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ORIGINAL ARTICLE

In-Hospital Mortality Among Patients with Acute Coronary Syndrome and Cardiogenic Shock Treated with Percutaneous Coronary Intervention and Intra-Aortic Balloon Pump

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ABSTRACT

Objective: The object of our research was to determine whether intra-aortic balloon pump-assisted PCI improved overall clinical outcomes during hospitalization, as well as to predict in-hospital mortality and cardiogenic shock.

Methods: This retrospective study was carried out at National Institute of Cardiovascular Diseases Karachi. We enrolled 60 consecutive patients with a history of AMI complicated by cardiogenic shock. These patients underwent PCI with insertion of an IABP between 1st September 2019 and 28th February 2020. Patients with cardiogenic shock would have better survival if the IABP was inserted before PCI rather than after PCI was performed. The prospective study included 60 patients (33 patients received IABP before PCI, before and 27 after PCI) suffering from cardiogenic shock complicating acute myocardial infarction who underwent PCI with IABP. SPSS version 23.0 was used to analyze all the data.

Results: Based on the type of treatment, we divided individuals into two groups in our study. The IABPs were inserted before PCI in 33 patients in group A, and the pumps were started after PCI in 27 participants in group B. It was significantly different regarding the 30-day mortality rate between IABP support after PCI and IABP-assisted PCI (59.2% versus 18.1%, respectively, $p = 0.006$). Among the entire study population, no reinfections or repeat PCI were reported. There was no significant difference between these two groups in the rates of emergency bypass surgery and cerebral vascular events.

Practical Implication: This research study on in-hospital mortality among patients with acute coronary syndrome and cardiogenic shock treated with PCI and IABP has practical implications that benefit the community. It enhances patient outcomes, informs clinical decision-making, contributes to treatment guidelines and protocols, facilitates healthcare resource allocation, and inspires future research and innovation. Ultimately, the study aims to improve the quality of care provided to patients in this specific population, leading to reduced mortality rates and improved patient well-being

Conclusion: This study concluded that PCI assisted by IABP results in a better outcome for patients with cardiogenic shock complicating acute myocardial infarction and a lower mortality rate compared to IABP after PCI.

Keywords: In-hospital mortality, percutaneous coronary intervention, intra-aortic balloon pump.

INTRODUCTION

There is a high risk of mortality and repeated coronary events for participants with acute coronary syndrome (ACS).[1] With acute ST-Elevation Myocardial Infarction (STEMI), percutaneous coronary intervention (PPCI) is currently considered the treatment of choice.[2] While its benefits remain undeniable, its appropriate use remains a contentious issue. The occurrence of cardiogenic shock (CS) is about 5–10% among acute myocardial infarctions (AMIs), a situation related to high in-hospital mortality.[3]

According to the landmark SHOCK trial, early mechanical revascularization can reduce mortality in patients with CS. AMI patients with CS were compared with patients who had an emergency revascularization (PCI) and insertion of an intra-aortic balloon pump (IABP).[4]

AMI continues to be the most serious complication for patients who have received revascularization,[4] and mortality still approaches 50% despite modern revascularization strategies. The pathophysiology and treatment of CS remain uncertain despite its obvious impact on public health. One large multicenter randomized controlled trial failed to reduce mortality with mechanical support and intra-aortic balloon pump counterpulsation (IABP).[5,6] Considering these findings, clinicians are uncertain how to treat individuals with CS based on the traditional concept of mechanical support.[7]

In-hospital mortality was still high among ACS individuals after either PCI or coronary artery bypass graft surgery (CABG) to restore epicardial coronary artery blood flow.[8] Heart failure patients are treated with pharmacological treatment with inotropic drugs, vasopressors, and mechanical circulatory support. PCI or CABG has been the means of reperfusion therapy until now for almost every ACS patient. As far as we know, there is scarce information regarding the result of IABP usage for hemodynamic support in cardiogenic shock patients.[9] Current guidelines for the assessment of acute myocardial infarctions (AMI) complicated by cardiogenic shock have been challenged by a recent meta-analysis.[10] This meta-analysis concluded that neither randomized studies nor observational studies suggested that IABP support was beneficial for participants undergoing percutaneous coronary intervention (PCI) because of high-risk ST-segment elevation AMI. A debate over the use of IABP in cardiogenic shock has not addressed whether it should be started before or after PCI.

Most of the available ICU outcomes are not appropriate for guiding CS patient management at present.[11] The object of our research was to determine whether intra-aortic balloon pump-assisted PCI improved overall clinical outcomes during hospitalization, as well as to predict in-hospital mortality and cardiogenic shock among patients with acute coronary syndromes.

MATERIAL AND METHODS

This retrospective study enrolled 60 consecutive patients with a history of AMI complicated by cardiogenic shock. These patients underwent PCI with insertion of an IABP between 1st September 2019 and 28th February 2020. It is often characterized by hypotension (systolic blood pressure ≤ 90mm Hg for ≥ 30 minutes or requiring supportive measures to maintain it > 90mm Hg) and Following adequate correction of preload and major arrhythmias, there may be hypoperfusion of an organ (cool extremities or urine output ofi30iml/hour). The operator considered clinical and logistic factors to determine whether an IABP should be inserted before or after PCI. In order to establish a truly homogeneous population, we only examined patients who suffered AMIs and cardiogenic shocks from left ventricle failure. A retrospective analysis of anonymized patient data was conducted with informed consent from all patients. All patients with AMI received a loading dose of 300 mg aspirin and 600 mg clopidogrel orally immediately following diagnosis. A physician had the discretion to use platelet glycoprotein IIb/IIIa inhibitors (based on angiographic findings). Activated clotting times of 250-300 seconds, or 200-250 seconds if a glycoprotein IIb/IIIa inhibitor was used, were maintained with unfractionated heparin at 70 U/kg at initial presentation and 70 U/kg at PCI. All patients had cardiac catheterizations using 6Fr systems performed via femoral route. The right anterior oblique projection was routinely used for contrast ventriculography. We executed conventional coronary angiography and PCI. In accordance with local institutional guidelines, all patients received drug eluting stents. An operator's discretion was reserved regarding thrombus aspiration devices. Through the femoral artery, continuous balloon counter pulsation was performed in group A. During cardiac catheterization and PCI in group B (IABP supportiafter PCI), a pump inserted through the same femoral artery was used to support the patient. Hemodynamically unstable patients were treated with vasopressor drugs. IABP balloons were left for upto 48 hours at standard settings. Vasoprosal drugs had to be tapered slowly off for 12 hours before the pump was removed. If there were complications at the access site such as limb ischemia or hemorrhage, the aortic counter pulsation was stopped earlier. The treatment provided was standard coronary care. After the procedure, all patients were prescribed aspirin indefinitely (Based on local institutional practices) and clopidogrel for 12 months (according to AHA guidelines). Statins were prescribed if there were no contraindications. If there are no contraindications, angiotensin-converting enzyme inhibitors/angiotensin receptor blockers can also be prescribed. In the present analysis, hospital death was the end point. Ischemic or hemorrhagic cerebrovascular events, recurrent myocardial infarctions, target vessel revascularizations, and composites of these events were evaluated as secondary end points. They included death, nonfatal re-infarctions, revascularization of target vessels, and cerebrovascular events during the hospital stay. Surgical bypass grafting or repeated PCI was defined as revascularizing target vessels in this study. We used SPSS version 23.0 as the statistical software package for analysis. The Student t test was used to calculate the mean, standard deviation, median, and interquartile range of continuous variables. Variables that are not counted or a percentage are analyzed using the Pearson chi-squared test or Fisher's exact test, as needed. Statistical significance was determined by a p value of <0.05.

RESULTS

A clinical status assessment was performed based on patients' initial hospital admission data. As part of our study, we divided patients into two groups based on the type of treatment they received. A total of 33 participants were enrolled in group A, who had IABP inserted before PCI. In contrast, 27 patients were enrolled in group B and whose after PCI. A significant difference between the 2 groups was not found in coronary artery disease risk factors or clinical characteristics at baseline. When compared with the highest level of cardiac enzymes achieved during hospitalization, a significant difference existed, but there was no difference in the mean of these levels. In the group B at presentation, creatine kinase and creatine kinase-MB levels were significantly higher than in the group A, and maximalilevels of cardiacienzymes were also significantly higher than those in the group A. (Table 1). Myocardial Infarction flow post-procedure thrombolysis did not show significant differences among groups A and B; however, diseased vessels per patient were higher in group A; infarct territory localization and treated vessels did not show significant difference between the groups. The management offered to the 2 groups did not differ significantly in terms of glycoprotein IIb/IIIa inhibitors, vasopressor drugs prescribed at higher doses, or stents used on average (Table 2). According to Table 3, patients suffering adverse events and in-hospital mortality were listed. The 30-day mortality rate for participants undergoing IABP support following PCI significantly exceeded that for those receiving PCI assisted by IABP (59.2 % vs 18.1%, respectively, p = 0.006). Among the entire study population, no reinfaction or repeat PCI were reported. There was, however, a significant difference between groups B and A in in-hospital mortality (77.7% vs 24.2%, respectively, p = 0.003). An independent predictor of in-hospital mortality was determined.

Table 1: Demographic profile of the study participants (n = 60)

Variables	IABP Before PCI (n=33)	IABP After PCI (n=27)	P-Value
Age (years)	71 ± 11	72 ± 12	0.70
Diabetes mellitus	23 (51.5%)	12(44.4%)	0.67
Arterial hypertension	23 (69.6%)	17 (62.9%)	0.65
Hyperlipidemia (total cholesterol 200 mg/dl)	19 (57.5%)	15 (55.5%)	1.0
Current smokers	14 (42.4%)	11 (40.7%)	1.0
Peripheral arterial disease	3 (9.0%)	5 (18.5%)	0.27
Previous myocardial infarction	12 (36.3%)	11 (40.7%)	0.66
Previous coronary bypass	5 (15.1%)	6 (22.2%)	0.62
Atrial fibrillation	6 (18.1%)	10 (37%)	0.12
Ejection fraction (%)	22.6 ± 11.5	22.3 ± 8.6	0.81
Systolic blood pressure (mm Hg)	108 ± 11	106 ± 15	0.25
Diastolic blood pressure (mm Hg)	61 ±11	63 ± 12	0.50
ST- segment elevation myocardial infarction	19 (57.5%)	20 (74%)	0.26

Table 2: Characteristics of the procedure and post-procedure (n = 60)

Characteristics	IABP Before PCI (n =33)	IABP After PCI (n=27)	P-Value
iDiseased vessels	2.7 ± 0.6	2.4 ± 0.6	0.021*
Treatedivessels	1.4 ± 0.4	1.5 ± 0.6	0.43
Left anterioridescending as culprit vessel	15 (45.4%)	12 (44.4%)	0.61
Stents implantediper patient	3 (1–5)	2.5 (1–3.35)	0.13
Length of stentsi(mm)	34 (18–64)	23 (15–46)	0.27
Use of glycoproteiniIIb/IIIa inhibitors	18 (54.5%)	21 (77.7%)	0.21
Post procedure TIMI flow	2.8 ± 0.8	2.2 ± 1.3	0.21
Interval of Door-to-needle (min)	116 (40–250)	90 (34–498)	0.34
Procedure (min)	87 ±27	86 ± 35	0.65
intra-aortic balloon support (hours)	44 ± 34	46 ± 36	0.68
Need for high-dose vasopressor	12 (36.3%)	14 (51.8%)	0.27
Need for renal dialysis	3 (9%)	4 (14.8%)	0.54
Need for mechanical ventilation	17 (51.5%)	19 (70.3%)	0.23
Mechanicaliventilation (days)	1.0 (0–4.50)	2.5 (1–8)	0.048*
ICUicare stay (days)	7.5 (1.8–10)	8 (2.5–16.9)	0.60
Hospitalistay (days)	17 (8.5–25)	13 (2.9–25)	0.25

Table 3: In-hospital outcome (n = 60)

Risk factors	IABP Before PCI (n =33)	IABP After PCI (n =27)	P-value
In-hospital mortality	6 (18.1%)	16 (59.2%)	0.006*
Emergency coronary bypass	0	3 (11.1%)	0.30
Adverse events	8 (24.2%)	21 (77.7%)	0.003*
Renal failure	8 (24.2%)	14 (51.8%)	0.061
Bleeding	8 (24.2%)	4 (14.8%)	0.35

DISCUSSION

Patients of acute myocardial infarction require prompt revascularization in contrast to other patients. Participants with AMI complicated by cardiogenic shock are usually treated by opening their infarct-related arteries first, stabilizing their hemodynamics, and inserting an IABP if the shock level remains uncontrollable. The present technique of IABP is limited by bleeding and access site complications, and it related bleeding complications with a greater risk of long-term and acute mortality.[12,13] In our study, patients treated with IABP-assisted PCI were numerically more likely to suffer major bleeding complications. It remains a significant limitation for this approach that simultaneous punctures of both femoral arteries may cause increased complications at the access site. It is interesting to note, however, that this did not affect patients' overall benefits during hospitalization. Long-term effects of IABP help in this setting are yet to be determined, but the positive effects seem to outweigh its risks in this setting. It has been showed in animal models of ischemia-reperfusion that unloading the left ventricle before reperfusion has a beneficial effect.[14,15] According to Achour et al.,[14] dogs occluded the left anterior descending artery for 2 hours and were re-perfused for 4 hours had significantly lowed myocardial necrosis.

According to LeDoux et al.,[15] similar results were got using IABP in porcine models. Cardiogenic shock patients have not been studied with IABP insertion before or after PCI, to the best of our knowledge. Neither a leftiventriculariassistidevice nor IABP had any significant differences in clinical outcomes for revascularized myocardial infarction complicated by cardiogenic shock,[16] according to a sub analysis of a randomized trial comparing them. IABP is no longer recommended by the current guideline recommendations, even though a wide range of data support its use in patients withicardiogenic shock complicating AMI, according to a recent meta-analysis.[17] In cardiogenic shock, Sjauw et al., revealed insufficient sign to support IABP therapy.[17] According to this study, biases and confounding have caused problems with all observational studies of IABP therapy. IABP timing in relation to PCI, however, is not discussed by Sjauw et al.[17] although mechanical circulatory support seems to have the greatest effect recanalization has occurred, delayed use has been found to reduce its potential benefits. Among both groups in the current study, I observed significant changes in the mean cardiac enzyme values at presentation and the maximum levels reached during hospitalization. As evidenced by multivariate analysis, delayed use of IABP after PCI did not negatively impact in-hospital outcomes and there was no difference in overall mortality between patients who received IABP after PCI and those who did not receive it. However, the results suggest that earlier insertion of IABP support in this setting resulted in lower mortality rates in hospital. However, unmeasured confounders cannot be ruled out. Its retrospective design and small sample size were the most significant limitations of the study, so it could not exclude bias and confounding. In spite of these findings, further study in larger prospective studies is strongly warranted because the results clearly suggest an association between prior use of IABP and favorable outcomes. Without standard work instructions, the operator inserted the IABP according to the patient's hemodynamic stability. However, neither strategy was preferred over time (data not shown), thus showing a lack of effect from improved institutional experience as a potential confounded. It was not possible to record or analyze significant intervals, including the interval leading up to the insertion of the IABP. In addition, long-term follow-up was not extended beyond the in-hospital phase.

CONCLUSION

This study concluded that PCI assisted by IABP results in a better outcome for patients with cardiogenic shockicomplicating acute myocardialiinfarction and a lower mortality rate compared to IABP after PCI.

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