

Comparison of Unstable Hemodynamic Patients Undergoing Coronary Artery Bypass Graft Surgery with on- or off-Pump Methods

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ABSTRACT

Introduction: Coronary artery disease (CAD) is the most common type of heart disease, with a mortality rate of 385,000 person per year in the United States. There are two main methods for CAD treatments: angioplasty and bypass surgery. Coronary Artery Bypass Grafting (CABG) is one of the greatest surgical operations of the 20th century and it is presented as most effective and long-term therapies in the treatment of ischemic heart disease. There are two different methods of CABG; on-pump and off-pump. While off-pump CABG is a newer method, it decreases stroke and maintains higher mental function. We conducted the assessment of patients' outcome that underwent on- or off-pump CABG with hemodynamic instability.

Materials and Methods: In this cross-sectional study, we evaluated cardiogenic shock patients with CABG who referred to Ghaem hospital for emergency operation from January 2012 to November 2013. We collected medical records archive from this hospital and all patients' information including demographic data, clinical variables, and past medical history separately. We performed on and off-pump CABG surgery for the patients. In on pump group, we performed beating on pump method, without aortic cross clamping.

Results: Twenty-eight patients who underwent CABG in two forms: on-pump and off-pump were studied. The minimal age of the patients was 34 and the maximal was 78. Patients' weight had a range between 60 to 95 kg. The minimum used graft were two and the maximum were five. Ejection fraction was diversified between 15% (min) and 50% (max). Operation time ranged 1.50 to 5.50 hours. The ICU stay time was between 2(min) to 11 (max) days. Finally death was occurred in 5(17.9%) of patients.

Conclusion: Our findings showed that CABG with beating heart could increase the survival of hemodynamic unstable patients in comparison with off-pump CABG.

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Introduction

Coronary artery disease (CAD) is the most common type of heart disease, with a mortality rate of 385,000 person per year in the United States (1). Risk factors are as following: smoking, high levels of certain fats (causes the arteries to get narrow), high blood cholesterol, high blood pressure, diabetes and etc (2-5).

Early diagnostic method could play a major role in optimal management and the detection of CAD, therefore noninvasive cardiac imaging has become a central tool for the assessment of CAD between men and women (6, 7).

There are two main methods for CAD treatments: angioplasty and bypass surgery. About

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583,000 coronary-artery bypass operations were performed in 1995, while the value of balloon angioplasty is approximately 739 procedures per million populations (8, 9). About sixty percent of treated patients with two mentioned method have multivessel disease that could be treated by either procedure, although individuals who treated by bypass surgery, needed fewer additional interventions (10, 11).

Coronary artery bypass grafting (CABG) is one of greatest surgical operation in 20th century and it is presented as most effective and long-term therapies in the treatment of ischemic heart disease (12). CABG was first performed by Kolesov and it was popularized by Favaloro (13, 14). There are two different methods of CABG; on-pump and off-pump. In the on-pump process, cardiopulmonary bypass machine is used to provide the circulation system and heart can be safely stopped with specialized medications. While off-pump CABG is a newer method, it decreases stroke and higher mental function. Off-pump is a complexity of attaching grafts to the heart, while it is constantly moving and filled with blood.

Concerns still remain about off-pump procedure including: the completeness of revascularization, the rate of perioperative myocardial infarction and long-term graft patency (15, 16).

Due to lack of the previous studies in this field and not having a large number population to CABG in Iran, we conducted the assessment of patients' survival who underwent on- or off-pump CABG with hemodynamic instability.

Materials and Methods

Patients

In this bi-group cross-sectional study we enrolled cardiogenic shock patients with CABG who referred to Ghaem hospital for emergency operation from January 2012 to November 2013. We collected medical records archive from hospital and all patients' information including demographic data, clinical variables and past medical history separately.

The sample size was calculated (n=28) by mortality rates with confidence interval of 95% and study power of 80%. All patients in cardiogenic shock who underwent coronary artery

bypass grafting from January 2012 to November 2013 were included in the study. The exclusion criteria were any clinically significant valve disease and patients who were out of this history range. In this bi-group cross sectional study we evaluated cardiogenic shock patients with CABG who referred to Ghaem hospital for emergency operation during January 2012 to November 2013. The sampling method was convenient and after enrollment we divided patients into two groups according to the type of operation: on-pump beating surgery (without aortic cross clamping) and off-pump. In on-pump group, bypass grafting operation was started with CPB (cardio pulmonary bypass) for 13 patients without cross clamping of aorta. In off-pump group we perform CABG without using CPB.

Statistical analyzed

In this study data were analyzed by SPSS version 11 and in all measurement P-value less than 0.05 was considered statistically significant. T-test and Chi-Square tests were used for analysis of quantitative and qualitative variables, respectively.

Ethical consideration

An informed consent was taken from patients who participated in this operation. Patients were ensured about confidentiality and security of their information.

Results

Twenty eight patients in cardiogenic shock were studied who underwent CABG. The minimal age of the patients was 34 and the maximal was 78 years old. Patients' weight had a range between 60 to 95 kg. The minimum used grafts were two and the maximum were five. Ejection fraction was diversified between 15% (min) and 50% (max). The minimal of blood cell pack used in the operation room was one and the maximal was 3 packs also this variable was between 0 and four in ICU.

The range of operation time was 1.5 to 5.5 hours. The ICU stay time was between 2(min) to 11 (max) days. The duration of hospitalization differed between 1 to 15 days (Table 1).

Table1. Minimum, maximum, mean and standard deviation of descriptive variables

Descriptive variables	Minimum	Maximum	Mean	Standard deviation
Age (years)	34	78	63.75	10.97
Weight (kg)	60	95	74.28	9.20
Graft (No.)	2	5	3.28	.65
Ejection fraction (%)	15	50	32.71	9.28
Vessel (No.)	2	5	3.03	.57
Cell pack (operation room)(No.)	1	3	1.96	.69
Cell pack (ICU) (No.)	0	4	1.85	1.0
Operation time (Min)	1.50	5.50	3.70	.85
Stay in ICU (Days)	2	11	3.82	2.63
Hospitalization (Days)	1	15	6.57	3.01
Intubation time in ICU (hours)	1	96.00	17.05	24.06

Table 2. Elevation of clinical variables between patient undergone CABG

Variable	Yes (%)	No (%)
Beating on pump	13(46.4%)	15(53.6%)
Myocardial infarction	8(28.6%)	20(71.4%)
Family history of CABG	6(21.4%)	22(78.6%)
Cardiomegaly	3(10.7%)	25(89.3%)
Diabetes mellitus	15(53.6%)	13(46.4%)
Hypertension	19(67.9%)	9(32.1%)
Hyperlipidemia	14(50%)	14(50%)
Smoking	5(17.9%)	23(82.1%)
Chronic renal failure	3(10.7%)	25(89.3%)
Intra aorta balloon pump	7(25%)	21(75%)
Cerebrovascular accident	4(14.3%)	24(85.7%)
Delirium	2(7.1%)	26(92.9%)
Need to pace maker	3(10.7%)	25(89.3%)
Return to operation room	7(25%)	21(75%)
ST elevation	4(14.3%)	24(85.7%)
Dead	5(17.9%)	23(82.1%)

Patients were 16 (57.1%) males and 12 (42.9%) females. Fifteen (53.6%) patients underwent off-pump CABG and thirteen (46.4%) were operated on-pump beating surgery. The frequency of myocardial infarction before operation was 8(28.6%). In the operation room, seven (25%) patients used one, 15(53.6%) cases used two and six (21.4%) patients used three blood cell packs, while this rate was different in ICU and most of patients (n=12) used two blood cell packs and for two patients didn't inject.

Only 6 (21.4%) patients were determined with family cardiogenic history and fifteen cases (53.6%) suffered from diabetes mellitus and hypertension frequency was 19(67.9%).

Hyperlipidemia was seen among half of all the patients and 5(17.9%) of them were smokers. Three (10.7%) patients had chronic renal failure.

In the operation room CPR was performed one time for 5(17.9%) patients and three times for 1(3.6%) case. Intra aorta balloon pump (IABP) was kept for 7(25%) and cerebrovascular accident (CVA) was observed among 4(14.3%) patients. Only 2(7.1%) patients had Delirium and 3(10.7%) need for pace maker.

Arrhythmia in ICU was seen in three forms: premature atrial contraction (n=3, 10.7%), bradycardia (n=1, 3.6%) and supraventricular tachycardia (n=1, 3.6%) and 15(53.6%) patients showed no sign of arrhythmia. We had been forced to return 7(25%) patients to operation room and 11(39.8%) needed pacemaker in operating room. ST elevation was performed in 4 (14.3%) patients. Finally death was occurred in 5(17.9%) of patients (Table 2).

Discussion

We performed emergency surgery operation on twenty eight patients who were in patients with cardiogenic shock. We studied patients who underwent CABG in two methods; beating on-pump and off-pump. Many investigations have

shown that without using cardiopulmonary bypass, off-pump could reduce postoperative complications including generalized systemic inflammatory response, cerebral dysfunction, myocardial depression and hemodynamic instability (17-25).

Many studies claim that off-pump method would improve mortality and represent a lower incidence of adverse events in patients; while several show that there is no significant difference between off-pump and on-pump coronary artery bypass. In 2009, Laurie Shroyer et al. in a comprehensive study showed that there was no significant difference between off-pump and on-pump CABG in a short time but after the rate of the one year composite outcome was higher for off-pump than for on-pump CABG. They randomly assigned 2203 patients scheduled for urgent or elective on-pump or off-pump CABG (26). Correspondingly, their study didn't present any advantage of use of the off-pump as compared with the on-pump cardiac surgical approach for coronary bypass.

Although off-pump CABG has been shown to be a safe and effective technique (27), but our findings didn't report the same; these discrepancies might be due to differing patient-selection and study methodology.

Hammon et al. (2007) studied coronary artery bypass grafting with single cross-clamp results in fewer persistent neuropsychological deficits than multiple clamp or off-pump coronary artery bypass grafting. They reported that cardiopulmonary bypass (on-pump) if performed in detail with single cross-clamp and minimal aortic manipulation is equal or may be superior to off-pump CABG (28). Similar to our findings, their study couldn't find majority in preference of bypass grafting surgery without cross clamping.

In contrast, some studies still indicate that off is better than on-pump CABG. Reston et al. (2003) showed that off-pump reduces length of hospital stay, operative morbidity and operative mortality (29).

Conclusion

Our findings showed that cardiopulmonary bypass after commencing the operation and using of CPB (on-pump method) could lead to acceptable results in cardiogenic shock patients. We concluded that survival is raised in on-pump beating CABG patients in unstable hemodynamic patients.

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Conflict of Interest

The authors declare no conflict of interest.

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