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ORIGINAL ARTICLE

Short-term clinical outcomes and mortality of coronary endarterectomy in the right coronary artery: A single-center experience

Hamid Hoseinikhah[1], Mohammad Abbassi Teshnisi[1], Ahmad raza Zarifian[2], Yasamin Moeinipour[3], Aliasghar Moeinipour[1]✉

[1] *Atherosclerosis Prevention Research Center, Mashhad University of Medical Sciences, Mashhad, Iran.*

[2] *Student Research Committee, Faculty of Medical science, Mashhad University of Medical Sciences, Mashhad, Iran*

[3] *Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran.*

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Abstract

Introduction: Coronary endarterectomy is not a perfect procedure. However, it is sometimes the only available alternative for cardiac surgeons in patients suffering from diffuse coronary artery disease. According to a large volume of studies, coronary endarterectomy results (such as survival, recurrence of the symptoms of myocardial ischemia, and graft patency) are not as satisfactory as standard coronary artery bypass grafting (CABG). While the left anterior descending artery (LAD) is the artery most commonly involved in coronary endarterectomy, RCA can be treated with coronary endarterectomy. This study aimed to evaluate clinical evidence and early results of right coronary artery endarterectomy.

Methods: A total of 20 cases of coronary endarterectomy of the RCA was studied from January 2015 to January 2016 in this retrospective study. Endarterectomy procedure was performed in Imam Reza Hospital affiliated to Mashhad University of Medical Sciences.

Results: The mean age of the subjects was 60±5.2 years (range: 48-75 years). From among them, 14 were male (70%), and the mean ejection fraction index was 36±5.7 (range: 15-60). Further, in 8 cases, a prior history of myocardial infarction was documented (40%). The mortality rate among patients was 10% (n=2). In total, 7 (35%) and 12 (60%) patients required intra-aortic balloon pump support and high-dose inotropic support, respectively. Perioperative myocardial infarction was observed in 5 (25%) cases, and 3 (15%) patients required re-exploration due to significant hemorrhage. Severe RV failure at the end of procedure was noticed in 4 patients (20%) with resultant mortality in half of them. Some type of heart block w occurred in 1 patient (5%).

Conclusions: In case coronary endarterectomy of the RCA is performed by an experienced cardiac surgeon, favorable outcomes can be expected.

Key Words: CABG, Coronary endarterectomy, Right Coronary Artery

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Tel: +985632381203
Fax: +985632440488
Po Bax 97175-379
Email: jsurgery@bums.ac.ir

✉**Correspondence to:**
Aliasghar Moeinipour; Assistant Professor of Cardiovascular Surgery, Faculty of Medicine, Atherosclerosis Prevention Research Center, Mashhad University of Medical Sciences, Mashhad, Iran;
Telephone Number: +98511-38525307 9137913316
Email Address: moinipoora1@mums.ac.ir

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Introduction

Notwithstanding advances in coronary artery interventions, increasing cases of severe and diffuse coronary artery disease are treated with coronary artery bypass grafting (CABG) concomitant with endarterectomy [1-3]. Followed by RCA, the left anterior descending (LAD) artery is the most commonly involved vessel in endarterectomy [4, 5, 7].

Theoretically speaking, poor prognosis and outcomes are highly expected in coronary endarterectomy, given the complexity of this procedure, endothelial injury of coronary arteries, , RV failure, inability to complete extraction of plaque especially in distal part and resultant perioperative MI, and heart block [6, 8-11].

Even though the initial outcomes of coronary endarterectomy are not as favorable as CABG alone, we evaluated, in this study, the early clinical findings and short-term mortality of 20 patients suffering from diffuse coronary artery disease who had undergone coronary endarterectomy of the right coronary artery.

Methods

In the present study, a total of 20 patients undergoing coronary endarterectomy of the RCA were included and assessed from January 2015 to January 2016. The whole procedures were performed by the same medical team in Imam Reza Hospital affiliated to Mashhad University of Medical Sciences. All the revascularization and CABG procedures in this study were performed using cardiopulmonary bypass and cardiac arrest. Left internal mammary artery (LIMA) graft and saphenous vein graft (SVG) were simultaneously harvested after median sternotomy. Arteriotomy was performed on the target portion of the RCA. Coronary endarterectomy of the RCA was performed whenever graft insertion was not possible because of diffuse disease of RCA and insufficient lumen diameter despite the fact that there might be enough distal extension of arteriotomy.

Afterwards, the atherosclerotic plaque was removed from the proximal and distal portions of the coronary artery through coronary dissection. Plaque excision from the distal part of the artery was more prominent whereby the surgeon needed to remove the atherosclerotic plaque from the distal part of RCA as well as PDA and PLV branches. Afterwards, the SVG conduit was inserted into the RCA.

The majority of the patients suffered from multi-vascular (2VD or 3VD) coronary artery disease, whereby one to four extra grafts were used. After the graft was inserted in the proximal site of aortic conduit, the weaning process from cardiopulmonary bypass was initiated. Following it, protamine was administered, and the sternum was closed. Afterwards, the patients were transferred to the intensive care unit (ICU).

The recorded variables in this study included low cardiac output syndrome requiring high-dose inotropic support, amount of bleeding, preoperative myocardial infarction (MI) with increased creatine phosphokinase (CPK) and cTP levels, need for intra-aortic balloon pump (IABP), ICU admission, ventricular arrhythmia (VA) or ventricular fibrillation (VF), length of hospital stay, hospital mortality, and three-month mortality rate.

Results

The patients' mean age was 60±5.2 years (range: 48-75 years). Of the patients, 14 were male (70%), and the mean ejection fraction index was 36±5.7 (range: 15-60) (Table 1). From among the 20 patients on whom coronary endarterectomy of the RCA was performed, two cases died from severe heart failure and RV failure and low cardiac output syndrome notwithstanding high-dose inotropic support and IABP insertion. They were 76- and 55-year-old men with 3VD coronary artery disease and recent MI. One of them was expired in the operating room, and the other was expired in the I.C.U 12 hours after the procedure.

On the other hand, 18 patients were successfully discharged from the hospital and were in good condition as the three-month follow-up showed. In 12 patients, high-dose inotropic support (epinephrine and norepinephrine) was needed within the first 48 hours after surgery. However, IABP support was essential in 7 patients. Postoperative bleeding ranged from 250 to 1600 cc in the first 24 hours following surgery.

In the operating room, three patients (15%) required re-exploration for hemorrhage management. Preoperative MI with increased CPK-MB and CTP levels was recorded in 5 patients (25%), a factor which was overcome without any further interventions. The mean length of ICU stay was 7.5 days (range: 4-16 days), and the mean length of hospital stay was 14 days (range: 9-24 days).

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Table 1: Results of endarterectomy patients

Need for high-dose inotropic support	**12 (60%)**
Intra-aortic balloon pump (IABP)	7 (35%)
Hemorrhage	700 cc (250- 1600)
Need for re-exploration	3 (15%)
Preoperative myocardial infarction (MI)	5 (25%)
Heart Block	1 (5%)
ICU stay	7.5 (4-16)
Length of hospital stay	14 (9-24)
Mortality	2 (10 %)

Discussion

The early reports on coronary endarterectomy refer back to more than 40 years ago. Today, the number of endarterectomy procedures at the time of CABG has increased due to later stage and diffuse state of coronary artery disease [1-3].

In some cases, coronary endarterectomy should be performed when the surgeon faces diffuse coronary artery disease with heavy calcification [5, 6, 7]. Under these circumstances, the cardiac surgeon cannot find a suitable target and acceptable coronary lumen with good distal run-off in the coronary artery for the insertion of conduit. In case there is not sufficient coronary lumen notwithstanding adequate distal extension of arteriotomy, coronary endarterectomy is performed [13].

Theoretically speaking, simultaneous application of CABG and mechanical extraction of atherosclerotic plaques in coronary artery disease, unlike CABG alone, expectedly result in complete revascularization with good clinical outcomes, prolonged short-term and long-term survival, and symptom free patients. Nonetheless, in actuality, as many scholars have reported, coronary endarterectomy has poor outcomes with no long-term survival, leading to rapid recurrence of patient symptoms and MI [11-14].

Experienced cardiac surgeons in referral centers should perform this challenging procedure to gain favorable short-term and long-term results in coronary endarterectomy. During endarterectomy, complete extraction of plaque in both sides especially from the distal part was necessary especially in the distal portion of vessels. Since the intimal cord and ulcerative plaque can break at the ostium of septal branch and RV branch, it can result in poor revascularization of the distal segment. Results of RCA endarterectomy present with severe RV failure and atrial dysrhytemia at the end of procedure. Therefore, incisions should be made close to large branches, and intimal extraction should be performed along the path of branches to achieve complete revascularization [13-16].

Poor results and high mortality rate (30 days) have been reported of coronary endarterectomy in both LAD and RCA artery [12-14]. While coronary endarterectomy has been in practice for around 40 years, some studies show that the results are poor as for different parameters within 30 days following the procedure. In this line, several large-scale meta-analyses have been conducted.

Poorer results of coronary endarterectomy may be related to endothelium damage during the procedure. In fact, damaged endothelium can result in endothelial dysfunction, platelet aggregation, inflammatory reactions, thrombous formation, and finally thrombosis in blood vessels [10-13]. Overall, after LAD, the right coronary artery needs endarterectomy more than other coronary arteries [4, 5].

In comparison with CABG alone, cardiac surgeons usually dislike coronary endarterectomy given its less favorable outcomes. According to different studies, in follow-up of coronary endarterectomy procedure, prevalence of early graft failure and recurrence of angina, perioperative MI, low cardiac output syndrome, need for assisting device especially IABP, prolonged stay in I.C.U, and prolonged intubation and respiratory failure are increased. Also, risks of repeated coronary interventions and CABG are increased [10-14].

Because of the mentioned shortcomings, cardiac surgeons do not favor coronary endarterectomy. Nevertheless, surgeons' skills and experience for this procedure have recently increased and better surgical techniques are available for complete extraction of diseased plaque. This can contribute to successfully perform coronary endarterectomy and remove atherosclerotic plaques from the proximal and distal portions of coronary arteries with better short-term and long-term results.

Conclusions

While we could not assess the long-term outcomes and survival of the patients, the results depicted promising short-term clinical outcomes and 30-day mortality. The findings are comparable with previous research. Overall, in cases for which cardiac surgeons have no alternative, coronary

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endarterectomy of the LAD can result in desirable outcomes and low mortality rates.

Conflicts of interest

The authors declare no conflicts of interest.

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