

Early outcomes of Intra-Aortic Balloon Pump in Patients Undergoing Coronary Artery Bypass Grafting (CABG) Surgery

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ABSTRACT

Background: Care of heart patients especially after coronary artery bypass graft (CABG) surgery can be difficult to manage especially in postoperative phase due to decreased cardiac output. Inotropes used to increase cardiac output during the peri or postoperative may cause harmful effects. Mechanical circulatory support devices, such as an intra-aortic balloon pump can be beneficial in such patients.

Objective: To compare early outcomes of Intra-Aortic Balloon Pump (IABP) in Patients Undergoing Coronary Artery Bypass Grafting (CABG) Surgery

Methods: Systematic random samples of 134 patients were registered from the department of cardiac surgery of Punjab Institute of Cardiology (PIC), Lahore undergone open heart surgery from December 2019 to May 2020. High-risk patients with hemodynamically stable undergoing scheduled CABG were included. The patients were divided into two groups. All information including gender and age were obtained using a structured questionnaire. Death and other complications were compared between two groups. Data was entered and analyzed using SPSS. Statistical test like chi-square and Independent t-tests were applied to obtain the required results and percentages.

Results: Total 134 patients enrolled and equally divided into two groups. Group A (with IABP) have mean age was 47.58 ± 2.0 compared with Group B (without IABP) mean age 48.43 ± 4.31 . There were 79 (63.2%) males and 46 (36.8%) were females enrolled. Hypertension, diabetes mellitus, smoking, Prior CVA, recent AMI and congestive heart failure remained statistically insignificant as p-value > 0.05 . The duration of IABP, respiratory failure, renal dysfunction and length of ICU stay showed statistically significant p-value < 0.05 . Reoperation for bleeding, acute AMI, pneumonia, stroke, wound infection and surgical mortality are statistically insignificant as p-value > 0.05 .

Conclusion: In high-risk patients of coronary artery bypass graft, early implantation of an intra-aortic balloon pump improves the outcomes by reducing ICU stay and death; increased post-insertion creatinine levels have been proven to be an indication of approaching mortality.

Keywords: Intra-aortic balloon pump, Coronary artery bypass graft, Creatinine levels, Low Cardiac Output Syndrome

INTRODUCTION

Coronary Artery Disease (CAD) can be difficult to manage especially in patients with severe left ventricular dysfunction or severe triple vessel disease. Low output cardiac states are associated with morbidity and mortality can occur during the postoperative period and necessary action must be taken to prevent this. ⁽¹⁾ Use of inotropes to increase cardiac output during preoperative or critical care period may have side effects. Inotropes may become ineffective as a result, necessitating the adoption of mechanical circulatory assist devices such as the intra-aortic balloon pump (IABP). ⁽²⁾ This support help to reduce myocardial oxygen demand and increases blood supply to coronaries during diastole which improves ventricular function, improves perfusion of other critical organs. ⁽³⁾

These activities are especially important in patients who had a coronary bypass graft (CABG). According to a recent review, CABG is the most common procedure performed in this facility. The combination of the IABP and some pharmacological medications may dramatically

improve the outcome of cardiac surgery. IABP insertion is an invasive procedure which may cause multiple problems so its use should be precisely limited to high-risk patients with persistently poor output of cardiac function to avoid the significant increase in mortality and morbidity. ⁽⁴⁾

Despite an ever-increasing number of older aged as well as very sick patients, the outcomes of cardiac surgical treatments continue to improve. Many of those who die do so as a result of low cardiac output during the peri-operative phase. During the preoperative period, the intra-aortic balloon pump (IABP) has been frequently used to support for patients with low cardiac output. ⁽⁵⁾

In 1968, the balloon pump was first time implemented in clinical practice to help those had cardiogenic shock patients after acute MI. The use of balloon pump was expanded to include postoperative assistance and patients of cardiopulmonary bypass. ⁽⁶⁾

International along with local publication focused only on physiology and practical use of balloon pump and no clinical outcomes related the use of IABP has been

documented.⁽⁷⁾ The main objective of current study was to review the use of the IABP in cardiac operations, particularly focused on evidence for the indications, utilization, and efficacy relating to use of IABP.

MATERIAL AND METHODS

It was cross-sectional comparative study at the department of cardiac surgery, PIC-Lahore. All patients of electives surgery were included. An informed consent was obtained from all participants. Data was analyzed by using SPSS version 21.0.number and %ages computed for categorical variables. Chi- square and independent t- test were applied to obtain the required results. Level of significance was taken as $\leq 0.05\%$.

RESULTS

In findings of study as:

Total 134 patients enrolled and formed into two groups. Group A (with IABP) have mean age was 47.58 ± 2.0 years compared with Group B (without IABP) mean age 48.43 ± 4.31 .(Table-1)There were 79(63.2%) males and 46(36.8%) were females enrolled. (Graph-1) The hypertension, diabetes mellitus, smoking, Prior CVA, recent AMI and congestive heart failure has statistically insignificant as p-value > 0.05 (Table-1).The duration of IABP, respiratory failure, renal dysfunction and length of ICU stay showed statistically significant as p-value < 0.05. Reoperation for bleeding, acute AMI, pneumonia, stroke, wound infection and surgical mortality statistically insignificant as p-value > 0.05. (Table-2)

Table 1: Basic and Clinical Characteristics with and Without IABP insertion

| Variables | Group A (With IABP) (n=67) | Group A (Without IABP) (n=67) | p-value |
|--------------------------|----------------------------|-------------------------------|---------|
| Age, years | 47.58 ± 2.0. | 48.43± 4.31. | 0.489 |
| Hypertension | 25(37.31%) | 31(46.27%) | 0.193 |
| Dyslipidemia | 28(41.79%) | 34(50.75%) | 0.789 |
| DiabetesMellitus | 15(22.39%) | 18(26.87%) | 0.627 |
| Smoking | 37(55.22%) | 35(52.24%) | 0.319 |
| Prior CVA | 19(28.36%) | 21(31.34%) | 0.512 |
| Recent AMI | 2(2.99%) | 5(7.46%) | 0.825 |
| Congestive Heart Failure | 3(4.47%) | 4(5.97%) | 0.328 |

Graph 1: Graphically presentation with respect to gender.

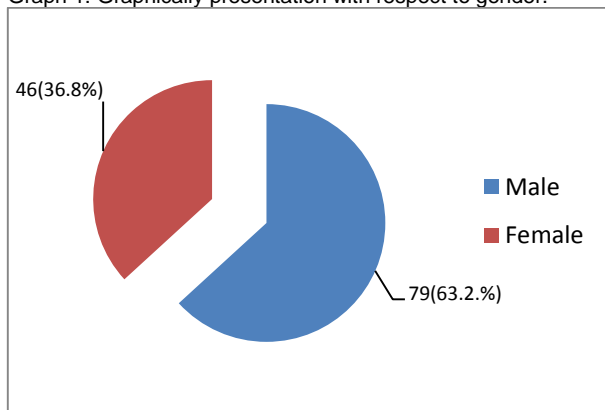


Table-2: Post operative morbidity and surgical mortality.

| Variables | Group A (With IABP) (n=67) | Group B (Without IABP) (n=67) | p- value |
|--------------------------|----------------------------|-------------------------------|----------|
| Duration of IABP, days | 2.7±1.7 | 3.8±1.4 | 0.041 |
| Reoperation for bleeding | 3(4.48%) | 5(7.46%) | 0.722 |
| Acute AMI | 5(7.46%) | 9(13.43%) | 0.512 |
| Pneumonia | 10(14.93%) | 13(19.40%) | 0.165 |
| Respiratory Failure | 12(17.91%) | 21(31.34%) | 0.036 |
| Renal Dysfunction | 5(7.46%) | 11(16.42%) | 0.026 |
| Stroke | 2(2.99%) | 3(4.48%) | 1.003 |
| Wound Infection | 2(2.99%) | 5(7.46%) | 0.183 |
| Length of ICU Stay(days) | 5.2+0.5 | 7.7+1.3 | 0.025 |
| Hospital stay(day) | 10.3 +9.1 | 15.6 +7.8 | 0.056 |
| Surgical mortality | 1(1.49%) | 3(4.48%) | 0.674 |

DISCUSSION

The current study was conducted to compare early outcomes of patients with and without IABP undergoing CABG surgery. IABP, the most commonly used device for mechanical circulatory support. Oxygen consumption improved the sub-endocardial perfusion and promoting the redistribution of coronary blood flow to the ischemic myocardium.

The current study enrolled 134 patients underwent CABG patients and divided into two groups. Group A (with IABP) have mean age was 47.58 ± 2.0 years compared with Group B (without IABP) mean age 48.43 ± 4.31 . Ding et.al; (2015) conducted a research for optimal use of intra-aortic balloon pump (IABP) to prevent post-cardiotomy low cardiac output syndrome (LCOS) which is still debated and poorly defined. They enrolled 141 consecutive risk patients underwent CABG. Of these 38 (27%) received IABP. The remaining 103 patients underwent operation without preoperative insertion of the device. The mean age of IABP group was 61.1 ± 10.9 compare with control group 67.7 ± 8.7 , the risk factors observed in IABP patients were more likely to be younger (P=0.0001), had a recent myocardial infarction (P=0.0001), lower ejection fraction (P=0.006), and higher New York Heart Association (NYHA) functional class (P=0.05).⁽⁸⁾

After risk-adjusting for propensity score, prophylactic IABP patients had a lower incidence of post-cardiotomy LCOS (adjusted OR 0.07, Ps0.006), postoperative myocardial infarction (adjusted OR 0.04, Ps0.04), a shorter length of hospital stay (10.4 ± 0.8 vs. 12.2 ± 0.6 days, P=0.0001) than those who did not receive IABP. This study shows that prophylactic IABP treatment for hemodynamically stable high-risk patients undergoing CABG may improve postoperative course reducing post-cardiotomy LCOS, postoperative myocardial infarction and length of hospital stay⁽⁹⁾.

The results of current study illustrated that hypertension, diabetes mellitus, smoking, Prior CVA, recent AMI and congestive heart failure has statistically insignificant as p-value > 0.05. Okontaet. al (2011) illustrate their results, they enrolled 107 patients those needed intra-aortic balloon pump insertion to support their cardiac function, their finding showed that 23(21.5%)

patients were diabetic, 9(8.4%) were hypertensive, 14 (13.1%) were hypertensive and diabetic, 5(4.7%) had chronic renal diseases and the remaining 56(52.3%) had no pre-morbid factors.¹⁰

The findings of current study showed that the duration of IABP, respiratory failure, renal dysfunction and length of ICU stay statistically significant as p-value < 0.05. reoperation for bleeding, acute AMI, pneumonia, stroke, wound infection and surgical mortality statistically insignificant as p-value > 0.05. the findings of research conducted by Jannati et. al; 2019, they found that IABP was associated with decrease in the mortality rates of patients with low cardiac output and severe myocardial ischemia in the preoperative period and avoid medically refractory arrhythmias in the postoperative period of patients in intensive care unit (ICU)¹¹

In another study conducted by Yumunet. al (2015), they applied IABP to recover low cardiac output, persistent angina pectoris, or arrhythmia in preoperative phase of patients with myocardial ischemia.¹² Thiele et al. in 2013 found that IABP counter pulsation had no significant effect on mortality rate of patients. In contrast, Prondzinsky et al; (2010). Indicated that IABP was efficient in reperfusion quality of patients with primary PCI after thrombolytic therapy without any increase in hospital mortality. Other randomized clinical trial in 2012 demonstrated that IABP counter pulsation had no different effect on cardiac output, left ventricular stroke work index among the patient group compared to the control one.¹³

CONCLUSION

Early implementation of an intra-aortic balloon pump improves the outcomes by reducing ICU Ward stay, death rate and raised creatinine levels which was an indicator of impending mortality.

Limitations: This study has some limitations. First of all, there was small number of participants enrolled. Second, this study was conducted at single center, the results may not be applicable to whole population. The nonrandomized design may have affected our results due to unmeasured confounds and procedural biasness.

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