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ORIGINAL ARTICLE

Predictors of in-Hospital Prognosis after Primary Percutaneous Coronary Intervention for Acute Myocardial Infarction Requiring Mechanical Support Devices

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ABSTRACT

Objectives: The study was designed to identify predictor variables of the hospitalized patient's primary percutaneous coronary intervention (PPCI) for MI needing mechanical support systems including some intra-aortic balloon-pumping and percutaneous cardiopulmonary. However, these predictors are still unknown.

Place and Duration: The research was carried out at National Institute of Cardiovascular Disease with the duration from 5th September 2021 to 5th March 2022.

Methodology: Clinical history, angiographic research results, primary PCI outcomes, as well as in hospital prognosis were retroactively evaluated by comparing primary PCI treated acute myocardial infarction patients needing mechanical aid devices (with intra-aortic balloon pump patient populations, n=550) versus those without (IABP patients, n=755). In comparison to individuals without IABP, those with intra-aortic balloon pump were much more inclined to have a greater proportion of diseased vessels, a lower TIMI score in the infarct related artery (IRA), and a considerably high death rate of hospitalized patients. On multivariate analysis, possession of Thrombolysis In Myocardial Infarction greater than or equal to 3 flow in the infarct-related artery right after PPCI was the poor indicator in the without intra-aortic balloon pump patients, in contrast to the patients with IABP. The percentage of diseased vessels or diseased left main trunk at preliminary cardiac catheterization was the impartial predictive factor of the hospitalized patient's fatalities in the sufferers with IABP, but not in the sufferers without intra-aortic balloon pump.

Results: A significant risk factor for fatality in hospitalized patients in PPCI-treated acute myocardial infarction patients needing mechanical assistance devices is the proportion of diseased vessels ≥ 2 or diseased left main trunk at baseline CAG.

Keywords: Percutaneous cardiopulmonary support; Intra-aortic balloon pumping, PPCI or primary percutaneous coronary intervention; Multi-vessel disease

INTRODUCTION

Acute myocardial infarction (AMI) sufferers are now routinely treated with PPCI, and mounting research indicates that initial percutaneous coronary intervention can enhance the outcome for acute myocardial infarction patients experiencing myocardial ischemia (Wester et al., 2019). For AMI sick people confounded with cardiogenic shock, sophisticated heart failure, or malfunctioned reperfusion, mechanical support devices like as percutaneous cardiopulmonary support and intra-aortic balloon pumping are essential in relation to interventional therapy. As a result, AMI sufferers who need mechanical assistance devices are regarded as a category of higher risk acute myocardial infarction sufferers who have a high rate of fatality while hospitalized (Wongthida et al., 2022). Recent studies have shown that repeat acute myocardial infarction people receiving primary PPCI, a diverse group of higher risk AMI patients, had an in-hospital death that was considerably higher compared to that of 1st AMI patients, as well as the factors that determined in-hospital consequences in recurrent AMI sufferers who undergo PPCI were distinctive from those who determined in-hospital consequence in 1st AMI patients (Corpus et al., 2004). Hence, more research is mandatory to find out the clinical signs and indicators of in-hospital mortality among PPCI treated AMI people who require IABP. The National Institute of Cardiovascular Disease was selected to analyze this data from Jan 2021 to July 2021 and create an urgent care network for cardiovascular problems in the large observational study. Using information from the National Institute of Cardiovascular Disease, the current study aimed to compare the clinical profiles, hospital record, and factors influencing in-hospital outcomes of PPCI treated acute myocardial infarction patients who required intra-aortic balloon pump with individuals treated with and without PPCI.

Table 1: Medical Characteristics of the Research Participants (the With and Without IABP Group)

	With IABP (n=550)	Without IABP (n=755)	P value
Age (mean ± SD)	65.5±15.5	65.5±15.5	0.072
Male (%)	402 (73.1%)	556 (73.8%)	1.662
Previous Myocardial Infarction (%)	110 (20.1%)	90 (11.8%)	< 0.002
Previous PCI (%)	76 (13.9%)	55 (7.5%)	< 0.002
Previous CABG (%)	14 (2.6%)	4 (0.8%)	< 0.002
Associated Risks			
Smokers (%)	200 (36.5%)	262 (34.8%)	0.2975
Hypercholesterolemia (%)	190 (34.6%)	243 (32. 5%)	0.0.91
High BP (%)	256 (46.7%)	244 (45.8%)	0.1.558
Diabetics (%)	146 (26.7%)	183 (24.4%)	0.828
Elapsed time < 24 hours (%)	476 (86.6%)	671 (88.8%)	0.53
Killip 3/4 (%)	236 (42.8%)	60 (7.8%)	< 0.002

Table 2**:** Angiography Results of the Research Study Respondents

Culprit lesions	With intra-aortic balloon pump (n=550)	Without intra-aortic balloon pump (n=755)	P-value
Right Coronary Artery (%)	184 (33.6 %)	272 (36.2 %)	< 0.001
Left Anterior Descending Coronary Artery (%)	244 (44.5 %)	351 (46.4 %)	
Left Circumflex (%)	48 (8.8 %)	117 (15.6 %)	
Left Main Trunk (%)	42 (7.8 %)	4 (0.8 %)	
Multi-vessels (%)	30 (5.6 %)	12 (1.9 %)	
Saphenous Vein Graft No. of diseased vessels	2 (0.5 %)	0 (0.0)	
0 (%)	0 (0.0)	1 (0.3 %)	< 0.001
1 (%)	216 (39.6 %)	458 (60.8 %)	
2 (%)	174 (31.5 %)	215 (28.8 %)	
3 (%)	120 (21.9 %)	76 (10.4 %)	
Left Main Trunk (%)	40 (7.5 %)	5 (0.9 %)	

METHODS

Targeted Population: The current investigation included 430 sufferers with acute myocardial infarction and was admitted at the National Institute of Cardiovascular Disease within a week of the commencement of their illness between 5th March 2021 and 5th September 2022. Total 908 of these sufferers underwent PPCI, and 892 of those had clinical history information accessible. intra-aortic balloon pump or PCPS were examples of mechanical support devices. We retroactively compared patients who underwent PPCI and required mechanical assistance devices during primary PCI or the admittance time frame (with IABP group, n=550) to those who did not (without intra-aortic balloon pump group, n=755). The clinical backstory, cardiac health conditions, echocardiography outcomes, acute outcomes of primary PCI, as well as in-hospital prognosis were contrasted. The inclusion of two of the following three criteria was necessary for the diagnosis of acute myocardial infarction: (1) a distinctive clinical background; (2) serial Electrocardiogram changes that suggested ischemic stroke (Q-waves) or damage (STEMI); and (3) a temporary rise in cardiovascular enzymes that was greater than two times the research lab value.

Collection of Data: Records were kept of the participants' demographic data, cardiac related past data, and risk factors (such as smokers, hypercholesterolemia, HTN, and DM). Total cholesterol levels below 220 mg/dl or the intake of medications to low cholesterol were considered to be signs of hyperlipidemia. Systemic blood pressure levels below 140/90 mmHg were considered to be signs of high blood pressure. Fasting blood glucose levels below 126 mg/dl were considered to be signs of diabetes mellitus. The Data was collected from the National Institute of Cardiovascular Disease. The ethics board at every hospital gave its approval to the research study.

Reperfusion Therapy and Emergency Coronary Angiography: The typical procedure for Emergency Coronary Angiography was used. The TIMI trial's categorization system was employed to grade the myocardial flow in the artery that was associated with the infarction. Substantial myocardial infarction stenosis was characterized by a decrease of 50 per cent in the inner diameter of the left trunk line or a decrease of at least 76 per cent in the internal diameter of the left, right anterior descending, or LCx coronary arteries as well as their major branches. Coronary artery shrinkage less than major stenosis was considered non-significant stenosis. Zero-vessel disease was defined as the presence of either radiographically normal blood vessels or non-significant narrowing in a patient. Multi-vessels were referred to be culprit lesions in the first Emergency Coronary Angiography as synchronous thrombosis of several coronary vessels. PPCI was then done after coronary angiography identified the responsible lesions.

Statistics: The mean and Standard deviations are used to express data. The chi-square test for categorical data and the unilateral Student's t-test for the dependent variable, respectively, were used to evaluate the groups without and with intra-aortic balloon pump.- The probability of in-hospital TIMI-flow grade was divided into two categories based on the probability value and 95 per cent confidence intervals: grade 3 and grade-2 or unknown. P value (0.05) was considered significant in each analysis.

RESULTS

Risk Factors and Patient Qualities: The table below provides a summary of the clinical traits and risk variables in the two categories. In contrast to the group without intra-aortic balloon pump, the group with IABP was older and had a high intensity of prior myocardial infarction (MI), PPCI, prior coronary artery bypass grafting and Killip class ≥ 3 at presentation. There was not any differ in the number of heart related risks among the ≥ 2 groups.

Angiographic Information: The 2nd table of the echocardiography data contains the emergency coronary angiography information for the two groups. In comparison to the group without intra-aortic balloon pump, the group with IABP had a higher likelihood of having LMT or multi-vessel culprit lesions and a lower likelihood of having circumflex blood vessels as culprit lesions. Comparing the two groups, those with IABP had more diseased vessels than those without.

Coronary Intervention Results: The outcomes of PPCI in the two groups are shown in the table following. 546 of the 550 AMI sufferers with intra-aortic balloon pump and 664 of the 755 acute myocardial infarction patients without IABP had data on the TIMI-grade available. The TIMI flow grade prior to and after PPCI was generally lower in the intra-aortic balloon pump group than in the group without IABP. 50 sufferers in the IABP group both had PCPS and IABP, compared to 6 patients who had PCPS alone and 247 patients who had intra-aortic balloon pump. Each hospital had a different prevalence of IABP use, ranging from 0.0 % to 28.2 % (mean 32.0 ± 16.4 %).

Table 3: Findings of Coronary Intervention in the Study Patients

	With Intra-aortic Balloon Pump (n=550)	Without Intra-aortic Balloon Pump (n=755)	P-value
Before Thrombolysis In Myocardial Infarction grade			
0	358 (65.8 %)	371 (55.8 %)	0.046
1	78 (14.4 %)	105 (15.9 %)	
2	48 (8.9 %)	86 (13.1 %)	
3	62 (11.5 %)	102 (15.4 %)	
Post Thrombolysis In Myocardial Infarction (TIMI) grade			
0	24 (4.5 %)	14 (2.3 %)	< 0.002
1	16 (2.8 %)	4 (0.6 %)	
2	74 (13.7 %)	20 (3.2 %)	
3	432 (79.2 %)	626 (94.3 %)	
Stent (%)	418 (76.1 %)	592 (78.6 %)	0.722
IABP (Balloon Pump) (%)	544(98.8 %)		
Percutaneous Cardiopulmonary Support (%)	56 (10.3 %)		
Cardiac Resynchronization Therapy (%)	110 (20.1 %)	53 (7.1 %)	< 0.002
Urgent coronary artery bypasses graft (%)	6 (1.2 %)	1 (0.2 %)	< 0.002

Table 4: Findings of Coronary Intervention in the Study Patients

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In-Hospital Results: The in-hospital prognosis for each group is displayed in the table following. Peak creatine kinase levels had been greater in the IABP participants in comparison to the group without the IABP, and their in-hospital overall mortality rate was also considerably higher. Comparing the with- IABP group to the group lacking the intra-aortic balloon pump, the former had a greater prevalence of either non-cardiac or cardiac-related deaths. Using all of the collected information (age group, past PCI, gender,

prior myocardial infarction, previous CABG, smoking, high cholesterol, high blood pressure, type-1 diabetes, the multitude of diseased vessels greater than or equal to 2 or diseased left main trunk, use of stents, elapsed time 24 hour, Killip class ɣreater than or equal to 3 at admission, and TIMI greater than or equal to 3 flow immediately after percutaneous coronary intervention (PCI), it was possible to evaluate the contribution of medical background, health conditions, Killip class greater than or equal to 3 at admission, TIMI greater than or equal to 3 flow before/immediately after percutaneous coronary intervention (PCI, left main trunk or multi-vessels as culprit lesions, the multitude of diseased vessels greater than or equal to 2 or diseased left main trunk, revascularization, elapsed time 24 hour, and over-all death throughout their stay at hospital in the with IABP group as well as in the without IABP (Intra-aortic Balloon Pump group) were evolved.

Table 5: In-Hospital Results in the Participants

With	Without	
Intra-aortic Balloon Pump	Intra-aortic Balloon Pump	P value
(n=550)	(n=755)	
Death (%) 184 (33.6 %)	44 (5.9 %)	< 0.001
Cardiac-related (%) 146 (26.7 %)	30 (4.0 %)	< 0.001
Shock 39 %	8 %	< 0.001
Cardiac failure 44 %	11 %	< 0.001
Rupture 8 %	7 %	0.2105
Non-cardiac-related (%) 9 (6.8 %)	28 (1.9)	< 0.001

DISCUSSION

The following are the main findings of the current multi-center study: between acute myocardial patients treated with primary PCI, the proportion of diseased vessels ≥ 2 or diseased left main trunk on preliminary coronary angiography was an impartial predictive factor of in-hospital fatalities in acute myocardial infarction patients who require IABP/PCPS, however not in acute myocardial infarction patients without IABP; acquisition of TIMI ≥3 flow right away after PPCI was an impartial poor indicator in acute myocardial infarction patients without IABP (Dauerman et al., 2002). The clinical symptoms and factors that affect in-hospital outcomes for PPCI-treated acute myocardial infarction patients who need mechanical assist devices are being examined for the first time in this research. The PPCI-treated acute myocardial infarction patients in this study who needed IABP were older, had a high incidence of prior MI, previous stenting revascularizations, and a Killip class of greater than or equal to 3 at their stay in hospotal, as well as a high likelihood of left main trunk and multi-vessels as culprit lesions, more diseased vessels on the preliminary coronary angiography, a reduced TIMI flow score pre and post PPCI, as well as a considerably higher in-hospital fatality rate than the PPCI (Ibanez et al., 2018). Despite the use of mechanical assistance devices, the greater in-hospital fatality in this study population may be related to mechanical impairment and persistent myocardial infarction because of their medical histories) in contrast to those who received treatment without IABP, primary PPCI-treated AMI patients who needed IABP had a significantly higher rate of cardiac related deaths from cardiac failure, heart failure, and irregular heartbeat. However, the intensity of deaths from cardiac perforation did not differ between these groups. In acute myocardial infarction patients receiving PPCI, advanced age, female gender, lower BMI, and delayed resuscitation have been identified as predictive factors of rupture (Kalarus et al., 2007).

Despite the lack of information on non-fatal ventricular rupture in the current investigation, it is plausible to assume that cardiovascular system depression necessitating mechanical support devices may not be directly linked to ventricular rupture (Katayama et al., 2005). In the main PCI treated acute myocardial infarction patients who required mechanical assistance devices, however not in those who did not, the present investigation has shown for the 1st time that the proportion of diseased vessels greater than or equal to 2 or diseased left main trunk on initial coronary angiography was an important predictive factor of in-hospital fatality. However, in contrast to those acute myocardial infarction patients who had IABP therapy, those AMI patients who did not get IABP therapy saw TIMI greater than or equal to 3 flow in the infarction related artery as soon as initial PCI. Despite the lack of information on non-fatal ventricular rupture in the current investigation, it is plausible to assume that cardiovascular system depression necessitating mechanical support devices may not be directly linked to ventricular rupture (Katayama et al., 2005). In the main PCI treated acute myocardial infarction patients who required mechanical assistance devices, however not in those who did not, the present investigation has shown for the 1st time that the proportion of diseased vessels ≥2 or diseased left main trunk on initial coronary angiography was an important predictive factor of in-hospital fatality. However, in contrast to those acute myocardial infarction patients who had IABP therapy, those AMI patients who did not get IABP therapy saw TIMI greater than or equal to 3 flow in the infarction related artery as soon as initial PCI. These contradictory data imply that PPCI against the infarction related artery alone for acute myocardial infarction patients with multi-vessel disease needing mechanical assist devices may be an inadequate method and that multi-vessel PCI or earlier than usual staged PCI must be taken into consideration to keep improving the in-hospital result. Even so, PCI in a coronary artery at the same time as PPCI of the infarction related artery could be considered acceptable in AMI patients with hypotension, However, the risk of experiencing multi-vessel PCI during primary PCI should be taken into consideration. The greater in-hospital mortality in this prospective study may be related to hemodynamic impairment and persistent myocardial infarction (because of their clinical histories). This is true even though mechanical support devices were used. The prevalence of cardiovascular deaths from cardiac failure, heart problems, and irregular heartbeat was considerably higher in the PPCI-treated acute myocardial infarction patients who needed IABP in the current study compared to those who didn't, but the regularity of cardiac rupture related deaths didn't differ among the patients. Age group, gender, BMI, and late resuscitation have all been identified as independent risk factors for rupture in acute myocardial infarction patients receiving initial PCI (Kalarus et al., 2007).

CONCLUSION

The current research clears that, in PPCI-treated AMI people receiving mechanical support devices, the multitude of diseased vasculature ≥2 or diseased left main trunk on initial coronary angiography is a distinct risk for the death rate of hospitalized patients. The comparatively small size of the study along with the dearth of information regarding LVF, although, are significant limitations, and a bigger, as well as a more thorough study, must be carried out to corroborate the results.

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