IN HOSPITAL OUTCOME OF PATIENTS UNDERGOING CORONARAY ENDARTERECTOMY: COMPARISON BETWEEN OFF-PUMP VS ON PUMP CABG

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Background: Due to advancement of non-surgical methods of coronary revascularization the patients referred for surgery have extensive and complex coronary anatomy. Patients with diffuse atheromatous coronary artery disease required coronary artery reconstruction or coronary endarterectomy (CE). Coronary endarterectomy on beating heart needs skill and better surgical technique. Coronary endarterectomy along with coronary artery bypass grafting (CABG) done on beating heart is compared with coronary endarterectomy done by using conventional CABG technique. **Methods:** Seven hundred and ninety five consecutive patients underwent CABG from January 2006 to March 2007 in a prospective randomized trial at cardiac surgery department, Punjab Institute of Cardiology, Lahore; out of these 115 patients underwent coronary endarterectomy (CE) and were included in this study. **Results**: Coronary artery bypass grafting was performed in 115 patients. Seventy two (62.6%) were in group A on-pump and 43 (37.39%) were in group B off-pump. Mean age in group A was 55.68±1.06 and 52.63±1.40 in group B. Sixty six male and 6 female were included in group A , 40 male and 3 female patients were in group B. In-hospital mortality among patients undergoing CABG was 5.6 % in on-pump group and 2.3 % in off-pump group (p=0.649), the duration of post-operative mechanical ventilation in on-pump was 6.78±9.34 hours and 5±4.0 hours in off-pump group (p=0.060), 66.7% patients in on-pump and 58.1% patients in off-pump group required blood transfusions, Intra-aortic balloon pump (IABP) was required in 5.6% of the patients in on-pump group. Other factors included, smoking 26.4% in on-pump and 41.9% in off-pump group (p=0.01), Intensive care unit (ICU) stay was statistically significant 4±3 in on-pump group and 4±2 in off-pump group (p=0.02), and drain in on-pump group was 455±208 ml and 540±370 ml in off-pump group (p=0.01). **Conclusion:** Coronary endarterectomy (CE) has higher post-operative morbidity and mortality but the post-operative outcome after the procedure on either technique is comparable and CE is feasible on off-pump technique as well.

Keywords: CABG, OPCAB, Coronary endarterectomy

INTRODUCTION

The increasing incidence of diffuse coronary artery disease in the current era challenges cardiac surgeons in accomplishing their goal of complete revascularization.[1] With advances in percutaneous coronary interventions (PCI), many patients now referred for coronary artery bypass grafting (CABG) have diffuse artery disease.[2] Off pump coronary artery bypass (OPCAB) graft surgery with coronary endarterectomy(CE) is feasible and achieves surgical revascularization in patients with diffuse coronary artery disease.[3] Despite the increased risk factors and comorbidities in patients presenting with diffuse coronary artery disease requiring coronary endarterectomy, the results of coronary endarterectomy are improving.[4] The results of off-pump coronary endarterectomy are encouraging and comparable with the conventional coronary endarterectomy using cardiopulmonary bypass.[5,6] Off-pump coronary artery bypass surgery reduces the likelihood of acute renal failure, reduced time of mechanical ventilation and decreased bleeding thus requiring less number of blood and blood products.[7] The early results and particularly the midterm survival rates, clinical status, and continued graft patency justify off-pump coronary artery endarterectomy in patients with severely depressed left ventricular function and diffuse coronary artery disease.[8] Off-pump coronary endarterectomy can be performed safely with morbidity and mortality comparable with those of conventional coronary endarterectomy.[9] This study has been designed to compare the in-hospital outcome in patients undergoing off pump coronary artery by pass grafting with that of conventional on pump CABG.

MATERIALS AND METHODS

One hundred and fifteen consecutive patients undergoing coronary artery bypass grafting and endarterectomy from January 2006 to March 2007 were included in this Cross-Sectional study. Out of these 115 patients, 72 (63%) patient were from on-pump group A and 43 (37%) were from off-pump group B. The procedure was performed at department of cardiac surgery, Punjab institute of cardiology, Lahore.

In group A all the patients operated for coronary artery bypass grafting was performed on cardiopulmonary bypass machine by using intermittent cross clamp and fibrillation technique.

In group B all the patients were operated without using the cardiopulmonary bypass machine (off-pump), grafting was performed with the help of heart stabilizer (Octopus-V by Medtronic Corporation); intra-coronary shunts were used for blood less operating field.

Internal mammary artery (IMA) was used for anastomosis to left anterior descending artery (LAD) and great saphenous vein (GSV) was used for other coronary artery bypass grafting (CABG) in both groups. Preoperative risk factors for coronary artery disease were studied along with postoperative out come for safety, morbidity and mortality in these patients.

Coronary endarterectomy was done in diffusely diseased coronary vessels otherwise not graftable. Decision for coronary endarterectomy was done peroperatively after opening up the vessel with atheromatous plaque. Endarterectomy was done by everting and dissecting the atheromatous plaque from the arterial wall by applying gentle traction and counter traction technique. The entire plaque was removed from the proximal end and checked for its tapered/proximal end and distal blood flow from the endarterectomised vessel.

We observed postoperatively mean ICU stay, hours of ventilation, hospital stay, postoperative arrhythmias, respiratory and renal complications along with postoperative morbidity and mortality in patients of both groups.

The data was analyzed using STATA 8.2 and SPSS 15.0, appropriate techniques were applied after checking necessary assumptions, Mean±S.E are given for normally distributed metric variables, Median±IQR are given for non-normally distributed metric variables, frequencies and percentages are given for non-metric variables. Shapiro-Wilk test was used to test normality, Independent sample t-test, Mann-Whitney U test were used to observe differences for quantitative variables, fisher exact test and Chi-square tests were used to observe associations for categorical variables.

RESULTS

Coronary artery bypass grafting was performed in 115 patients. Seventy two (62.6%) were in group A on-pump and 43 (37.39%) were in group B. Mean age in group A was 55.68±1.06 and 52.63±1.40 in group B. Sixty six male and 6 female were included in group A , 40 male and 3 female patients were in group B (Table-1).

Table-1: Demographic Indicators

Variables	ON-PUMP (%) (Mean±SE)	OFF-PUMP (%) (Mean±SE)	*p*-value
N	72	43	__
Age	(55.68±1.06)	(52.63±1.40)	0.084
Male	66 (91.7)	40 (93.0)	0.801
Female	6 (8.3)	3 (7.0)	0.806

Preoperative risk factors for coronary artery disease were observed in both groups. 47.2% patients were hypertensive in group A and 46.5 were in group B. Diabetes mellitus was present in 47.2% of patients in group A and 41.9% patients in group B. Family history for coronary artery disease was prevalent in 36.1% patients in group A and 46.5% of patients in group B. Hyperlipidemia, smoking and renal failure was present in 12.5%, 26.4%, 0% in group A and 14%, 41.9% and 2.3% respectively in group B (Table-2).

Table-2: Risk Factors

Variables	ON-PUMP (%)	OFF-PUMP (%)	*p*-value
N	72	43	
Hypertension	34 (47.2)	20 (46.5)	0.941
Diabetes Mellitus	34 (47.2)	18 (41.9)	0.576
Family History	26 (36.1)	20 (46.5)	0.327
Hyperlipidemia	9 (12.5)	6 (14.0)	0.823
Smoking	19 (26.4)	18 (41.9)	0.086
Renal Failure	0 (0.0)	1 (2.3)	0.374

Left internal mammary artery was used in all patients of both groups (100%). One hundred and eighty four grafts were applied in group A (2.55±per patient) and 113 grafts were applied in group B (2.62±per patient). (Table-3)

Table-3: Per-op Graft Distribution

	ON-PUMP (%)	OFF-PUMP (%)	*p*-value
N	72	43	
LAD	72 (100.0)	43 (100.0)	
D1	26 (36.1)	17 (39.5)	0.714
D2	2 (2.8)	3 (7.0)	0.361
OM	1 (1.4)	0 (0.0)	0.438
OM1	46 (63.9)	19 (44.2)	0.039*
OM2	12 (16.7)	2 (4.7)	0.057
CX	5 (6.9)	4 (9.3)	0.726
RI	8 (11.1)	13 (30.2)	0.010*
PLV	1 (1.4)	2 (4.7)	0.555
PDA	11 (15.3)	10 (23.3)	0.284

Out of 184 grafts applied in group A coronary endarterectomy was performed in 95 vessels (51.63%). In group B out of 113 grafts coronary endarterectomy was performed in 45 vessels (39.82%). Left anterior descending artery endarterectomy was performed in 18 (25%) patients in group A and in 16 (37.2%) patients in group B. Right coronary endarterectomy was done in 22 (30.5%) vessels in group A and 14 (32.6%) vessels in group B. Seventeen patients in group A underwent multiple artery endarterectomy and 4 patients in group B (Table-4).

Single vessel coronary endarterectomy was performed in 55 (76.4%) patients in group A and in 39 (90.7%) patients in group B. Double vessel coronary endarterectomy was done in 12 (16.7%) patients and in 4 patients in group B. Triple vessel endarterectomy was done in 5 (6.9) patients in group A only, and one patient in group A out of these five patients had 4 endarterectomies, (Table-5).

Table-4: Endarterectomy Vessel Distribution

Variables	ON-PUMP (%)	OFF-PUMP (%)
N	72	43
Total Grafts	184	113
Coronary Endarterectomy	95 (51.63 %)	45 (39.82 %)
LAD	18 (25.0)	16 (37.2)
CX	1 (1.4)	0 (0.0)
RCA	22 (30.5)	14 (32.6)
RI	1 (1.4)	1 (2.3)
OM1	5 (6.9)	7 (16.3)
OM2	2 (2.8)	0 (0.0)
D1	2 (2.8)	1 (2.3)
PDA	4 (5.5)	0 (0.0)
LAD,RCA	3 (4.2)	2 (4.7)
OM1,RCA	1 (1.4)	1 (2.3)
D1,RCA	1 (1.4)	0 (0.0)
OM1,OM2	1 (1.4)	0 (0.0)
LAD,OM2	1 (1.4)	0 (0.0)
OM1,D1	1 (1.4)	0 (0.0)
LAD,OM1	1 (1.4)	0 (0.0)
LAD,D1	1 (1.4)	1 (2.3)
LAD,PDA	1 (1.4)	0 (0.0)
D1,PDA	1 (1.4)	0 (0.0)
LAD,OM2,RCA	2 (2.7)	0 (0.0)
D1,OM2,RCA	1 (1.4)	0 (0.0)
D1,D2,RCA	1 (1.4)	0 (0.0)
LAD,D1,OM1,RCA	1 (1.4)	0 (0.0)

Table-5: Multiple vessel endarterectomy

Variables	ON-PUMP (%)	OFF-PUMP (%)
N	72	43
Single Vessel Coronary Endarterectomy	55 (76.4)	39 (90.7)
Double Vessel coronary Endarterectomy	12 (16.7)	4 (9.3)
Triple vessel and more coronary Endarterectomy	5 (6.9)	0 (0.0)

Number of grafts applied, mean ICU stay, hours of ventilated, hospital stay was noted post operatively in all patients in both groups. Mean ICU stay was found significant among these findings (with p=0.007), (Table-6).

Table-6: Post-operative Findings

Variables	ON-PUMP (Median±*IQR)	OFF-PUMP (Median±*IQR)	p-value
Grafts Applied	(3.0 ± 1.0)	(3.0 ± 1.0)	0.533
ICU Stay	(4.0 ± 3.0)	(4.0 ± 1.0)	0.007*
Hours Ventilated	(6.78 ± 9.34)	(5.0 ± 4.0)	0.060
Hospital stay	(10.5 ± 6.0)	(10.0 ± 7)	0.368
Drain	(465.0 ± 267.50)	(500.0 ± 220.0)	0.515

* Interquartile Range

Out of 115 patients 2 (4.7%) patients were converted to on- pump from off-pump due to haemodynamic instability. Post operative atrial fibrillation was noted in 13 (18.1%) patients in group A and in 4 (9.3%) patients in group B. Respiratory tract complications were observed in 11 (15.3%) patients in group A and in 6 (14.0) patients in group B. Four patients required Intra aortic balloon pump (IABP) counter pulsation in group A for coronary perfusion and left ventricular dysfunction. Renal dysfunction was observed in 18 (25.6%) patients in group A and in 4 (9.3%) patients in B. Blood transfusion was required in 66.7% patients in group A and 58.1% in group B. In hospital mortality in both groups was 5.6% in group A and 2.3% in group B, (Table-7).

Table-7: Post-operative Complications

Complications	ON-PUMP %)	OFF-PUMP (%)	p-value
N	72	43	
Conversion to ON-PUMP	2 (4.7)		
Arrhythmias	13 (18.1)	4 (9.3)	0.197
Respiratory	11 (15.3)	6 (14.0)	0.211
Wound Infection	2 (2.8)	3 (7.0)	0.286
IABP	4 (5.6)	0 (0.0)	0.295
Renal dysfunction	18 (25.0)	4 (9.3)	0.075
Mortality	4 (5.6)	1 (2.3)	0.649
Miscellaneous	1 (1.4)	3 (6.9)	0.146
Blood Used	Yes: 48 (66.7) No: 24 (33.3)	Yes: 25 (58.1) No: 18 (41.9)	0.354
AMI	8 (11.2)	8 (18.5)	0.576

DISCUSSION

With the development in percutaneous coronary intervention techniques (PCI) and new generation of coronary stents most of the patients with coronary artery disease are now treated by the cardiologists. Cardiac surgical team is left with high risk patients, along with multiple and diffuses coronary artery disease. The increasing number of elderly patients with multiple risk factors, complex anatomy of coronary artery disease, increasing incidence of diabetes and need for redo revascularization effect the out come of coronary artery bypass grafting. Management of the patients with complex, diffuse atheromatous coronary artery disease is a real task factor for surgical team.

In patients with diffuse coronary artery disease, coronary endarterectomy is an option for the surgeon in non-operate able vessels with significant reversible ischemic area of the myocardium.

Before the advent of extracorporeal circulation coronary endarterectomy was attempted on beating heart with discouraging results. The advent of extracorporeal circulation, coronary angiography combined with bypass grafting enabled adequate results with coronary endarterectomy. With the advancement of 'off-pump' coronary artery bypass grafting technique with good outcome, encouraged surgeons to perform endarterectomy on beating heart. Off-pump CABG can avoid the potential damaging effects of CPB. Resent work with off-pump technique showed that it carries a low early morbidity and mortality. Regardless of the technique, performing complete revascularization is our aim. To

achieve effective revascularization of vessels otherwise seem to be in-operable coronary endarterectomy is our alternative option.

The significantly stenosed vessels to be grafted, seems easy when the stenosis is localized. But with complex morphology of the disease, diffuse calcific involvement and multiple sites of stenosis, complete revascularization can be performed only after removal of plaques and sites of calcification. Managing the patients with diffuse calcific coronary artery disease renews the risks and benefits of coronary endarterectomy. The previous data showed that procedure is safe and effective in selected group of patients.

The use of LIMA in left sided endarterectomies decreases the risk and enhances outcome. In history the coronary endarterectomy was performed earlier on beating heart, but the experience with off-pump technique was limited. Now some significant studies have been reported, some studies show encouraging results with coronary endarterectomy combined with aortocoronary bypass grafting. The overall analysis of studies is controversial with mortality around 0% to 10%, perioperative infarction of 3–25% and graft patency 38–100% and disappearance of symptoms in 75–95% of endarterectomy patients. Different studies showed varying results and experience with off pump and on pump coronary endarterectomy.

Shneider *et al* in his study considered reconstruction of coronary arteries after coronary endarterectomy. According to them coronary endarterectomy is necessary in up to 37% of patients undergoing CABG. This is the high percentage of patients requiring endarterectomies.[10]

Vohra HA reviewed the early and late results of off-pump coronary artery bypass graft surgery (OPCAB) with coronary endarterectomy in patients undergoing surgical revascularization. Out of 680 OPCAB patients, 70 (10.29%) underwent concomitant coronary endarterectomy. The 30-day mortality rate was 2.85% (n=2). Postoperative myocardial infarction was observed in 4.3%. The median follow-up was 4.91 years, 90% of patients were angina free, and the survival at 10 years was 78.04%.[3]

Few authors showed in their studies that coronary artery endarterectomy is associated with increased morbidity and mortality.

Sirivella S and colleagues also described in their study that Coronary artery endarterectomy with coronary artery bypass grafting for diffuse coronary artery disease has been associated with increased morbidity and mortality. They performed isolated coronary artery endarterectomy with coronary artery bypass grafting in 1,478 consecutive patients. They compared the short-term outcomes with concurrent series of conventional coronary artery bypass graft surgery. The operative mortality (3.2% versus control 2.2%, p=0.03) and the incidence of major postoperative morbidity (not significant) were comparable between the groups. They found that prolonged cardiopulmonary bypass time, recent acute myocardial infarction, redo surgery, and poor ventricular function were important predictors of in-hospital mortality in their study. They concluded that vessel endarterectomised, technique of endarterectomy, and cardiopulmonary bypass versus off-pump technique did not alter results. Five year and 10 year survivals were 83% and 74% respectively.[6]

Atik *et al* discussed in their study the myocardial revascularization with coronary endarterectomy and stratification of risk factors for early mortality. They assessed 353 patients retrospectively who underwent 373 coronary endarterectomies representing 3.73% of the myocardial revascularizations. In-hospital mortality among their patients was 9.3% as compared with 5.7% in patients with myocardial revascularizations without endarterectomy (p=0.003). Cause of death was related to acute myocardial infarction in 18 (54.55%) patients. They noted following significant risk factors for mortality, diabetes mellitus (p=0.001), left main disease (p<0.001), female sex (p=0.01), acute myocardial infarction (p=0.02), ejection fraction <35% (p<0.001), and previous myocardial revascularization (p<0.001). In their conclusion coronary endarterectomy is related to higher mortality, and the risk factors involved are important elements of a poor outcome.[11]

Most studies stressed on the safe and effective use of coronary endarterectomy in patients undergoing coronary artery bypass grafting.

Naseri in their study did the comparison of off-pump and conventional coronary endarterectomy. They included 332 patients who underwent off-pump coronary artery bypass grafting. They did off-pump coronary endarterectomy in 44 (13%) of the patients. The mean follow-up period was 16 months. In 35 patients they did single and in 9 patients they did double endarterectomy. Three (6.8%) of the patients in group 1 and 2 (4.4%) of the patients in group 2 developed postoperative myocardial infarction (p<0.05). One (2.2%) of the patients in group 1 and 2 (4.4%) of the patients in group 2 died in the postoperative period (p<0.05). The numbers of patients with perioperative neurological deficit in groups 1 and 2 were 0 and 7, respectively (p<0.001). They concluded in their study that off-pump coronary endarterectomy can be performed safely with morbidity and mortality comparable with those of conventional coronary endarterectomy.[9]

In some studies authors described the benefits of reconstructive technique and advantages of on-lay patch on endarterectomised vessels.

Tiruvoipati R described that the technique of open coronary endarterectomy with on-lay patch bypass grafting has been shown to be safe and effective in reducing mortality and improving patency as compared with the closed (traction) method of coronary endarterectomy. 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 coronary endarterectomy are encouraging and comparable with the conventional coronary endarterectomy using cardiopulmonary bypass.[1]

In another study by Nishi H described the optimal method of coronary endarterectomy for diffusely diseased coronary arteries. Out of 127 patients who underwent coronary artery bypass grafting with CE, 68 patients had CE with long arteriotomies and on-lay patch bypass grafting were compared with 59 patients who underwent CE with the conventional pull-out method. They found that thirty-day mortality was 2.9% in group with on-lay patch technique and 6.8% in group with pull out technique. The early angiographic results of 115 patients revealed a patency rate of 92.1% in on-lay patch group and 88.6% in pull-out group. Actuarial survival at 5 years was 90.7% in group 1st and 74.0% in 2nd group (p=0.1). Angiograms performed on 78 patients after a mean period of 21 months showed a patency rate of 89.1% in group 1st and 81.0% in 2nd group (p<0.001). They concluded that midterm angiographic results of CE with long arteriotomies and on-lay patch bypass grafting were better than the results obtained with the conventional pull-out method.[12]

Coronary artery bypass grafting in patients with in-stent re-stenosis is technically demanded and require more surgical skill. Patients with stenosis of coronary stents and advanced coronary artery disease end up in CABG

Fukui T described coronary endarterectomy and stent removal in patients with in-stent re-stenosis in their study. Eleven consecutive patients who presented with angina and angiographically severe In-stent re-stenosis (ISR) were treated with coronary endarterectomy and stent removal with concomitant multivessel coronary bypass grafting. The target vessel was the left anterior descending artery (LAD) in all patients. The left internal mammary artery (LIMA) was grafted in situ, as an on-lay patch. Procedural success without in-hospital complications was achieved in all cases, except one patient with low cardiac output syndrome. Post procedure angiography demonstrated that all LIMA patches and LAD arteries were patent and left ventricular functions were preserved. They concluded that coronary endarterectomy and stent removal with on-lay LIMA patch is a safe and effective technique used in patients with ISR involving diffuse target vessel disease.[13]

Ferraris VA and colleagues presented long-term angiographic results of coronary endarterectomy in their study. They performed 132 Coronary endarterectomies in 97 patients. At a mean of 7.1 years of follow-up, significantly fewer bypass grafts to endarterectomised vessels were patent compared with non-endarterectomised vessels (40% of endarterectomised vessels compared with 58% of non-endarterectomised vessels in study patients and 65% in control patients, p=0.0003). In their results long-term patency in bypass grafts to endarterectomised vessels is lesser than in non-endarterectomised vessels. They suggested that CE should be used with caution in smaller patients with less BMI and aggressive control of risk factors is important in patients who have CE.[14]

Most surgeons performing coronary endarterectomy are comfortable and satisfied with the results of their procedures. Nurozler F reviewed the outcome of off-pump endarterectomy in patients with diffuse coronary artery disease. Overall operative mortality in his study was 3.1%. Perioperative myocardial infarction occurred in 6.2%. The mean follow-up period was 14±3.3 months. Late survival was 93%. Freedom from cardiac events that required hospital re-admission was 89%. Freedom from angioplasty of the endarterectomised vessel was 96%. These findings indicate that off-pump endarterectomy can be performed with good results in patients with diffuse coronary artery disease.[15]

Kunt performed coronary endarterectomy on beating heart with poor ventricular function. Forty two patients underwent off-pump myocardial revascularization with coronary artery endarterectomy. In their study 27 (64.2%) patients had experienced a previous myocardial infarction, and 11 (26.2%) had undergone an operation on an emergency basis. All patients had an ejection fraction of less than 30%. The left anterior descending coronary artery was the most endarterectomised vessel (75% of patients). There were 5 early deaths (11%). Twenty-five (67.6%) of the surviving patients were symptom free, and 8 were in Canadian Cardiovascular Society Classes II to IV. The ejection fraction improved after the operation in the 30 patients (71.42%) who underwent echocardiography control and coronary angiography. The 28.4 month patency rate of the endarterectomised coronary arteries was 89%. The patency rates were 93.3% for the left internal thoracic artery-left anterior descending coronary artery and 88.8% for the right coronary artery.[8]

Marinelli *et al* described immediate and long-term results with coronary endarterectomy. In their study 107 patients underwent myocardial revascularization with coronary endarterectomy to achieve a complete revascularization. Out of these 107 patients 90 were men and 17 were women. There were 5 (4.7%) early deaths. The 72-month survival was 91.2%. Seventy-seven (83.7%) of the survivors were symptom free, and 15 (16.3%) were in Canadian Cardiovascular Society class II to III. An improvement of the ejection fraction after the operation was noted in the 97 patients. The 30.4 month patency rate of the endarterectomised coronary arteries was 72%.They concluded that in patients with end-stage coronary disease coronary endarterectomy is a safe and effective procedure for achieving a complete revascularization.[16]

The current study deals with the patients who underwent coronary endarterectomy both on conventional and off-pump coronary artery bypass grafting. Seven hundred and ninety five consecutive patients under went CABG were studied and out of them 115 patients underwent CE and were included in this study. Sixty six male and 6 female were included in group A , 40 male and 3 female patients were in group B. In-hospital mortality among patients undergoing CABG was 5.6% in on-pump group and 2.3% in off-pump group (p=0.649), the duration of post-operative mechanical ventilation in on-pump was 6.78±9.34 and 5±4.0 in off-pump group (p=0.060), 66.7% patients in on-pump and 58.1% patients in off-pump group required blood transfusions, IABP was required in 5.6% of the patients in on-pump group. ICU stay was statistically significant 4±3 in on-pump group and 4±2 in off-pump group (p=0.02).CE has higher post-operative morbidity and mortality but the post-operative outcome after the procedure on either technique is comparable and CE is feasible on off-pump technique as well. Most important complications encountered in our study were the post operative dysarrythmias after RCA coronary endarterectomy, in two of our patients RCA graft was thrombosed just after coronary endarterectomy

Total number of grafts in each group and number of vessel endarterectomised nearly similar in each group. The short term results of coronary endarterectomy with aortocoronary bypass grafting vary in different studies, reflecting variability in race, sex, and region, indications of surgery and surgical technique. Recent results are significantly improved. Most of studies show higher incidence of arrhythmias, acute myocardial infarction, immediate mortalities and lower patency rates in grafts applied on vessels undergoing endarterectomy: in relation to those where endarterectomy was not done. The off-pump technique differs with that of conventional, starting with management and support of anaesthesia provision of significant cardiac out put during the grafting phase. There is certain limitation of the technique but at the same time we can avoid from the complications of CPB leading to better out come in field of respiratory, renal, neurocognitive and cerebrovascular accidents. When performed in an indiscriminate manner in diffuse atherosclerotic vessels a high in hospital mortality and morbidity observed, related to perioperative acute myocardial infarction.

Coronary endarterectomy should be used whenever possible in selected patients in a programmed manner to promote myocardial revascularization.

CONCLUSION

Performing coronary endarterectomy on beating heart is not an easy task, simultaneous off-pump coronary artery bypass grafting and endarterectomy is available alternative, when there is no other option for adequate revascularization. We can achieve effective short term clinical improvement doing off-pump coronary endarterectomy with comparable results to conventional coronary artery bypass grafting technique.

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