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## **CORONARY ENDARTERECTOMY: TO DO OR NOT TO DO IT, THAT IS THE QUESTION**

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### **ABSTRACT**

One of the most important questions addressing a cardiac surgeon during a coronary bypass grafting is to do or not to do an endarterectomy at a target site. We at a major and largest 600 bed Heart Center in the Middle East with over 4600 pumps a year followed a 15 year 950 cases of CAD undergoing CABG with partial or extensive (EA) and came to conclude that it is better to do it, but expertly!.

**Keywords: Coronary Endarterectomy, Ejection Fraction; Left Anterior Descending Artery; Left Internal Mammary Artery**

### **INTRODUCTION**

By doing a coronary endarterectomy (EA), we allow a vessel that appears to be an otherwise inoperable vessel to be recanalized. Although there is a big controversy for application of this procedure, but now there is an increasing tendency to apply the EA more frequently and recent data confirms that. There are many techniques to perform EA namely "Open" the vessel with coronary reconstruction using vein patch or LIMA

(Left Internal Mammary Artery), or "Blind" EA, local or partial EA, and finally laser EA. Many aspects of each technique such as graft patency, symptomatic improvement, operative risks had directed the indication of each procedure and evaluated based on the current experiences. It is again pointed out that EA as a valuable tool at the disposal of each cardiac surgeon will be supplemented to coronary artery bypass grafting so it will extend the

indications for more cases undergoing revascularization. EA carries with it a moderately higher than routine hospital mortality and perioperative infarction rates. Overall we know that two aspects of the deal are a larger number of inoperable cases can undergo CABG and benefit from it and also more complete revascularizations in those cases with diffuse coronary artery diseases are possible.

According to Fundaro P., considering the morphological aspects of diffuse coronary disease, one must argue that, in their presence, myocardial revascularization can be performed only by coronary endarterectomy (EA), together with conventional bypass grafting. Many techniques for endarterectomy (“Open” and “Blind” EA) are analyzed and each procedure according to its indications, long and short term results namely operative risks, symptomatic improvements, and graft patency are evaluated on the basis of current experiences. So they conclude that (EA) is a valuable complement to coronary bypass grafting and again confirms the notion that a larger number of conventionally inoperable cases to benefit and more complete revascularization in those cases of diffuse coronary diseases will be done<sup>(1)</sup>.

Schmitto JD mentioned a case of coronary disease whom intraoperatively, the revascularization of the left anterior descending artery (LAD) was technically challenging because of the extremely calcified coronary artery disease, therefore, he performed the longest endarterectomy of the LAD that has so far been described<sup>(2)</sup>. He would have otherwise missed that opportunity to the cost of the patient.

Coronary endarterectomy was first introduced in early 1950's as a treatment option for diffusely diseased vessels. These vessels are challenging for cardiac surgeon because diffuse atherosclerotic lesions frequently render these target sites unsuitable for conventional distal grafting. However, the initial studies showed a very high morbidity and mortality associated with coronary endarterectomy. So many cardiac surgeons have been reluctant to perform this procedure. With percutaneous coronary intervention surpassing surgical cases in CAD cases, the incidence of diffuse and complex CAD which are referred for surgery has been increasing and recent advances in the surgical techniques and perioperative managements have improved tremendously the surgical outcomes of coronary artery endarterectomy<sup>(3)</sup>.

To accomplish the goal of complete revascularization in a scenario of diffuse

CAD challenges many cardiac surgeons in the current treatment era.

As mentioned by Thiruvipati R. in *Current Opinion Cardiology* (2005), despite the increased risk factors and comorbidities in patients presenting with diffuse CAD requiring coronary endarterectomy (EA), the results of coronary endarterectomy are improving in line with the improvements in the results of conventional coronary artery bypass grafting surgery.

The better and improving results of endarterectomy in the region of the left anterior descending artery can further be clarified by the use of intra-and post operative use of Prostacyclin in overall reducing mortality and peri-operative myocardial infarction<sup>(4)</sup>.

Comparing the technique of closed (traction) method of endarterectomy and that of open endarterectomy with on-lay patch bypass grafting is shown to be not only safer and more effective but also reducing the rate of mortality and improving its patency. The use of coronary endarterectomy was also found to be effective in the treatment of in-stent restenosis in the setting of diffuse coronary artery disease.

The results of off-pump as compared with on-pump coronary endarterectomy are encouraging and comparable while using cardiopulmonary bypassing to do it. With

increasing incidence of diffuse CAD and improving results of coronary endarterectomy, it is vital for cardiac surgeon to have coronary endarterectomy in their armamentarium to achieve complete coronary revascularization<sup>(4)</sup>.

As described by Baily et al in 1957, coronary endarterectomy is an old surgical procedure against CAD. Despite its first adverse results early on, several current articles point to the benefits of coronary endarterectomy with on-pump or off-pump CABG which can be safely performed with acceptable morbidity, mortality and angiographically proved patency rate<sup>(5)</sup>. Coronary endarterectomy can assure complete revascularization supplying the heart with good blood flow in cases of a diffusely diseased LAD artery and or diffuse calcification, thus preventing residual ischemia<sup>(5)</sup>.

In a sprawling scenic 250 acres of land in north of Tehran, Iran, lies one of the most advanced and best equipped 600 beds Heart Hospital.

This Shahid Rajaie Heart Hospital enjoys having the best group of specialists and well-equipped state of the art wards. As we may assume, a well-trained Iranian Cardiac Surgeon can not afford the luxury of merely affirming its pre-eminence without improving its performance. So we should do our best at this largest Heart Center in

the Middle East with over 4800 pumps a year with 12 operating rooms and near 2000 employees as the largest referral center in the country.

The patients enjoy receiving 24-7 services by on duty experts ranging from small stenting to all the way for echmo and pacemaker implants.

Although our transplant program has taken off recently, but it is not that of a major program.

Here we reviewed the cases of CABG by a single surgeon in a fixed routine operating room set up and followed his cases that had been undergone partial or extensive endarterectomy at single or multiple anastomotic sites. From July 1991 all the way to June 2014 about 950 cases were followed and the mortality and their morbidity were noticed to be slightly higher. By extrapolating an earlier results of the study of about 100 cases the data by

occurring from early July 1991 to June 1997, we deduced that the data will occur for the rest of the 950 cases, and by confirming occasional random case studies out of the above pool of aforementioned patients.

About 12.3% needed to undergo re-exploration due to bleeding or tamponades, and only 3.4% succumbed to hospital death.

Again about 12.3% of patients developed mild EKG changes and/or elevated enzyme titers. At last about 2.2% developed mediastinitis. The age, and diabetes and smoking with male gender all played out a very big role. The use of internal mammary graft also increased the above risks. Those all played out as a single variable. By the end, Smoking played out the most important intervening element for all above cases (3.5% involvement with P value=0.05) (Table 1-6).

**Table 1: Age distribution of patients undergoing (EA)**

	Average	±SD	P value
Male	58.1	10.1	0.472
Female	56.4	9.2	
Overall	57.7	9.7	

SD: Standard Deviation

**Table 2: Risk Factors leading to CAD**

	Prevalence	Percent
Smoking	35	39.3
Hypercholesterolemia	46	51.7
Diabetes Mellitus	34	38.2
Hypertension	40	44.9

**Table 3: Functional Class in CAD cases**

	Occurrence	Percent
Class I	5	2.2
Class II	48	51.7
Class III	42	44.9
Class IV	3	1.1

Ejection Fraction	Prevalence	Percent
25	4	44
30	8	10
34	8	10
40	22	23
45	24	25
50	21	23
55	4	4
60	4	4

		Percent
LAD	18	18
RCA	60	60
OM	14	14
Multiple	8	8

		Percent
Re Do Surgery	11	10
Bleeding	10	9
Tamponade	2	2
Perioperative Myocardial Infarction	11	12
Mediastinitis	2	2.2

## DISCUSSION:

We tried to assess the rate of mortality and morbidity in patients with severe CAD whom had undergone coronary endarterectomy and analyse the risks involved with this procedure.

We realized that certain risk factors such as Smoking, Diabetes Mellitus, Gender Identification, and harvesting the Left Interval Mammary Arteries (LIMA) would all lead to higher rate of complications, but going retrogradely, the only item standing out and having an outstanding effect on mortality and morbidity in these CAD cases who undergo coronary endarterectomy is Smoking. The overall mortality rate of 3-4% was acceptable and was slightly lower compared with other studies.

We know that with advance of invasive interventional cardiology, these days there are less cases of pure, discrete, isolated, single or multiple coronary artery disease whom will be referred to cardiac surgeons for bypass surgery. So we will be faced with complicated or failed P.C.I CAD cases with long diffuse lesions in coronary arteries, Here the able cardiac surgeon will have to show his gifted ability to out-manuever these hurdles to be able to help his patients. Recent data from coronary endarterectomy has shown good results<sup>(6)</sup>. This procedure namely EA can also benefit end-stage patients whom are in dire need of CABG<sup>(7)</sup>. But there are also still reports of poor end-result leading to higher mortality and morbidity in CAD patients undergoing

coronary endarterectomy (EA) in LAD region<sup>(8)</sup>.

Most recent studies confirm the notion that those patients undergoing coronary endarterectomy during CABG will have higher survival rate than the rest of regular coronary artery bypass grafting patients<sup>(8-10)</sup>.

Mortality is higher in those cases having related other diseases<sup>(11)</sup>. Also it is higher when CAD combined with diffuse coronary artery disease in need of endarterectomy<sup>(11)</sup>. So it is concluded that one should not compare the results of EA with those of regular CABG cases since the extent of disease and relative prevalence of the disease are higher, therefore higher mortality is faced in this group of CAD patients<sup>(10,12)</sup>.

There are a lot of factors involved in end results of EA in these patients such as left ventricular ejection fraction, old age, peripheral vascular disease, chronic renal failure, diabetes mellitus, female gender, emergency surgeries, and use of balloon pump which all will have effect in final outcome each independently in mortality<sup>(13)</sup>.

Myocardial infarction rate following EA is variable from 1.5% to 13%<sup>(13,14)</sup>. The reason for myocardial infarction has been attributed to lack of endothelium along with the internal elastic band of media of vessels

which could lead to thrombosis formation and followed by coagulation cascades and finally leading to thrombosed graft<sup>(12)</sup>.

A group of researches (Joniev) showed the effect of prostacyclin before, during, and after EA.

In this study the rate of myocardial infarction during and after surgery and related mortality was significantly reduced<sup>(15)</sup>. Another aspect of the failure of EA could be attributed to incomplete removal of atheromatous lesion, or dissection at the site of EA, or creation of flap leading to early complications.

So the bottom line in coronary endarterectomy is to do it, but expertly.!

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