RESEARCH PAPER

TO STUDY TEN-YEAR SURVIVAL FOR PATIENTS UNDERGOING CORONARY ENDARTERECTOMY IN PATIENTS WITH CORONARY ARTERY DISEASE

***Prashanth M Harsur[1], Praveen N B[2], H R Hemanth Kumar[3]**
[1]Assistant Professor, CT Surgery, Sree Jayadeva Institute of Cardiovascular Sciences and Research, Kalaburgi
[2]Assistant Professor, Department of Cardiac Anaesthesia, Sri Jayadeva Institute of Cardiovascular Sciences, Mysore
[3]Medical Officer, ESI Hospital, Mysore

Corresponding Author: Dr Prashanth M Harsur

ABSTRACT

Background:
Coronary endarterectomy (CE) is used as an adjunct to coronary artery bypass grafting (CABG) in patients with diffuse coronary artery disease (CAD) when standard revascularization is difficult. This study assessed the long-term survival and clinical outcomes of patients undergoing CABG with CE.

Materials and Methods:
This was a retrospective observational study of all patients who underwent CABG with coronary endarterectomy at SCTIMST from 01/01/2000 to 31/12/2010. Medical records were reviewed, and follow-up was done using routine departmental protocol, including transthoracic echocardiography, ECG, chest X-ray, INR monitoring, and telephonic interviews for patients lost to follow-up. Patients who underwent concomitant procedures or redo CABG were excluded.

Results:
A total of 62 patients were included; 61 underwent elective surgery and 1 underwent emergency surgery. The mean age was 68.5 ± 10 years, and 91.9% were male. Diabetes was the most common comorbidity (64.5%), followed by hypertension (37.1%), smoking (33.9%), and dyslipidaemia (24.2%). Most patients had triple-vessel disease (96.8%). Functional status improved significantly after surgery, and left ventricular function also improved, with mean ejection fraction increasing from 61 ± 10.6 to 63.7 ± 10.7 ($P < 0.001$). At follow-up, survival rates were 98.4% at 1 year, 96.5% at 5 years, and 81.4% at 10 years.

Conclusion:
Coronary endarterectomy as an adjunct to CABG provided acceptable safety and effective long-term results in patients with diffuse CAD. In this study, CE was associated with significant improvement in functional status, better ventricular performance, and encouraging long-term survival.

Keywords:
Coronary endarterectomy; coronary artery bypass grafting; diffuse coronary artery disease; long-term survival; retrospective observational study.

How to cite this article: Harsur PM, Praveen NB, Kumar HRH. To Study Ten-Year Survival for Patients Undergoing Coronary Endarterectomy in Patients with Coronary Artery Disease. Int J Drug Deliv Technol. 2026;16(63s):54-59. DOI: 10.25258/ijddt.16.63s.8

Source of support: Nil.

Conflict of interest: None

INTRODUCTION

Complete revascularization of coronary arteries, and mainly of the left anterior descending artery (LAD) which plays a significant role in terms of postoperative outcomes, is the primary objective in coronary artery bypass grafting (CABG). Nowadays, more and more patients having stenoses in one or two coronary vessels tend to be treated by percutaneous coronary intervention (PCI)[1]. As a result, diffuse coronary artery disease (CAD) is more likely among patients referred for CABG[2,3]. However, up to 25% of patients with diffuse CAD cannot be safely and successfully treated by standard CABG[4]. Therefore, several techniques including coronary endarterectomy, which involves the removal of the atherosclerotic core from the coronary artery lumen through an arteriotomy[5], have been proposed to expand surgical possibilities.

Baily et al.[6] were the first to describe coronary endarterectomy (CE) as a treatment against CAD without using CABG in 1957. However, its accompanying morbidity and mortality over shadowed its success in angina relief[7]. In particular, endarterectomy of the LAD was considered technically difficult[8] and it initially appeared to be accompanied by high operative mortality and perioperative myocardial infarction[9]. Hence, coronary endarterectomy indications were restricted to those patients with diffuse Coronary artery disease. Since that time, several publications have shown that coronary endarterectomy either with on-pump CABG[10] or with off-pump CABG can be safely performed[11] and is associated with favourable long-term

outcomes[12]

There are two different approaches to perform coronary endarterectomy: a closed and an open coronary endarterectomy: Nevertheless, it is not clear which is the optimal technique[13]. There is a common point when these two approaches are compared. An arteriotomy of the coronary vessel to remove the atherosclerotic plaque is necessary in both of them[14]. In the closed technique, a smaller arteriotomy is needed to remove the atherosclerotic plaque by applying gentle steady traction on it proximally[15]. Two concurrent arteriotomies can also be used for coronary endarterectomy to make the procedure faster and shorten ischemic time[16]. The closed technique is shorter and the anastomosis of the graft is easier[17], but occurrence of the snow plow effect – occlusion of the distal LAD and its side branches – due to insufficient endarterectomy is more possible[18]. Despite gentle traction applied on the proximal part of the atheromatous core in LAD, its distal part in diagonal branches and septal perforators may be torn off forming an intimal flap. As a result, occlusion of the lumen may occur distally due to a thrombus or dissection[19].

On the contrary, when the open approach is applied, a longitudinal arteriotomy is performed on the coronary vessel beyond the limits of the atheromatous plaque and the atherosclerotic plaque is lifted off[20]. Then, an on-lay patch anastomosis to the LAD derived from the internal thoracic artery or saphenous vein graft, which is opened to the appropriate length, is performed[21]. Alternatively, a longitudinally opened saphenous vein patch can be sewn in place of the arteriotomy and then the left internal thoracic graft can be anastomosed entirely to the vein patch[22]. Although this method takes more time, the atheromatous plaque is removed under direct vision, so the openings of the side branches and of the distal end of the LAD can be directly checked. Moreover, if a dissection of the intima of the distal LAD happens, it can be fixed to secure the distal flow[23]. Consequently, although the open technique takes more time[24] it prevents intimal flap formation and therefore avoids residual obstruction[25]. Therefore, provided that the open technique is used, the quality is guaranteed[26]. According to the results of Nishi's study[27], comparing the open method with the closed one, open endarterectomy is superior to the latter. Patients who underwent open endarterectomy had a lower, although non-significant perioperative mortality. However, this group was associated with statistically significantly better long- term results. The five-year survival rate was 90.7% in the group of open endarterectomy, whereas it was 74% for the group of the closed technique. Moreover, the open method was also associated with better results in terms of morbidity, as 85.2% of patients openly endarterectomized compared to 76.6% of patients endarterectomized with the closed method suffered neither from angina nor from congestive heart failure during the follow-up[28]. Therefore, it can be assumed that although time-consuming, the open approach is the best method of endarterectomy.

METHODS AND METHODOLOGY

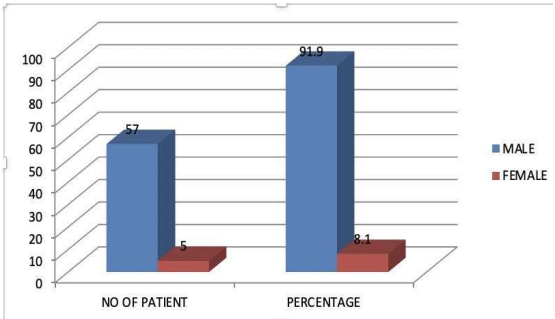
Study Type: A Retrospective observational study

Study Population: All patients who underwent coronary artery bypass grafting with coronary endarterectomy at SCTIMST during period of 01/01/2000 to 31/12/2010

Data collection procedure: All patients who underwent coronary artery bypass grafting with coronary endarterectomy at SCTIMST during period of 01/01/2000 to 31/12/2010 and who satisfied the inclusion and exclusion criteria were included in the study. Retrospective analysis was performed by principal investigator after going through medical records. All the patients underwent follow up after the procedure and routinely as per departmental protocol. Follow up involved Transthoracic ECHO, ECG, Chest X-ray and INR monitoring. Patients who were lost to follow up were contacted through Telephonic interview . Patients were asked about symptoms in the follow up period. Data so collected from the medical records and telephonic interview was analyzed. Procedure DID NOT involve banking of biological samples, HIV testing, Genetic testing

Eligibility Criteria Inclusion Criteria :

Patients with coronary artery disease who has undergone coronary artery bypass grafting with coronary Endarterectomy at SCTIMST during period of 01/01/2000 to 31/12/2010



Exclusion Criteria:

- Patients who underwent any other concomitant procedures such as carotid endarterectomy, Valve repair or replacement along with Coronary Artery Bypass Grafting (CABG) were excluded.
- Redo – CABG were excluded.
- Gender, class, caste, ethnicity, race, will NOT be used as Inclusion and/or Exclusion criteria.

RESULT

Patient Selection:

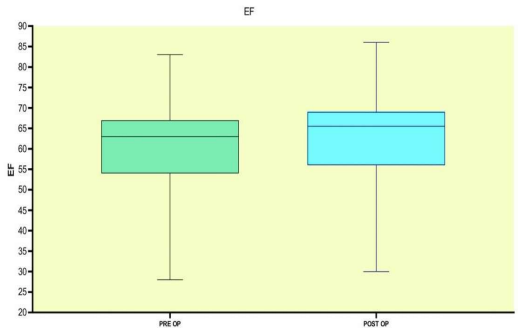
Total of 62 patients underwent coronary artery bypass grafting with coronary endarterectomy and were included in the study.61 patients were Elective and 1 patient was taken up as Emergency procedure.

Figure 1: Gender distribution

Out of 62 patients, 57(91.9%) patients were males and 5 patients (8.1%) were females.

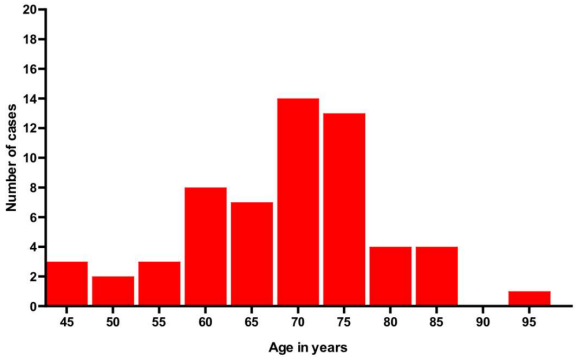
Table 1: Gender distribution

Gender	Frequency	Percent



Male	57	91.9
Female	05	8.1
Total	62	100

Figure 2: Age Distribution

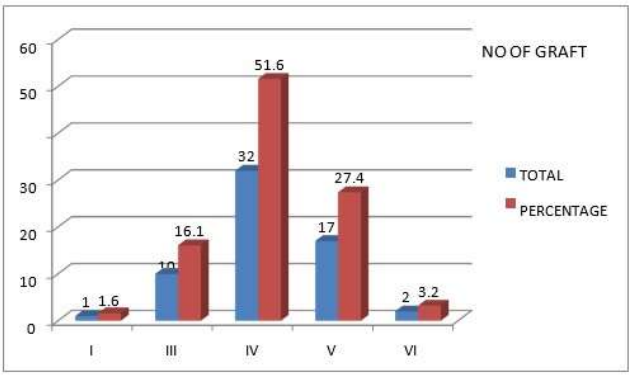


Mean age was 68.5 +/-10 years

Table 2: Comorbidities and Risk factors

COMORBIDITIES AND RISK FACTORS	NO OF PATIENTS	PERCENTAGE
DIABETES	40	64.5
HTN	23	37.1
SMOKING	21	33.9
DYSLIPIDAEMIC	15	24.2

Figure 3: Comorbidities and Risk factors

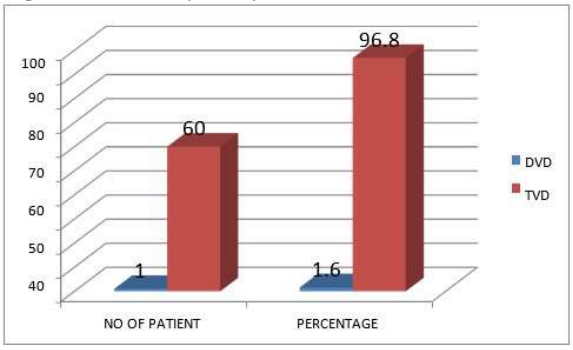


Most common risk factor associated in our study with coronary artery disease was diabetes, present in 40 patients (64.5%), Hypertension in 32 patients(37.1%),21 patients has history of smoking (33.9%),and 15 patients were dyslipidemia (24.2%).
Majority of the patients 64.5 % who underwent coronary endarterectomy were diabetic.

Table 3: Coronary vessel involvement

DISEASED VESSEL	NO OF PATIENT	PERCENTAGE
DOUBLE VESSEL DISEASE	1	1.6
TRIPLE VESSEL DISEASE	60	96.8

Figure 4: Coronary artery involvement



Out of 62 patients, 61 no of patients (96.8%) had triple vessel disease and only 1 patient (1.6%) had double vessel disease.

Table 4: Functional Class

FUNCTIONAL CLASS	PRE OP	POST OP AT DISCHARGE
I	O	13(21%
II	8(12.9 %)	44(71%)
III	54(87.1	4(6.5%)

	%	

There was an improvement in the Functional Status post operatively and it was statistically significant with P value <0.001)

Table 5: LV Function

LV FUNCTION	PRE OP LV FUNCTION	IMMEDIATE POST OP LV FUNCTION
GOOD LV FUNCTION	54(87.1%)	54(87.1%)
FAIR LV FUNCTION	1(1.6%)	1(1.6%)
MILD LV DYSFUNCTION	1(1.6%)	2(3.2%)
MODERATE LV DYSFUNCTION	2(3.2%)	2(3.2%)
SEVERE LV DYSFUNCTION	4(6.5%)	3(4.8%)

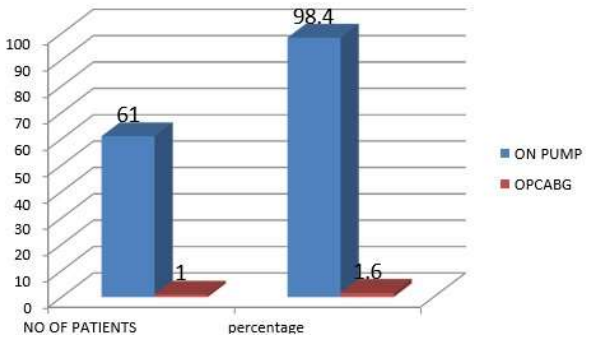
Figure 5: comparison of Preoperative and Post-Operative Ejection fraction

Mean Pre operative EF was (61+/-10.6) and Mean postoperative EF was 63.7+/-10.7. There was improvement in the postoperative EF compared to pre operative EF and the difference was statistically significant P value - <0.001

Table 6: ON pump v/s off pump

ON PUMP/OF PUMP	NO OF PATIENTS	percentage
ON PUMP	61	98.4
OPCABG	1	1.6

Figure 6: ON pump v/s Off pump



Out of 62 patients, 61 patient underwent surgery using Cardiopulmonary bypass (98.4%) and one patient underwent surgery OPCABG (1.6%)

DISCUSSION

Coronary endarterectomy is a surgical procedure performed alongside CABG for the treatment of diffuse CAD. It involves an arteriotomy of the coronary artery and the excision of the atheromatous plaque occluding the vessel in order to revascularise the ischaemic myocardium and improve the success rate and safety of CABG . CE is performed in a highly selected group of patients with severe atherosclerotic disease.

In a study by Djalilian et al, where LIMA was used to anastomose with LAD in 100% of cases. Previously, the internal mammary artery (IMA) has been utilized cautiously as a conduit to an endarterectomized vessel, but many authors have shown satisfactory early and late clinical results with luminal patency of IMA to an endarterectomized vessel compared to great saphenous vein conduit[29]. Acute MI due to acute graft occlusion is a noteworthy complication following CE with an incidence rate of 1.5–19%[30]. The occurrence of postoperative MI in Djalilian et al study patients was only 3.5% compared to a study by Naseri et al[31] who observed higher postoperative MI rate of 6.8% after CABG with CE. In our study 15 Patients underwent LAD endarterectomy and all the patients received LIMA to LAD anastomosis and Acute MI as a late postoperative complication was seen in only 1 (1.6%) patient among those 15 patients. However, in another study, Vohra et al[32] observed that postoperative MI rate following OPCABG with CE was 4.3% . In our study of , the early mortality rate in ICU was of 1.6%, which is consistent with findings form previous studies by Carega et al. The frequency of early mortality following CE with CABG has been found to be between 2% and 15% .

The incidence of three-vessel disease and diffuse coronary artery disease is increasing worldwide, necessitating the use of coronary artery endarterectomy as a procedure. The rate of CE with CABG surgeries is reported somewhere between 3.7%-42% at different institutions, which shows that a significant number of the population has required it.

In a study by Soylu et al[3], The risk factors identified with mortality associated with CE were female gender, diabetes mellitus, left main disease, acute MI, previous myocardial revascularisation and ejection fraction <35% .Comordities and risk factors for mortality identified in our study were Diabetes (64.5%) ,hypertension (37.1%),Dyslipidaemia (24.2%) and smoking (33.9%).we didn't find any variables relating to mortality. Recent investigations have shown that endarterectomy with /without use of cardiopulmonary bypass (off-pump CABG) can be performed safely. In our study we have performed coronary endarterectomy safely and effectively in 62 patients with 61 patients(98.4%) on pump and 1 patient (1.6%) OPCABG.

In a study Xin Chen et al, who studied the survival outcomes of coronary endarterectomy in coronary artery bypass grafting where Kaplan-Meier survival estimates outcome survival at 1, 5 and 10 years were 96%, 89% and 73% respectively. In our study Kaplan-Meier survival curve at

1,5, and 10 years were 98.45%,96.5%,and 89.9 % respectively. Although 1 year outcome is comparable but 5 year and 10 year outcomes are significantly better.

The ultimate aim of Coronary endarterectomy is to ensure a patent coronary artery. The general impression from Xin Chen et al review is that CE is accompanied by acceptable patency rates, that ranged from 56% to 100% at a post-operative follow-up ranging from 2 months to 10 years despite the significant heterogeneity between the studies methodology and design. A patent endarterectomised artery leads to improvement of symptoms and reduction in Cerebro vascular events. 90% of patients at 1 year and 84% at 5 years respectively reported freedom from angina, MI, congestive heart failure and admission to hospital in a study by Byrne et al. In our Study the freedom from Angina and myocardial infarction and stroke was 96.8% at 10 years which is better than the previous mentioned studies .In our study one patient was kept on IABP in post operative period and one patient had deep sternal wound infection.

The risk of cardiac complications was increased significantly by coronary endarterectomy. The incidence of myocardial infarction after endarterectomy (5.4%)in a study done by James et al[33], Nevertheless, the incidence of myocardial infarction has declined substantially from the 10% to 30% rate reported previously for ischemic arrest. Advances in methods of myocardial preservation have extended the limits of safe arrest and have allowed the necessary time and optimal conditions for endarterectomy and multiple vessel grafting. Most studies on endarterectomy have reported an increased risk of perioperative myocardial infarction , but in our study we didn't have any incidence of perioperative myocardial infarction.

In a study by Marzab et al out of 271 patients included in study 70 patients (25.8%) were double vessel disease and 201 patients (74.2%) were triple vessel disease. In our study 60 patients (96.8% were triple vessel disease and 1 patient(1.6%) had double vessel disease.

In a study performed by Andre et al Thirty-eight endarterectomies were performed in 32 patients (1.18 endarterectomies/patient) as 15.62% of the patients required multiple endarterectomies. Of the 38 endarterectomies, 78.95% were performed in the left coronary arteries and 21.05% were performed in the right coronary branches. The anterior interventricular branch was grafted in 90.6% of the cases with the left internal thoracic artery (LITA), however In our study Of the 62 endarterectomies, 31 endarterectomies (50.0%) were performed in the right coronary artery and 15 endarterectomies (24.2%) were done on left anterior descending artery followed by 6.5%,3.2%,1.6% in obtuse marginal -II, obtuse marginal -I, Obtuse marginal -III respectively.

In a study done by sakakibara et al The mean patient age was 65.95 year and 200 patients (85.8%) were male. The mean number of distal anastomoses was 4.5 +/-1.3, and the mean length of the incision on the LAD was 6.1+/- 1.7 cm. Two hundred thirty-two patients (99.6%) underwent surgery with an off-pump procedure, and 16 (6.9%) required on-pump conversion. Postoperatively, stroke occurred in 8 patients (3.4%), and deep sternal wound infection was seen in 5 patients (2.3%). Operative mortality was 0.9% (2 of 233) and In our study mean age of the patient was 68 years, mean cross clamp time 73.3 +/- 31 min, mean CPB time 119 +/-40 min , mean ventilation hours 15+/-2 hours ,mean Hospital stay in days 10 + /-4 days ,mean ICU stays in days - 5 days .The post operative mortality and incidence of stroke are similar in both the studies.

CONCLUSION

In the recent decades, the treatment of older patients with diffuse CAD, alongside multiple comorbidities and high expectations for successful treatment, has become a real challenge. CE is a surgical method that can provide acceptably effective and safe results in the treatment of CAD. CE as an adjunct to CABG, has a significant role in achieving adequate revascularisation and in improvement of long term outcomes. In our study the survival rate at 1 year,5 year, and 10 year was 98.4%,96.5% and 81.4% respectively.

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