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COMPARING THE COMPLICATIONS BETWEEN ON-PUMPAND OFF-PUMP CORONARY ARTERY BYPASS GRAFTING

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ABSTRACT

Background: Off- pump coronary artery bypass grafting surgery(OPCAB) was developed in the hope of reducing perioperative complications related to the use of cardiopulmonary bypass (on –pump). **Objective:** The present study aims to compare the complications between off pump and the conventional CABG (on pump). **Materials and Methods:** This is Prospective comparative Study conducted in the Department of Cardiovascular surgery from October 2018 to October 2019. The study included 88 patients who underwent CABG surgery (60 on-pump and 28 off- pump). **Results:** Of all 88 patients,28 underwent off-pump CABG surgery. There were no significant differences between the groups in terms of age, sex, and co- morbidities. Levels of Hb and PLT were significantly decreased after on- pump CABG surgery :(9.3±1.06 vs. 12.4±1.9 preoperative, p: 0.0001) and (156.4±44.6 vs. 229.06±50.8 preoperative ,p: 0.0001) respectively. Creatinine levels were significantly increased in on- pump CABG surgery(1.32±0.3 vs. 1.07±0.2 preoperative, p:0.006). Compared to off-pump, On- pump CABG surgery was associated with more need for blood product transfusions (4.9±3.5 vs. 1.4±1.2, p: 0.0001), and increased drainage output (1086±414.8 vs. 608.9±179.2, p: 0.0001).The incidence of respiratory failure and bleeding was higher in On- pump CABG: (13.3% vs. 3.6%, p: 0.04) and (18.3% vs. 3.6%, p:0.002), and all deaths were in On - pump CABG. **Conclusion**: In our study, the off-pump CABG surgery is safe and associated with lower complications compared to the on-pump CABG surgery.

KEYWORDS: Coronary artery bypass grafting CABG, On pump, off pump.

INTRODUCTION

Coronary artery bypass grafting(CABG) surgery is a surgical procedure in which a section of a blood vessel is grafted into the coronary artery to bypass the blocked section of its circulation.[1,2] CABG is performed for patients with coronary artery disease(CAD) to improve quality of life and reduce cardiac-related mortality.[3] It is still the most commonly performed cardiac surgery procedure worldwide.[4]

There are two basic ways of performing CABG: On pump CABG and off pump CABG.[5] On pump CABG is the more traditional method of performing bypass surgery, in which the heart is stopped with the body's blood supply being maintained by the cardiopulmonary bypass(CPB) machine, but its resultant inflammatory effects cause many complications.[6] Off –pump CABG (OPCAB) approach has evolved in part, to mitigate these on-pump problems. It began in the mid-1980s and has since become increasingly popular worldwide.[7] However, the relative benefits and risks of off-pump versus on-pump techniques have been debated. Thus due to a lack of local studies discussing the subject, the present study aimed to assess the complications between the two methods.

MATERIALS AND METHODS

Study design and data collection This study included patients with coronary disease who underwent on –pump or off –pump CABG in Tishreen University Hospital – Lattakia-Syria from October 2018 to October 2019. Demographic data including age, sex, co-morbidities were recorded.

Blood samples were collected pre-operatively and post-operatively for measurement of hemoglobin HB, platelet PLT, INR, and renal function. Chest X –ray and echocardiogram were performed for all patients. Complications were compared between the two groups.

Surgical procedure

On-pump CABG: employs a midline incision through the sternum, placement of thepatient on coronary bypass, arrest of the heart with cardioplegia.[8]

Off –pump CABG: All operations were performed through a median sternotomy without use of the cardiopulmonary bypass and heart was stabilized with an Octopustissue-stabilizing device.[9]

Statistical Analysis

Statistical analysis was performed by using IBM SPSS version20. Basic Descriptive statistics included means, standard deviations(SD) Frequency and percentages. Independent t student test was used to compare 2 independent groups. Differences among different groups were examined with using chi- square test. Statistical significance was accepted at a p value of <0.05.

RESULTS

A total of 88 patients with coronary disease (mean age: 62.1±6.6; 79.50% males), who presented to the Department of Cardiovascular surgery from October 2018 to October 2019 were included in the study. The baseline characteristics of patients are as given in table(1). There were no significant differences between the two groups inregard to: age, sex, co-morbidities and EF(p>0.05).

Table 1: Demographic characteristics and echocardiography findings of thestudy population.

Variables	Group1(on pump) n=60(68.2%)	Group2(off pump) n= 28(31.8%)	p-value
Age(year)	61.3±7.2	63.6±4.9	0.3
Sex			
Male	45(75%)	25(89.3%)	
Female	15(25%)	3(10.7%)	0.1
Co-morbidities			
Hypertension	43(71.7%)	17(60.7%)	0.3
Diabetes mellitus	28(46.7%)	9(32.1%)	0.09
Ejection fraction(EF)	47.8±9.8	44.9±11.8	0.2

As shown below, there were significant differences in the laboratory values(HB, PLT, INR, Creatinine) after surgery in the group 1, in which the mean values of HB and PLT were decreased significantly after CABG surgery, whereas INR and creatinine levels were increased after CABG surgery (p<0.05).

In group 2, INR levels were found to be significantly increased after CABG surgery(1.31±0.2 vs. 1.14±0.1, p:0.001).

Table 2: Changes in laboratory findings after CABG surgery in the studypopulation.

Variable	CABG					
	Group1(on pump)			Group2(off pump)		
	Before	After	P- value	Before	After	P- value
HB	12.4±1.9	9.3±1.06	0.0001	13.2±1.8	12.4±0.2	0.1
PLT	229.06±50.8	156.4±44.6	0.0001	244.3±55.7	220.2±55.8	0.3
INR	1.13±0.06	1.40±0.2	0.002	1.14±0.1	1.31±0.2	0.001
Urea	38.7±14.4	40.6±15.3	0.6	37.9±20.4	37.3±9.2	0.8
Creatinine	1.07±0.2	1.32±0.3	0.006	1.03±0.3	1.04±0.3	0.9

Postoperative variables of patients undergoing CABG surgery with and without use of heart lung machine are presented in Table3. On –pump was associated with significantly increased blood loss and the need for blood transfusions .In hospital stay was longer in group1 without significant difference (5.8±2.3 vs. 4.9±0.9, p:0.8).

Table 3: Comparison postoperative variables of the study population accordingto CABG surgery.

Variable	Group1(on pump)	Group2(off pump)	P- value
Drainage output(ml)	1086±414.8	608.9±179.2	0.0001
Number of blood products (units)	4.9±3.5	1.4±1.2	0.0001
In hospital stay(days)	5.8±2.3	4.9±0.9	0.8

As shown below, respiratory failure and bleeding were more frequently in group1(p<0.05). Renal failure, hemiparesis and all deaths were only in group1.

Table 4: Comparison of complications between the study population according toCABG surgery.

Complication	CABG		
	Group1(on pump)	Group2(off pump)	P value
Renal failure	7(11.7%)	0(0%)	-----
Respiratory failure	8(13.3%)	1(3.6%)	0.04
Hemiparesis	8(13.3%)	0(0%)	-----
Bleeding	11(18.3%)	1(3.6%)	0.002
Death	4(6.7%)	0(0%)	-----

DISCUSSION

Our study demonstrates that blood loss and transfusion requirements are higher in patients undergoing on pump-CABG compared with off-pump. Bleeding after CPB has several causes: exposure of blood to synthetic, nonendothelial surfaces cause severe hemostatic defects that inhibit or alter many components of the thrombotic and fibrinolytic systems.[10] Similar to our findings, Walczak *et al*(2014),[11] and Ercan *et al*(2014),[12] demonstrated that mean value of blood products units was higher in on-pump:(3.94±0.3 vs. 2.31±0.2) and (1.14±1.09 vs. 0.5±0.16) respectively.

All cases of renal failure were found in on pump CABG. Renal injury during CPB might be due to altered renal perfusion during periods of hypotension or low flow, vasoconstrictors, or microemboli. Hemoglobinuria, as a result of hemolysis during CPB, might also lead to renal dysfunction,[13] Erkut *et al*(2008),[14] and El-Naggar *et al*(2011),[15] also found that cases of renal failure were in on-pump CABG which represents 18.75%, 10% respectively.

Respiratory failure was more frequently in on pump CABG. The main causes for occurrence of respiratory complications are the effects of sternotomy internal mammary artery harvesting, pulmonary ischemia with subsequent reperfusion, as well as the inflammatory reaction caused by CPB.[16] Ercan *et al*(2014),[12] and El-Naggar *et al*(2011).[15] demonstrated that incidence of respiratory failure was more frequently in on pump compared to off pump:(8.4% vs.3.1%) and (50% vs. 3.3%) respectively.

All cases of hemiparesis were found in on pump CABG. Postoperative neuronal damage can result from cerebral hypoxia, but is more often due to microembolism.[17] Ercan *et al*(2014)[12] and El-Naggar *et al*(2011).[15] found that hemiparesis was more frequently in on pump: (6% vs. 1.1%) and (10% vs. 0%) respectively.

In the present study, all deaths were in on pump group. Compared to other studies, Attaran *et al*(2010).[18] and Ercan *et al*(2014).[12] demonstrated that deaths were in two groups but more frequently in on pump CABG: (7.8% vs. 5.7%) and (1.2% vs. 1.01%) respectively.

CONCLUSION

Off -pump CABG is associated with good outcome and can bealternative to on-pump.

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