5
Triple or more	34	40.5

stay was 23 h, and the discharge period was 6.4 days in our paper, highly acceptable results.

Thirteen patients underwent a combined procedure in 10 months between 2000 and 2001 in a study performed by Youssuf et al.; it was not a comparative manuscript, but the results were found to be reliable and effective (15). We also did not make a comparison with any other group of patients who underwent any other type of procedures, but only reported the results of ours retrospectively.

Mishra et al. (16) compared a group of 166 patients who underwent a combined procedure by OPCABG and CEA with 192 patients who underwent a combined procedure by conventional CABG via CPB and CEA. Pre-, intra-, and postoperative findings of both groups were compared and even though the OPCABG group's results were better there were no statistically significant differences between the groups but some of the beneficial effects of OPCABG in these potentially high risk patients for perioperative neurologic adverse effects were apparently experienced. The combination of OPCABG with CEA for patients with coexisting coronary and carotid diseases avoids CPB and protects the patients from stroke by prohibiting nonpulsatile extracorporeal circulation and its adverse effects such as low flow phenomena and inflammation, and circumvents most of the major risk factors of stroke via minimal or no aortic manipulation with a result of a diminished risk of atheroembolism arising from the aorta. The other source for embolism is carotid arteries and the risk for carotid embolism is reduced by performing CEA before OPCABG in combined procedures.

Table 3. Postoperative results.

Variable	
Intubation time	344.23 ± 188.46 min
Stroke	4 (4.8%)
TIA	5 (5.9%)
MI	2 (2.38%)
Atrial fibrillation	17 (20.2%)
Mortality	3 (3.5%)
ICU stay	23.76 ± 18.39 h

A review of 324 patients (17) and another one investigating 22,792 patients (18) both concluded that staged procedures demonstrated a greater risk of overall complications and higher hospital charges than concomitant procedures and also conventional CABG showed higher stroke rates in OPCABG patients.

In conclusion, we performed a combined procedure via only OPCABG and did not make a comparison with conventional on-pump CABG or any other groups. The small number of patients is another drawback of our study. These can be considered limitations but our results in concomitant CEA/OPCABG yielded acceptable morbidity and mortality rates with short hospital and intensive care unit stay intervals just like the other studies about this subject performed recently (15–18.

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