Comparison of Post-Operative Morbidity and Mortality in Patients Undergoing On-Pump versus Off-Pump CABG

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ABSTRACT

Objective: The aim of this study is to compare in hospital morbidity and mortality in on pump versus off pump CABG.

Methodology: All the patients undergoing CABG surgery were enrolled after taking informed consent. Demographic and postoperative variables were entered in the predesigned questionnaire and patients were followed for early outcomes after surgical procedure.

Results: A total of 470 patients wasdivided in two groups 235 (on pump and off pump). The mean age of patients was 54.85 ± 9.57 (23-85). There were 400(85.1%) males and 70(14.9%) females. The total data of 470 patients was divided in two groups 235 in on Pump and 235 in off pump CABG. The mean age of patients was 54.85 ± 9.57 (23-85). There were 400(85.1%) males and 70(14.9%) females. Different clinical outcomes were compared in both groups (On-Pump versus Off-Pump CABG) by using Euro Score, we found Peripheral Disease in On-Pump CABG group compared with Off-Pump CABG as 11(4.68%) vs 12(5.11%) with p-value=0.831 which was statistically insignificant, current data assessed lung disease in both groups as 11(4.68%) vs 13(5.53%) with statistically insignificant p-value (0.675). and unstable angina were 12(5.11%), p-value 1.00) patients founded and peri and post myocardial infarction also assessed in both groups with p-value (0.74 & 1.20). respectively.Data regarding in hospital mortality was analyzed and found that 7(2.98%) in on pump group compare with off pump group was According to our research mean number of grafts placed in On-Pump CABG were 9(3.83%) with statistically insignificant p-value (0.611). **Conclusion**:Proof is presented that surgery on beating heart (Off-Pump) is as safe and effective as Conventional CABG, and

cheaper than conventional surgery. However, it is uncertain whether the cost savings are sustained over a longer period of time. **Keywords:** Coronary artery Bypass grafting surgery, On Pump Off Pump

INTRODUCTION

At least 12 Pakistani dies every hour in Pakistan due to heart attack. An estimated 30 to 40% of all deaths in Pakistan are due to CVD that claims not least than 200,000 lives every year in the country while CHD is now the leading cause of death in Pakistan. The global epidemic of CVDs is not only increasing but also shifting from developed to developing countries.

On the report of WHO cardiac disease among chronic diseases causes 63% of all worldwide mortality. Non-transmittable diseases are responsible for 9 million mortalities below the age of 60 years annually. Beside for any Non-CVD condition or cancer the occurrence of IHD is still higher. In the Western countries cardiovascular consequence of CVD 17.1 million people die annually and 82% of this mortality happens in Western countries. Death of 2030,23 million people forecasted from CVD. The rate of CVD is decreasing in the developing countries despite rates of risk factors increasing day by day. modern therapeutic.

Patients with class 1 angina managed completely in the primary health care centers, as conservative (Sugar control, smoking cessation, low salt and fatty diet). Revascularization of stenotic vessels electively decreases risk of mortality. Patients present with symbolic chest discomfort express an MI and ST segment changes should urgently revascularize. PCI must not be late no more than 1.5 hour from the initiate of chest discomfort and fibrinolytic therapy must be initiated within half hour. Management for NSTEMI is started with platelets aggregation inhibitors, glycoprotein Ilb/Illa inhibitor. Nitrates, heprin and morphin can be used for intractable pain.

According to several literatures, ON-PUMP surgery is a complete revascularization technique for the treatment of IHD. Robertson and Colleagues (2013) found that on pump CABG has tendency towards complete restoration of blood flow to the territory of occluded vessels as compared to beating technique (88.3% to 79.2%, p=0.002). The above findings are buttressed by (Ivanov et al 2008) demonstrated off pump technique is better for less

number distal anastomosis. Tendency toward partial revascularization, Lattouf and colleagues (2008) demonstrated that on-pump is better for those who are suffering more than 3 vessels occlusion. There is marked link between incomplete revascularization and high mortality.

Buda et al (1981) reported 5-year survival rate just 69% in incomplete revascularized patients but survival rate higher in complete revascularized patients (84%), Jones and Weintraub (1996) supported above results by recent study and reported that incomplete revascularization is key factor for recurrent angina and low survival rate one major cause of Redo CABG is incomplete revascularization. As a consequence, there is higher rate of Redo CABG in beating technique patients as compared to conventional CABG patients (Ivanov et al 2008).

In emergent circumstances conventional surgery is superior to beating technique. The above results lead us that unloading of heart by CPB machine causes decreasing oxygen demand of the heart and off pump causes additional work load on diseased myocardium. Darwazah and colleague (2009) reported that doing of emergent CABG by the help of CPB machine decreases risk of recurrent angina, decreases risks of cardiac failure and readmission in hospital.

Although there was an opinion that CPB machine is responsible for higher rate of Ischemic Brain Stroke (Knipp et al 2004). But no study among many studies demonstrated advantage of off pump over conventional CABG in the term of avoiding Ischemic brain stroke (Puskas et al 2003). Hammon and colleagues (2007) demonstrated that neuro-cognitive complication is lower in single cross clamp. They demonstrated, reducing of body temperature in on pump is also beneficial in avoiding of ischemic brain stroke.

The surgeon's familiarity to on pump CABG is the significant superiority of on pump over off pump (Legare and Hirsh, 2006). Off pump CABG technically requires prolonged learning duration. Most surgeons feel comfortable with performing on pump ABG (Lamy et

al 2012). For better outcomes the surgeons experience and familiarity to on pump are key factors. (Brown et al 2002).

Regardless the technique of CABG (beating or on arrested heart) there is low mortality rate in both techniques. But morbidity rate is lower in off pump CABG. Higher morbidity in on pump CABG is due to CPB process (Sabik et al 2002). The aforementioned results are promoted by subsequent research which demonstrates there is lower surgery related death rate in off pump technique. The complications rate of risk adjusted is 14-15% in on pump and 16.62% in off pump (Cleveland, Shroyer, Chen, Peterson and Grover 2001). The above mentioned results were supported by Plomondon et al 2001, that complications in off pump 8.8% while 14% in on pump and death rate 2.7% in beating and 4% in conventional.

METHODS

After taking consent from the patients undergoing cardiac surgery at the Punjab Institute of Cardiology, Lahore between September, 2019 and April 2020, a prospective comparative study was conducted. Informed consent was taken from all the patients fulfilling the inclusion criteria. Patients' related factors (age, gender, renal profile, lung disease, peripheral vascular disease, Neurologic dysfunctions, active endocarditis, critical preoperative state,) Cardiac related factors (combined surgery, aortic involvement or other valve surgery), as well it would be worth mentioning that our study include the (peri and post-operative MI, neurological status, blood transfusion, acute renal failure, time of surgery and hospital stay) were recorded in the pre-designed proforma.the data were compiled and analyzed using SPSS version 24. Chi-square test was used for comparison. P value ≤0.05 was considered as significant.

RESULTS

The total data of 470 patients was divided in two groups 235 in on Pump and 235 in off pump CABG.The mean age of patients was 54.85 \pm 9.57 (23-85). There were 400(85.1%) males and 70(14.9%) females. Peripheral Disease was found 11(4.68%), Lung Disease 199 (42.34%), Active Endocarditis 202(42.98%), Unstable Angina 197(41.91%) and Previous Surgery was found in 210(44.68%) (Table 1)

Table-2: Post-operative early outcomes in on pump vs off pump CABG.

Different clinical outcomes were compared in both groups (On-Pump versus Off-Pump CABG), we found Peripheral Disease in On-Pump CABG group compared with Off-Pump CABG as 11(4.68%vs12(5.11%) with p-value=0.831 which was statistically insignificant, current data assessedlung disease in both groups as 11(4.68%) vs13(5.53%) with statistically insignificant p-value (0.675). and unstable angina were 12(5.11%, p-value 1.00) patients founded and peri and post myocardial infarction also assessed in both groups with p-value (0.74 & 1.20)respectively. (Table 2)

Data regarding in hospital mortality was analyzed and found that 7(2.98%) in on pump group compare with off pump group was According to our research mean number of grafts placed in On-Pump CABG were 9(3.83%) with statistically insignificant p-value (0.611) (Table 3)

Variables			
Age (years)			
Mean ± S.D	54.85 ± 9.57 (23-85)		
Condor	Male	400(85.1%)	
Gender	Female	70(14.9%)	
Derinheral Diagona	Yes	11(4.68%)	
Periprieral Disease	No	252(53.62%)	
	Yes	199(42.34%)	
Lung Disease	No	271(57.70%)	
Active Endegerditie	Yes	202(42.98%)	
Active Endocarditis	No	268(57.02%)	
Linetable Angine	Yes	197(41.91%)	
Unstable Angina	No	273(58.09%)	
	Yes	210(44.68%)	
Previous Surgery	No	260(55.32%)	

Table-1: Descriptive Statistic of Clinical Hi	story.
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Variables		Type of Surgery	Type of Surgery		
		On Pump	Off Pump	Total	p-value
Peripheral Disease	Yes	11(4.68%)	12(5.11%)	23(4.89%)	0.831
	No	224(95.32%)	223(94.89%)	447(95.11%)	
Lung Disease	Yes	11(4.68%)	13(5.53%)	24(5.11%)	0.675
	No	224(95.32%)	222(94.47%)	446(94.89%)	
Unstable Angina	Yes	12(5.11%)	12(5.11%)	24(5.11%)	1.00
	No	223(94.89%)	223(94.89%)	446(94.89%)	
Peri-MI	Yes	9(3.83%)	7(2.98%)	16(3.40%)	0.74
	No	226(96.17%)	228(97.02%)	454(96.60%)	
Post-MI	Yes	0(0.00%)	0(0.00%)	0(0.00%)	1.20
	No	235(100%)	235(100%)	470(100%)	

Table-3: Comparison of Post-operative complication Mortality.

Type of Surgery	Mortality			p-value
	Yes	No	Total	
On Pump	7(2.98%)	228(97.02%)	235(100%)	
Off Pump	9(3.83%)	226(96.17%)	235(100%)	0.611
Total	16(3.40%)	454(96.60%)	470(100%)	

DISCUSSION

This current study was carried out to compare early outcomes in groups; on pump and off pump. In this study 470 patients undergoing CABG were studied. Patients were divided in two groups: 235 patients in on pump and 235 in off pump. The mean

age was 54.85 ± 9.57 years with minimum and maximum age being 23 and 85 years. Okanoet.al; (2019) reported that 344 patients had off-pump surgery and 741 had on-pump surgery in their research. Both groups had a comparable mean age (about 41 years in both; p = 0.18), and both had a similar proportion of male patients. Off-pump participants had a higher incidence of one-vessel disease (15.99% off-pump vs. 6.34% on-pump).

In this current study from the total of 470, 11(4.68%) patients of the On-Pump and 12(5.11%) patients of Off-Pump have Peripheral disease. Similarly, in a study by Shroyer Laurie et al (2005), the peripheral disease occurred in 163(14.8%) patients in On-Pump and 179(16.2%) patients in Off-Pump CABG. Statistically, there was no significant difference in the mortality within 30 days' time period of both groups. This result supported our study.

In this current study 11(4.68%) patients of On-Pump and 13(5.53%) patients of Off-Pump have Lung disease with an insignificant p-value 0.675 which is consistent to another study Ercan et al (2014) pulmonary complications occurred in 7(8.4%) in On-Pump group while 12(3.1%) in Off-Pump group with a significant p-value 0.031Ercan et al (2014).

In this current study the comparison of unstable angina between On-Pump and Off-Pump shows insignificant p-value 1.00. Similar results were found in literature by Michel Pompeu Barros et al (2010) in that study unstable angina found in 230(58.6%) patients in On-Pump group and 332(60.5%) patients in Off-Pump group with an insignificant p-value of 0.768 (Michel Pompeu Barros et al 2010).

As it has been shown post-operative complications in both groups are nearly same. In this current study no significant difference was found between the On-pump and Off-Pump groups in terms of mortality. This result supported by a previous study by Ercan et al (2014) which showed similar results of mortality and found no significant difference in On-Pump versus Off-Pump CABG. In another study by Fausto Biancari et al (2007) the rate of mortality in Off-Pump versus On-Pump CABG was also similar (pvalue=0.820) which supports our study. Xia et al, (2017) reported that patients in the on-pump group compared to the OFF group had a low circulatory morbidity, including low incidences of postoperative low cardiac output syndrome and new onset of acute myocardial infarction, but no significant differences were found (12.5 3.4 3.9%, *p* = 1.000, VS. 19.5%, p = 0.197;VS. respectively).Rastan and colleagues had prospectively examined randomized data of markers of myocardial injury in 20 patients with a normal ejection fraction who underwent off-pump CABG compared to 20 patients with a normal ejection fraction who underwent on-pump beating-heart CABG, and they showed offpump CABG had less myocardial injury than on-pump beatingheart CABG. This evidence differed from the results of this study. The reason for this difference may have been the study population because the current study focused on high-risk patients.

Gulcan and colleagues evaluated myocardial function and clinical outcomes of 46 high-risk patients with an ejection fraction <30% who received on-pump beating-heart CABG and associated procedures, and they found that the on-pump beating-heart CABG technique was effective for protecting myocardial functions in patients with severe left ventricular dysfunction and was associated with low postoperative morbidity and mortality.

CONCLUSION

The results of current study showed that early complication in both procedures is nearly same. So we can say both techniques are equally safe and effective.

Limitation: These recommendations may decrease the disease and death as well will be able to predict which procedure is better to perform in our population. This will lead to a reduce hospital stay and saving in cost to both the patient and hospital.

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