

Predicted Operative Factors for Early Mortality after OFFPUMP Coronary Artery Bypass Grafting Surgery (CABG)

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Abstract

Objective: OFFPump CABG surgery (opcab) is performing worldwide and the rate of coronary revascularization without CPB (cardiopulmonary Bypass) is growing significantly. The aim of this study is to evaluate the risk factors for early mortality after OPCABG.

Methods: From April 2009 to April 2011, data were collected from a total of 920 patients who underwent OFFPump CABG. Variables that were recorded were age, gender, EF, preoperative Cr, any comorbidity diseases like DM, HTN, Hyperlipidemia, Valvular pathology especially MR and TR. In postoperative period, need for Reexploration and any neurologic complications.

Result: Older age was a risk factor for early mortality (30 days) after OFFPump CABG, but female gender was not a risk factor. Although in dead patients the average EF was lower but low EF was not an important risk factor for early mortality. Mild Cr elevation was not a risk factor for early mortality as well. In CAD patients, valvular pathology is a known risk factor for mortality. In our study Sever TR was a risk factor for early mortality but MR was not a risk factor for early mortality. Need for early reexploration was a factor for early mortality.

Conclusion: risk factors of CABG- Ischemic heart disease- cardiopulmonary bypass- coronary heart disease- OPCAB post operative mortality

Key words: Beta (β)-thalassemia Major; Systolic and diastolic dysfunction; Echocardiography.

Introduction

CABG is still the main treatment for patients with three-vessel coronary disease. The indications are well documented and the results are relatively satisfying in terms of low mortality and morbidity (1). The incidence of risk factors and preoperative comorbidities is increasing (2) and many patients candidated for surgery, are at an advanced age, with severe left ventricular dysfunction, chronic renal disease, peripheral vascular disease, chronic bronchopulmonary disease, etc. To improve the management of these patients, surgeons needed to adapt their operating

techniques. CPB can trigger numerous complications or worsen pre-existing organ damage (cardiac, pulmonary, renal), which in turn may increase operative morbidity and mortality. OPCAB strategy is to be able to carry out revascularization as complete as possible, under technical conditions offering maximum safety for the patient, by avoiding the triggering of possible complications induced by CPB and by avoiding myocardial ischemia (3, 4). It seems that OPCAB offers results at least equal compared to CPB under cardioplegic arrest in terms of low or moderate risk patients (5). Patients condition,



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who candidated for myocardial revascularization surgery has changed in recent years: patients are older, with myocardial infarction and Left ventricular dysfunction, with greater comorbidities, which means the predicted operative risk is greater than for those operated in the past. However, despite the worse characteristics of the patients and increased predicted risk, Mortality of CABG was decreased recently. Until the mid-1990s, coronary bypass surgery was performed with cardiopulmonary bypass (CPB) and cardioplegia in almost all cases, producing an arrested and flaccid heart and providing ideal conditions for the construction of anastomoses in arteries 1 to 2 mm in diameter. However, by placing the blood in contact with nonbiological surfaces, CPB causes systemic inflammatory reactions and a series of deleterious effects in various organs (6). With the aim of further reducing mortality and preventing morbidity resulting from the use of CPB, at the end of the 1990s various teams began performing beating heart or off-pump coronary artery bypass (OPCAB) surgery, originally for revascularization of the left anterior descending artery and later for arteries located in the inferior and lateral walls (7). There is little consensus in the literature on the advantages of not using CPB. Some studies have indicated that mortality is lower in OFFPump coronary surgery compared to patients operated with CPB. Others have shown reduced morbidity, particularly a lower incidence of transfusion and fewer renal and neurologic complications, lower levels of biochemical markers of myocardial ischemia, and shorter ICU and hospital stay (8-10). The objective of this study was evaluation of risk factors for early mortality (30 days) after OFFPUMP Coronary artery bypass surgery.

Methods:

Between April 2009 and April 2011, 920 patients undergoing isolated myocardial revascularization surgery, in Cardiovascular surgery department in Imam Reza hospital of Mashhad medical science university were evaluated in a cross sectional study. Exclusion criteria was recent MI, unstable hemodynamic states, recurrent and intractable ventricular arrhythmia especially VT/VF. Only patients undergoing Primary isolated OPCAB through median sternotomy were included. Re-operative OFFPump CABG and minimal invasive direct coronary artery bypass (MIDCAB) procedures were also excluded. Preoperative, intraopera-

tive and postoperative data were recorded. The variables that were recorded consisted of preoperative EF, history of HTN and DM, hyperlipidemia, smoking and addiction. Coronary Angiography showed that 760 patients (68%) had 3VD, and others had 1VD and 2VD. Renal function tests also were recorded with preoperative Cr. Echocardiography data about valvular heart pathology were recorded with special attention to MR and TR. Patients were operated with median sternotomy approach and OFFPump facilities. During surgery, if there was any necessity to emergent conversion OFFPump to conventional CABG, patient was excluded from the study. The number of constructed grafts and any significant problems were recorded, and in the end of procedure, intubated patient was transferred to ICU, under monitoring and with infusion of low dose dopamine (5 microgr/Kg/Min). In ICU, any mortality and morbidity of patients were recorded and they closely followed up, during hospital stay, and after releasing from hospital, patients re-evaluated and visited in a regular program for 30 days. Any event that was necessitated to Re-explore the Sternum was recorded too.

Result:

In this study 920 patients with Coronary Artery Disease who were candidated for OFFPump CABG was evaluated. 557 patients (60.5%) were male and 363 (39.5%) were female. Mean age of patients was 58.47 with range 27-80 years. Due to Echocardiography data, mean EF was 45.12% and in range of 15%-66%. In this study, Prevalence of HTN was 47.7% (439 patients), for DM was 27.8% (256patients), and for Hyperlipidemia was 37.9% (349 patients). Smoking and other addiction history was seen in 195 patients (21.2%). Preoperative Cr greater than 2mg/dl was seen in 93 patients (10.1%). Preoperative Echocardiography showed that MR was seen in 189 patients (20.5%) with different degrees. 115 patients(12.5%) had mild MR, 55 patients (5%) had moderate MR and 19 patient (2%) had sever MR, and also 88 patients (9.6%) had some degrees of TR that 86 (9.3%) had mild TR and only Two patients (.2%) had Sever TR (Table 1). In our study 40 patients (4.3%) were necessitated to Sternum Re-exploration, due to excessive hemorrhage and Drainage, Tamponade, Cardiac Arrest, Graft failure and other reasons during ICU or Hospital stay and until 30 days. In our study the mortality rate was 1.2% (11 patients).

Table 1: Patient demographic

Total patient	920	
HTN	439	47.7%
DM	256	27.8%
Hyperlipidemia	349	37.9%
3 VD	760	68.2%
MR	189	20.5%
TR	88	9.6%
Cr >2 mg/dl	93	10.1%

In analysis of data we evaluated relation of selected variables with early mortality.

The average age of dead patients was 67 ± 8.1 years and the mean age of survived patients was 58.37 ± 9.6 years ($P=0.004$). The mean of EF in dead patients was $40.9\% \pm 11.79$ and the mean of EF in survived patients was $45.17\% \pm 9.7$ ($P=0.281$). Manvitny test show that older age have significant differences in the increase of early mortality after OFFPump CABG but Low EF have no significant differences in the increase of early mortality after OFF-Pump CABG, although the mean of EF was lower in dead patient than alive patients (Table 2). Among 909 alive patients female sex was 39.2% but this percentage for dead patients was 54.5%.

Table 2: Patients age and LV EF

	Mean		SD
	Dead	alive	P-value
Age	67 ± 8.1	58.37 ± 9.6	0.04
EF (%)	40.9 ± 11.79	45.17 ± 9.7	0.281

With fisher test our study shows that sex has no significant difference in early mortality (Table 3)

Table 3: Division of patients according to gender

	Dead		Alive		P-value
	percent	Number	Percent	number	
Female	54.5	6	39.2	357	0.365
Male	45.5	5	60.7	552	
Sum	100	11	100	909	

In Chi-square test for evaluation of valvular pathology effect on early mortality after OFFPump CABG shows that only TR had significant difference ($P=0.015$). Preoperative MR had no significant difference in early mortality. With Chi-square test the number of diseased vessels and preoperative Cr greater than 2mg/dl had no significant difference. 30-day mortality was higher in patients that have reexplored for any reason (P -value <0.02).

Discussion:

OFFPump CABG is a safe and absolutely effective alternative for conventional CABG with the use of Cardiopulmonary Bypass, which avoids all potential and proven complication of CPB especially hematologic and coagulopathy effects, neuro-cognitive disorders and renal impairment.

Conventional bypass surgery with extracorporeal circulation is a source of morbidity, particularly in older patients and those with associated pathologies. Besides the systemic inflammatory response, manipulation of the aorta and the trauma produced by the jet of blood and nonpulsatile flow give rise to the risk of gaseous and atheromatous or lipid micro-embolization, which could be the causes of neurologic or other organ dysfunction (11,12). Awareness that less invasive off-pump surgery could reduce morbidity while retaining the beneficial effects of surgical myocardial revascularization had led to its gradual adoption, and it now accounts for 20-25% of coronary bypass procedures in the USA (13). This retrospective study was designed to evaluate the major risk factors that have increased mortality of OFFPump CABG. In our study older age is a factor for early mortality but female gender is not, but in other studies female sex is risk factor for early mortality. Women undergoing CABG procedures are at increased risk of death, stroke, MI, and composite end point of death/stroke/MI compared with Men (14). Although both men and women have superior risk adjusted outcomes after OFFPump CABG than after CABG on CPB. Women may benefit more than men from avoidance of CPB. Long term survival after OFF-Pump CABG is worse for women than men. LV dysfunction is a risk factor in early mortality but OFFPump CABG could be an interesting and safe alternative in these high risk patients. With low mortality and morbidity and OFFPump CABG morbidity and mortality for high risk patients could

be improved. In contrast, we found that preoperative EF \leq 30% was an independent risk factor for postoperative complications and in-hospital mortality. A large study on 55,515 patients undergoing CABG concluded that those with low EF were sicker at baseline and had more than 4-times higher mortality than patients with normal EF. We found significantly higher rates of postoperative cardiac complications, neurologic events, and infections, intra-aortic balloon pump and inotropic support in patients with LV dysfunction (15). CABG without CPB has a renal protection in compare to conventional coronary revascularization surgery and therefore in patients with borderline renal function OFFPump CAB is recommended. Mild Cr elevation (Cr = 2-3 mg/dl) may not worsen the prognosis for OFFPump CABG, but in CRF patients with Dialysis dependent, it is a strong risk factor for early mortality after surgery (16). DM is a risk factor for early mortality and morbidity. These patients almost have small and diffuse coronary artery and multiple prior MI. Mortality in diabetic patients is greater than non-diabetic patients and also they have greater morbidity due to sternal and wound complications and renal impairment. Development of different neurologic complications from TIA to Stroke is a strong factor for early mortality and major morbidity in OFFPump CABG (17).

Conclusion:

OFFPump CABG is a safe and effective method for coronary artery revascularization with fewer mortality and morbidity compared with conventional CABG with Cardiopulmonary Bypass.

OFFPump CABG can be done for nearly all of coronary artery disease patients and risk factor for early mortality is similar to conventional CABG.

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