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Surgical Revascularization of Coexistent Significant Left Main and Right Coronary Artery Stenosis: A Single Center Experience

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ABSTRACT

Background: Patients with left main coronary artery stenosis often have complex coexisting coronary artery disease. Surgical revascularization is still the standard modality of treatment.

Objective: To present our experience in surgical revascularization for patients with stenosis of both left main and right coronary artery and evaluate the impact of the latter on the outcome of surgery.

Methods: From 2006 to 2015, a total of 46 patients (38 male and 8 female, mean age 56.3 years) underwent coronary artery bypass grafts for stenosis of both left main and right coronary artery. Risk factors for coronary artery disease were identified in 93.4%. EuroSCORE II was 2.2 ± 4.29. All were operated on pump with mean grafts 3.3 ± 0.8.1 per patient. Intraaortic balloon was inserted in 11 patients.

Results: Early postoperative mortality was 8.7%. Regarding complications, we reported bleeding in 6 patients, sternal wound infection in 5, renal impairment in 5, respiratory complications in 2, and myocardial infarction in 4.

Conclusion: Surgical revascularization for patients with stenosis of both left main and right coronary artery has a higher morbidity and mortality when compared to results of surgery for isolated left main disease.

INTRODUCTION

Left main coronary artery (LMCA) stenosis is an independent risk factor for increased morbidity and mortality in patients with coronary artery disease [Takaro 1985]. The reported incidence of LMCA stenosis was 2.5% to 17.5% among patients undergoing coronary catheterization [Takaro 1982]. Most patients have concomitant lesions in one or more of other major coronary vessels [Bulkley 1976]. The frequency of associated right coronary artery (RCA) stenosis ranges from 9% to 14% in patients with LMCA stenosis [Darabian 2008]. The aim of this study was to present our experience and early outcome of this challenging surgical revascularization.

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METHODS

This study was conducted in King Abdul Aziz University Hospital from 2006 to 2015 and was approved by our Institutional Review Board on clinical study. It included 46 patients who underwent coronary artery bypass grafting (CABG) for concomitant LMCA and RCA stenosis. Angiographically significant stenosis of either LMCA or RCA was defined as lumen narrowing more than 50%. We excluded redo cases and those who underwent any associated procedures (e.g., valvular or aneurysm surgery). Collected data included age, sex, and risk factors (diabetes, hypertension, smoking, dyslipidemia, family history of coronary artery disease, renal impairment, previous stroke, and previous myocardial infarction). Preoperative clinical characteristics are shown in Table 1.

Table 1. Preoperative Characteristics of Patients (n = 46)

Age, y, mean ±SD	56.3 ± 8.62
Sex, male/female	38/8
Risk factors	
Diabetes mellitus, n	28
Hypertension, n	26
Smoking, n	4
Dyslipidemia, n	22
Family history, n	6
Renal impairment, n	5
Previous stoke, n	1
Previous PCI of RCA, n	10
IAB insertion, n	3
EF mean ± SD	45 ± 12.03
Euro SCORE II	2.2 ± 4.29
Coronary angiography (significant lesions)	
Left main, n	46 (100%)
RCA, n	46 (100%)
LAD, n	20 (43.5%)
Cx, n	14 (30.4%)

PCI indicates percutaneous coronary intervention; RCA, right coronary artery; IAB, intraaortic balloon; EF, ejection fraction; LAD, left anterior descending artery, Cx, circumflex artery.

Table 2. Operative Variables

Grafts	
LAD	46
D	28
OM	35
RI	7
RCA	36
Mean graft per patient	3.3±0.81
CPB time (minutes)	123.93±47.77
Clamping time (minutes)	67.11±24.86

LAD indicates left anterior descending artery; D, diagonal artery; OM, obtuse marginal; RI, ramus intermedius; RCA, right coronary artery; CPB, cardiopulmonary bypass.

Table 3. Postoperative Results

Troponin	10.2 ±4.3
Intraaortic balloon	11
Ejection fraction	49.4±12.3
Mortality	4 (8.7%)
Complications	
Bleeding, n (%)	6 (13%)
Infection, n (%)	5 (10.9%)
Respiratory, n (%)	2 (4.3%)
Acute renal failure, n (%)	2 (4.3%)
Recurrent chest pain, n (%)	4 (9.1%)

The surgical database were analyzed for data including number, sites of grafts, aortic clamping and bypass times, and need for intraaortic balloon. All patients were operated on using cardiopulmonary bypass. Whenever possible we completely revascularized all targets using left internal mammary artery (LIMA) to left anterior descending artery (LAD) and great saphenous vein (GSV) for other coronary vessels. We used antegrade cold blood cardioplegia for myocardial protection. Clinical outcomes including morbidity and mortality were recorded.

Categorical variables were expressed as frequencies and percentages for each variable. Continuous variables were presented as means ± SD.

RESULTS

Preoperative patient characteristics are shown in Table 1. Forty-six patients were included in our study. The majority were males (82.6%). The mean age was 56.3 years (range, 39-78 years). The follow-up period ranged from 6 months to 8 years (mean, 1.5 years). Apart from age, risk factors for coronary artery disease were identified in 93.4%. The mean preoperative ejection fraction (EF) was 45%. We operated on 5 patients with renal impairment. None were on dialysis. One patient (63-year-old female, diabetic and hypertensive) had a history of stroke. Three patients were operated on emergently after insertion of intraaortic balloon. All patients had significant stenosis of LMCA and RCA. In addition, LAD stenosis was found in 20 patients and circumflex artery (Cx) stenosis in 18. Ten patients had history of stenting RCA and all developed in-stent stenosis preoperatively. Three operations were performed as emergencies, 15 as urgent, and 28 as elective. EuroSCORE II was calculated. The mean was 2.2 ± 4.29. We had anastomosed the LIMA to LAD in all patients. GSV was used to bypass stenosis of 28 diagonal, 35 obtuse marginal, 7 ramus intermedius, and 36 RCA. Intraaortic balloon (IAB) was needed in 8 patients to facilitate weaning of CBP and support postoperative period. The operative variables are provided in Table 2. We had 4 cases (8.7%) of mortality. The cause of death was low cardiac output in all. Regarding complications, 6 patients were reexplored for bleeding; 5 patients had sternal wound infection, and 2 of them had rewiring; 2 patients developed acute renal failure and required ultrafiltration; 2 patients required prolonged mechanical ventilation; and 4 patients had recurrent ischemic chest pain that was managed medically. The postoperative data are included in Table 3.

DISCUSSION

LMCA stenosis is infrequent coronary artery disease and an independent risk factor of increased morbidity and mortality [Takaro 1985]. Significant left main lesion usually indicates extensive coronary artery disease [Mott 1999]. In addition to LMCA stenosis, all our patients had significant RCA stenosis, 43.5% had LAD stenosis, and 30% had Cx stenosis. The major cause of LMCA disease is atherosclerosis. Other causes include Takayasu arteritis, Kawasaki disease, rheumatoid arthritis, syphilis, and injury during coronary intervention [Bergelson 1995; Gökhan 2014]. All of our cases had LMCA stenosis caused by atherosclerosis. None of the patients had any criteria of other nonatherosclerotic diseases. Hypertriglyceridemia and female sex were suggested as independent risk factors for ostial lesions of both LMCA and RCA [Darabian 2008]. Yildirimturk et al, in their series, found that the incidence of coexistent ostial LMCA stenosis and RCA ostial stenosis was 22.1%. They reported higher incidence in female sex compared to male and explained that by a smaller diameter of LMCA in females and the drop of estrogen level in the postmenopausal period [Yildirimturk 2011]. However, female patients were significantly older in their study. We identified dyslipidemia in 47.8% and female sex accounted for 17.4% of our patients. Other risk factors of coronary artery disease included diabetes, hypertension, renal impairment, smoking, and family history; in 60.8%, 56.5%, 19.6%, 8.7%, and 13% respectively. CABG is the gold standard for revascularization for LMCA stenosis (class I, level B according to ESC/EACTS guidelines) regardless of SYNTAX score [Windecker 2014]. With technical improvement and increased experience the scope of percutaneous coronary

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intervention (PCI) has been widened [Mete 2014]. Stenting of unprotected LMCA stenosis can achieve good results in carefully selected patients, especially those with non-distal lesions [Fajadet 2012]. Results of CABG for LMCA stenosis have been improved. In 2008, Taggart et al reviewed a series of studies for the results of surgery for LMCA stenosis. They reported 2-3% in-hospital mortality and 5-6% mortality at 5 years [Taggart 2008]. A review study for 20-years of experience of Cleveland Clinic by Sabik et al for 3,803 patients who underwent CABG for LMCA stenosis reported 97.6% survival at 30 days, 93.6% at 1 year, and 83% at 5 years [Sabik 2007]. These two studies represent a benchmark for comparison. If RCA is also involved, does this adversely affect the outcome of surgery for LMCA stenosis? To our knowledge, few studies addressed this issue mainly based on stenting of unprotected LMCA stenosis. The aim of our study was to evaluate results of surgical revascularization for this critical group of patients with ischemic heart disease. Lu et al conducted a study on 164 patients undergoing PCI for unprotected LMCA stenosis. They found that concomitant significant RCA lesions are an independent risk factor for major adverse cardiac events, 30-day deaths, and even late mortality [Lu 2011]. Mendes et al suggested that RCA stenosis is an independent risk factor for postoperative AF in patients undergoing CABG [Mendes 1995]. On the other hand, Virani et al studied 97 patients with LMCA stenosis awaiting surgery and found that RCA stenosis was not a risk factor for preoperative adverse cardiac events. However, a small number of cardiac events (only 4) limits the significance of differentiating several risk factors affecting preoperative outcome [Virani 2006]. We had an early mortality rate of 8.7%, which is relatively higher when compared with that reported by Taggart et al and Sabik et al. Regarding adverse cardiac events, 4 of our patients (8.7%) developed postoperative MI. Eleven patients (23.9%) needed support of IABP postoperatively. Our results support the conclusion of Lu et al regarding the adverse impact of RCA stenosis. More extensive atherosclerotic disease may explain this finding. We could not identify any change of rhythm postoperatively.

Our study has several limitations. It is a retrospective study with a small number of patients and reflects a single-center experience. Prospective randomized controlled trials are suggested to further clarify the impact of RCA stenosis on CABG for left main disease. Also, we studied midterm results. Long-term follow up will be carried out.

Conclusion

Our results based on single-center experience showed higher mortality and complications for patients who underwent CABG for stenosis of both LMCA and RCA when compared to standard results of surgery for isolated left main disease.

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