

# Coronary Endarterectomy, is it a Rescue Procedure?

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## Abstract

### Aim:

To prove that coronary endarterectomy is a safe and beneficial procedure.

### Introduction:

Coronary endarterectomy is an adjunctive procedure done in diffuse coronary artery disease patients. Long term outcomes are not clear despite many studies.

### Statistical analysis:

Continuous data were expressed as mean  $\pm$  standard deviation or median with categorical data as percentages. All reported P values are two-sided, and P values of  $< 0.05$  were considered to indicate statistical significance. Materials: 54 patients were included in this retrospective study over 5 years, short term outcome over 3 month was analysed, with mortality (1.85%) which is near to National Adult Cardiac surgery audit NACSA (2018-2019) results of (1.32%). Experienced surgeons are needed to perform this procedure, knowing the risks of graft failure and bleeding.

### Conclusion:

Coronary endarterectomy appears to be safe, offering no additional mortality and provide symptom free results over short term assessment especially when done to culprit lesions which otherwise will not be operable.

**Keywords:** coronary endarterectomy; coronary artery disease; cardiac surgery

## Introduction

Coronary artery endarterectomy (CE) is a procedure performed adjunctive to coronary artery bypass grafting in patients with diffuse coronary artery disease (CAD). The benefits of coronary endarterectomy remain uncertain. The aim of this study was to evaluate short term surgical outcomes and factors affecting graft patency post-coronary endarterectomy, coronary endarterectomy (CEA) within coronary artery bypass grafting (CABG) is controversially discussed; however, CEA is considered as a last option for severely diseased coronary arteries. We therefore aimed to evaluate outcomes of patients undergoing CABG with CEA. (Shehada et al 2019) There are several limitations of this meta-analysis, most studies were cohort retrospective studies and cohort prospective studies until now, randomized controlled trials are still lacking due to small sample size and non-randomization, several confounders might bias our results, secondly, the baseline risk profile differed between CE with CABG and isolated CABG, with patients undergoing CE more likely suffering from three vessel disease and diabetes mellitus, which revealed selection bias. (Laroc et al 1987)

The previous published rates for graft patency after endarterectomy, ranged from 38% to 100%. This reflected the discrepancy which revealed the considerable variations in the patient demographics and differences in intervals and indications for postoperative catheterization, on the other

hand, the low percentage of patients showed that CE was performed selectively on a specific group. Patients undergoing CE had 3 or 4 cardiac risk factors and mainly suffered from 3-vessel disease, which could affect comparisons between study and control groups. (Djalilian et al 1995)

With the advances of modern cardiac surgery, CE can be performed in the diffusely diseased area of left anterior descending artery and the clinical outcomes and graft patency are encouraging, substantiating its safety and efficacy in this subgroup of patients. (Fukui et al 2011)

In high-risk patients, the durable effect of CE justifies its application in the mid-term and long-term course. After propensity score matching, patients undergoing CABG with CE have comparable operative mortality, major complication rates, and it was reported that there was little difference in the long-term survival rate, the technique of CE yields relatively poor outcomes of graft patency but encouraging survival rates indicates that CE may serve as a viable option in patients where culprit lesions will be otherwise inoperable. (La Par et al 2011)

### Materials:

Retrospective study involving of 54 patients had coronary endarterectomy (one vessel) over a period of 5 years in our centre. Isolated CABG (Coronary artery bypass graft surgery) was the predominant operation (49

patients) , Mitral valve plus CABG ( 4 patients) and Aortic valve plus CABG (1 patient).

Inclusion criteria included all patients who had coronary endarterectomy in either simple CABG or combined CABG and other procedures as bailout (rescue) technique plus if coronary endarterectomy supplies blood to a coronary bed of at least moderate size so that incomplete revascularization would result in residual angina. Any planned coronary endarterectomy pre-operative was excluded from the study. Primary end point is intra operative survival and secondary end point is 3 month post-operative survival.

Average age (45-82) mean 66.6 years old. male to female ration 1.25:1 (30:24 patients).

Most cases were done as open endarterectomy, 2 cases only were closed endarterectomy. (short atheroma which were pulled out completely without need to extend the arteriotomy). Prolene 8-0 was used to stitch the anastomosis regarding the friability of tissues and high risk of

bleeding post operative. Intra aortic ballon pump was needed in 8 patients post operatively to support the circulation,

All patients were successfully weaned from bypass, and transferred to ITU. only one patient died few days later in ITU due to multi organ system failure (patient pre operatively was having chest pain at rest, very tight and calcific lesions , on CPAP at home ).

Endarterectomy vessels were: LAD (Left anterior descending) (32 patients) more than half of the cases, followed by RCA –PDA (Right coronary artery- Posterior descending artery (12 patients), OM (Obtuse marginal) (6 patients), and Diagonal (5 patients).

Conduit used was Internal mammary artery to all LAD grafts, and long saphenous vein for the rest of coronary arteries, which is the standard technique.

Average cross clamp time (83.7 min ) , average Bypass time (112.5 min), no patients had to go back to theatre for bleeding , post-operative bleeding was managed conservatively with blood products guided by TEG ( thromboelastinogram ) .

Conduit-Grafted vessel)	LIMA	LSV	RIMA	Total
LAD	29	3	0	32
Diag	0	5	0	5
OM	0	5	0	5
RCA	0	11	1	12
PDA	0	0	0	
mean	5.8	4.8	0.2	13.5
median	0	5	0	8.5
mode	0	5	0	5
standard deviation	12.96919	4.024922	0.447214	12.76715

Table 1: (Conduit- Graft vessel) percentages

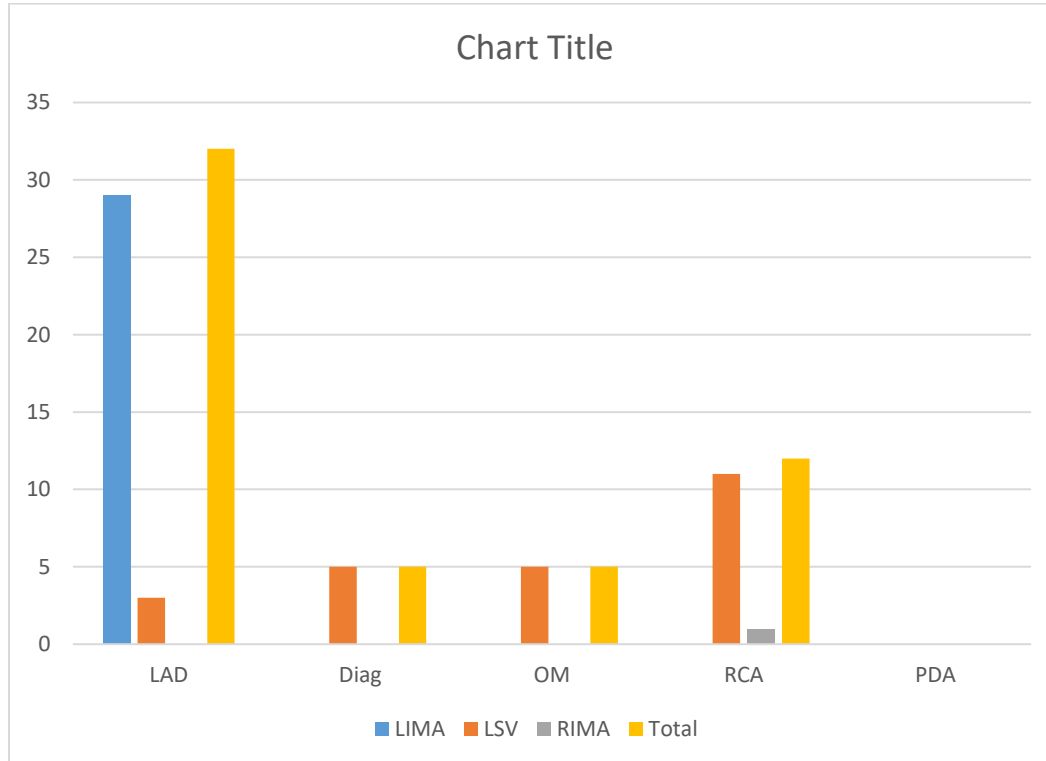


Figure 1: (Conduit- graft vessel) Column Chart with LIMA to LAD represents the highest number of cases.

**Discussion :**

Coronary endarterectomy is an old surgical procedure against coronary artery disease first described in 1957. Despite its first adverse results, several current publications (ex.The midterm results of coronary endarterectomy in patients with diffuse coronary artery disease by Zhibing Qiu et al 2018) included more than 300 patients with coronary endarterectomy with graft patency follow up more than 80%. Coronary

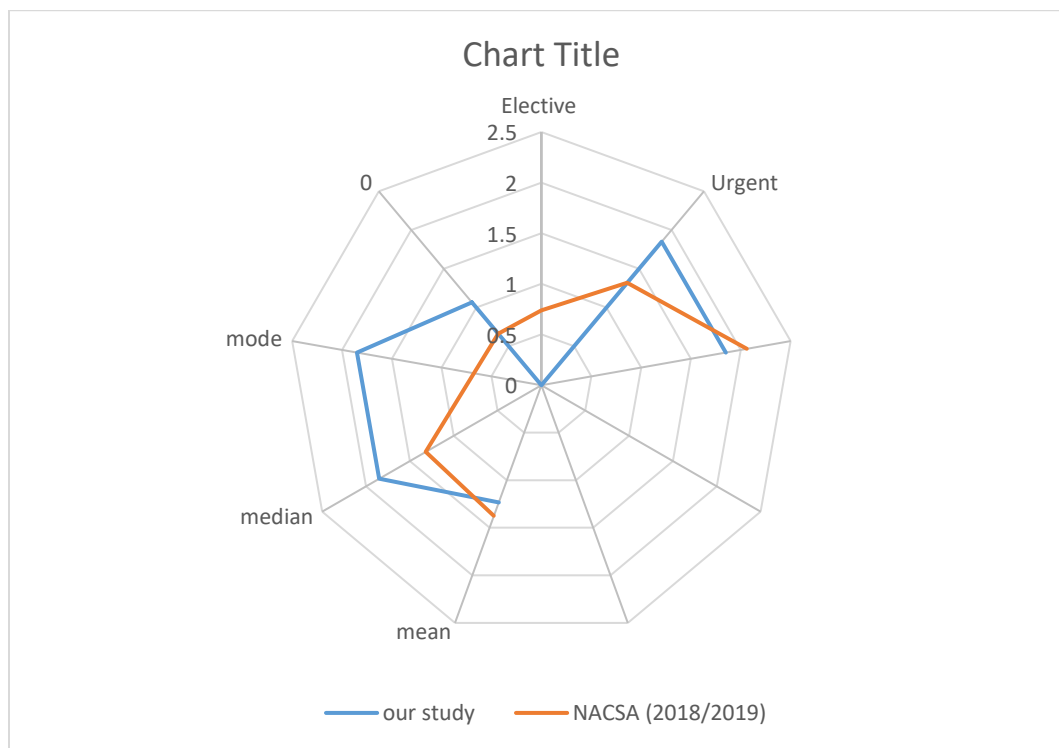
endarterectomy with on-pump or off-pump coronary artery bypass grafting can be safely performed with acceptable mortality, morbidity, and angiographic patency rates. Coronary endarterectomy can assure complete revascularization supplying the myocardium with satisfactory blood flow in cases of a diffusely diseased left anterior descending artery or diffuse calcification, thus preventing residual ischemia. Hence, it is important to evaluate current results, rethink this old recipe, and redefine its indications. (S. Takanashi et al 2008)

	our study	NACSA (2018/2019)
Elective	0	0.74
Urgent	1.85	1.32
mean	1.233333333	1.373333333
median	1.85	1.32
mode	1.85	#N/A
Standard deviation	1.068097998	0.661614188

**Table 2:** Comparison between mortality percentages in our study to NACSA

Although the efficiency of coronary endarterectomy is doubted, it constitutes an additional treatment in cases of diffuse CAD and severe calcification of coronary arteries. In cases of diffuse CAD, affected side branches (diagonal and septal branches) obtain sufficient blood flow when endarterectomy is efficiently performed. However,

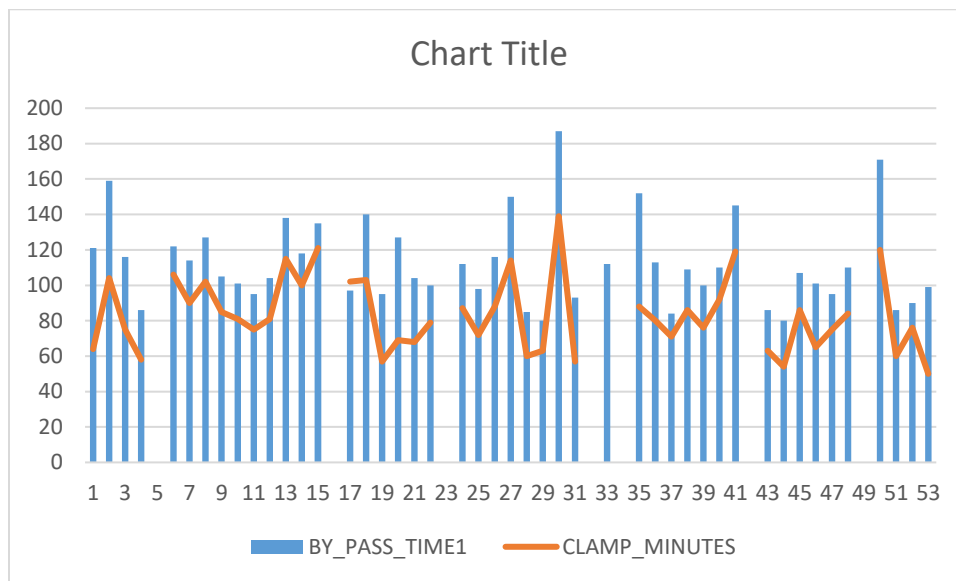
conventional CABG with a distal anastomosis to LAD itself is not sufficient to supply blood to side branches and residual angina is possible. Moreover, neither intense calcification nor soft atherosclerotic plaques are contraindications to obtain a satisfying anastomosis after coronary endarterectomy. (J.D. Schmitto et al 2009)



**Figure 2:** Mortality comparison our study and NASCA

Although endarterectomy has been described to multiple vessels, single-LAD endarterectomy is preferred as LAD can be easily visible along nearly all its length, its adequate stabilization is easier, and less

displacement of the heart is needed to reveal it during off-pump CABG. (M.Takahashi et al 2013)

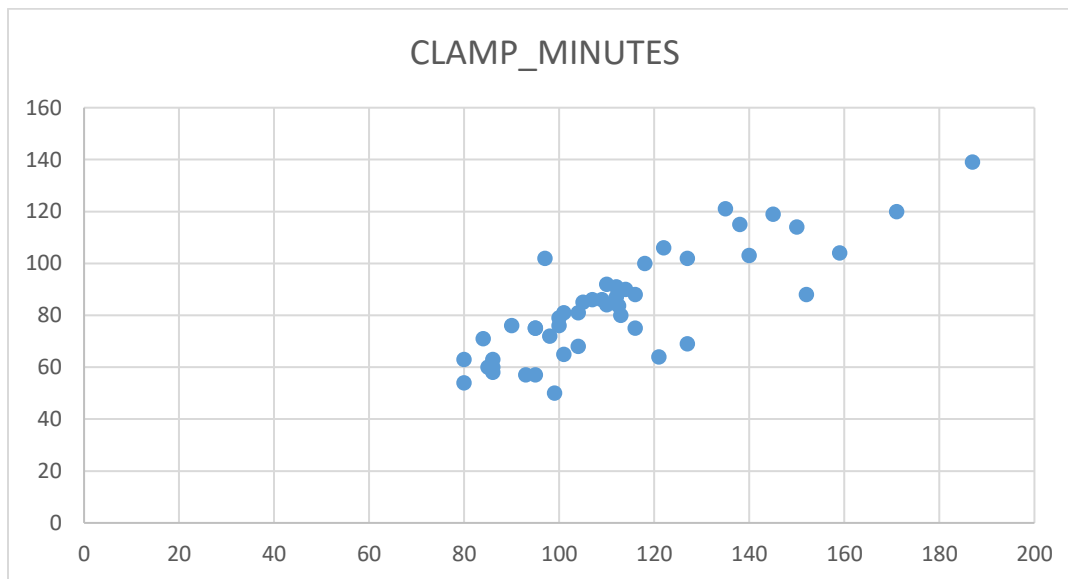


**Figure 3:** Comparison between cross clamp time in relation to total bypass time (Average cross clamp time 83.71 min, average bypass time 112.5 min)

Adding to this, excellent short-term clinical and angiographic results accompany right coronary artery (RCA) endarterectomy . Moreover, no additional morbidity or mortality is associated with RCA endarterectomy when compared to non-endarterectomized RCAs during RCA bypass. (N.Erdil et al 2002)

But is coronary endarterectomy a safe procedure? Overall, hospital mortality rate ranges from 2.0% to 6.5% in international literature.

However, the mortality after CABG along with endarterectomy appears to be higher compared to that after conventional CABG because of the associated comorbidities and risk factors rather than the endarterectomy itself. Furthermore, perioperative myocardial infarction, which is one of the most severe problems during coronary endarterectomy, is limited to 1.5–8% of patients. (F. santani et al 2002)



**Figure 4:** Cross Clamp time / Bypass time chart (with most patients had cross clamp time less than 90 minutes and bypass time less than 120 minute) Recommended safe times are 150 and 240 minutes respectively (Juha et al 2009)

Finally, late graft patency rates after coronary endarterectomy range from 40% to 81.5% . However, single endarterectomy is safer than double endarterectomy. When the RCA is endarterectomized in addition to the LAD or a diagonal branch is endarterectomized in addition to the RCA, early mortality is increased. Postoperative myocardial infarction is also

increased when a second coronary vessel is endarterectomized, no matter which coronary vessel is involved. Subsequently, this article will introduce you in detail to the results of some studies including patients who underwent coronary endarterectomy. (M. Marzban et al 2008)

### Limitations:

It is a retrospective study from a single centre experience, small number of patients include in the study is also a limiting factor. Large number of cases in the study would have shown benefits is unknown.

### Conclusion:

Coronary endarterectomy is an adjuvant valuable surgical option in cases of diffuse coronary artery disease when complete revascularization cannot otherwise be obtained.

The procedure should be done by experienced surgeons as it is not technically simple and associated with high risk of bleeding and graft failure. mortality and morbidity (5-10 % is acceptable) after coronary endarterectomy, this is not related to specific graft, although it seems that extensive disease in younger patients with no collaterals is accompanied by the worst outcome. Coronary endarterectomy proves to be a bail out procedure accompanied by a good short time outcome.

Long term outcome follow up is advised and should be accessed clinically (recurring of symptoms) and radiologically (by angiogram).

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