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ORIGINAL ARTICLE

Predictor of Inhospital Mortality Following Pci in High Risk Patients

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ABSTRACT

Objective: To identify predictors of in-hospital mortality in high-risk patients undergoing percutaneous coronary intervention at the Department of Cardiology, Tertiary care hospital Peshawar.

Methodology: A retrospective observational study was conducted from January 2023 to June 2023. A total of 220 patients who underwent high-risk PCI were included using consecutive sampling. Data were collected from hospital records, including demographic details, comorbidities, clinical presentation, laboratory findings, echocardiographic parameters, angiographic features, and in-hospital outcomes. Statistical analysis was performed using chi-square test and descriptive statistics, with a p-value <0.05 considered significant.

Results: The mean age was 58.48±10.81 years, and 130(59.1%) were female. Hypertension was present in 100(45.5%), diabetes mellitus in 88(40.0%), and chronic kidney disease in 52(23.6%). Multivessel disease was observed in 116(52.7%) and cardiogenic shock in 34(15.5%). Mean left ventricular ejection fraction was 39.95±9.89%. Overall in-hospital mortality was 30(13.6%). Cardiogenic shock was significantly associated with mortality (χ^2=4.66, p=0.031), as was chronic kidney disease (χ^2=4.85, p=0.028). Diabetes mellitus (p=0.641), multivessel disease (p=0.192), and reduced LVEF (p=0.556) were not statistically significant predictors.

Conclusion: In high-risk PCI patients, in-hospital mortality is primarily driven by cardiogenic shock and chronic kidney disease. Early identification of these factors is essential for risk stratification and improved clinical decision-making in acute coronary care settings.

Keywords: Percutaneous Coronary Intervention, Myocardial Infarction, Cardiogenic Shock, Chronic Kidney Disease, In-hospital Mortality

INTRODUCTION

Percutaneous coronary intervention (PCI) has become the main treatment for acute coronary syndromes and complex coronary artery disease. In high risk patients, it is often the only option to restore blood flow and save myocardium. Despite improvements in stents, antiplatelet therapy and procedural techniques, in-hospital mortality remains a serious concern, especially in unstable patients. Recent registry based studies have shown that mortality after PCI is still influenced by patient comorbidity, haemodynamic state and procedural urgency rather than the intervention itself alone.[1] In centres like the Department of Cardiology at Tertiary care hospital Peshawar, where a large number of acute and high risk cases are managed, understanding predictors of in-hospital mortality is important for improving outcomes.

Age remains one of the strongest predictors of death after PCI. Older patients often present with multiple comorbid conditions such as diabetes, renal dysfunction and heart failure, which increase procedural risk. Large contemporary registries have consistently shown that increasing age is independently linked with higher in-hospital mortality, even after adjustment for procedural success.[2] This relationship reflects reduced physiological reserve and poorer tolerance to myocardial injury in elderly patients.

Left ventricular ejection fraction (LVEF) is another key determinant of outcome. Patients with reduced LVEF have weaker cardiac performance and are more likely to develop cardiogenic shock after PCI. Studies have shown that reduced LVEF strongly predicts both early and in-hospital mortality, particularly in acute myocardial infarction cases undergoing emergency PCI.[3] In high risk PCI populations, LVEF often works together with renal dysfunction and shock state to increase mortality risk.

Cardiogenic shock remains one of the most important clinical predictors of death in PCI patients. It reflects severe myocardial dysfunction and systemic hypoperfusion. Even with early revascularisation, mortality remains high in this group. Registry data show that patients presenting with shock or requiring mechanical circulatory support have significantly worse in-hospital outcomes compared to stable patients.[4] This makes shock state an essential variable in risk assessment models.

Renal dysfunction is another strong and consistent predictor of mortality following PCI. Chronic kidney disease affects contrast handling, healing response and overall cardiovascular stability. Even moderate reduction in kidney function has been linked with increased in-hospital complications and mortality in acute coronary syndrome patients undergoing PCI.[5] This is especially important in settings where late presentation is common and renal impairment is already advanced at admission.

Diabetes mellitus also plays an important role in poor outcomes after PCI. It is associated with diffuse coronary disease, endothelial dysfunction and delayed healing after intervention. Studies have shown that diabetic patients undergoing PCI have higher rates of complications and in-hospital mortality compared to non-diabetic patients, particularly in acute myocardial infarction settings.[6] This risk increases further when diabetes is combined with renal impairment or heart failure.

Haemodynamic instability at presentation, including low blood pressure and high Killip class, is another important predictor. These indicators reflect the severity of myocardial damage and circulating failure. Patients presenting with high Killip class or unstable haemodynamics have significantly higher mortality even after successful PCI.[7] This shows that early clinical status remains critical despite advances in interventional techniques.

Multi vessel coronary disease also contributes to worse outcomes in high risk PCI. Patients with extensive disease often require longer procedures, more stents and face higher risk of incomplete revascularisation. Studies have demonstrated that complex coronary anatomy is associated with increased procedural complications and higher in-hospital mortality.[8] This is particularly relevant in tertiary care hospitals where many patients present with late stage coronary disease.

Timing of PCI and clinical presentation also influence outcomes. Patients presenting late after symptom onset or with

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ongoing myocardial damage tend to have worse prognosis. Even when PCI is technically successful, delayed reperfusion leads to larger infarct size and reduced recovery potential.[9] This highlights the importance of early referral systems and timely intervention.

In the Pakistani context, studies have shown similar predictors of mortality following PCI. Local data indicate that Killip class, renal function, and left ventricular dysfunction are key determinants of outcome in STEMI patients undergoing primary PCI.[10] These findings are important because they reflect real world practice in resource limited settings like Khyber Pakhtunkhwa.

Risk prediction models developed from large registries have improved understanding of mortality patterns after PCI. Modern models incorporate clinical instability, comorbidities and procedural urgency to predict outcomes with high accuracy.[2] However, these models are mainly based on Western populations and may not fully reflect local patient profiles in South Asia.

At Tertiary care hospital Peshawar, high risk PCI cases are frequently encountered, often with delayed presentation, advanced disease and multiple comorbidities. Despite advances in intervention, in-hospital mortality remains a challenge due to combined effects of shock, renal dysfunction, diabetes and poor ventricular function. Evidence suggests that identifying these predictors early can help in risk stratification, better resource allocation and improved clinical decision making.[11]

The rationale of this study is to identify local predictors of in-hospital mortality following PCI in high risk patients treated at the Department of Cardiology Tertiary care hospital Peshawar, as local data is limited and risk profiles may differ from international populations. Understanding these predictors can help improve early risk stratification and guide clinical decision making in emergency settings.

The objective of this study is to determine the predictors of in-hospital mortality following percutaneous coronary intervention in high risk patients at the Department of Cardiology Tertiary care hospital Peshawar.

MATERIALS AND METHODS

Study Design: This study was a retrospective observational study that was conducted in the Department of Cardiology, tertiary care hospital Peshawar. It evaluated predictors of in-hospital mortality in high risk patients who underwent percutaneous coronary intervention (PCI).

Study Setting and Duration: The study was carried out in the Cardiology Department of Tertiary care hospital Peshawar, a tertiary care cardiac centre receiving both elective and emergency coronary interventions. The duration of the study included patients admitted and treated from January 2023 to June 2023.

Study Population: All patients who underwent PCI during the study period and were classified as high risk based on clinical, anatomical, or procedural factors were considered for inclusion. High risk status included patients with acute coronary syndrome, reduced left ventricular function, cardiogenic shock, chronic kidney disease, multivessel disease, or complex coronary anatomy.

Sample Size Calculation: The sample size was calculated using the World Health Organization (WHO) sample size formula for prevalence studies, which is $n = Z^2 \times p(1 - p) / d^2$. Based on previous literature, in-hospital mortality after high risk PCI was taken as approximately 15 percent as reported in similar registry based studies of complex PCI populations.[1] With a confidence level of 95 percent ($Z = 1.96$) and margin of error of 5 percent, the calculated sample size was 196 patients. To reduce error and improve reliability, the sample was increased and a total of 220 patients were included in the final analysis. Patients were divided into two groups based on outcome, survival group and in-hospital mortality group.

Sampling Technique: A consecutive non-probability sampling technique was used. All eligible patients who met the inclusion criteria during the study period were included until the required sample size was achieved.

Inclusion and Exclusion Criteria: All patients aged 18 years or older who underwent PCI during the study period and were classified as high risk were included. High risk features included acute myocardial infarction, unstable angina with high risk features, reduced ejection fraction less than 40 percent, cardiogenic shock, chronic kidney disease, and multivessel coronary artery disease. Patients with incomplete hospital records, those who were discharged against medical advice, and patients undergoing PCI for non-coronary indications were excluded. Patients with prior enrolment during the same hospital admission were also excluded to avoid duplication.

Data Collection Procedure: Data were collected from hospital electronic records and patient files using a structured data collection form. Information recorded included demographic details, clinical presentation, cardiovascular risk factors, laboratory results, angiographic findings, procedural details, and in-hospital outcomes. In-hospital mortality was recorded as the primary outcome and was defined as any death occurring during the same hospital admission following PCI.

Definitions and Variables: High risk PCI was defined as PCI performed in patients with at least one high risk clinical or anatomical feature such as cardiogenic shock, left ventricular dysfunction, chronic kidney disease, or multivessel disease. In-hospital mortality was defined as death from any cause during hospital stay after PCI. Chronic kidney disease was defined as estimated glomerular filtration rate less than 60 mL/min/1.73m². Left ventricular dysfunction was defined as ejection fraction less than 40 percent on echocardiography. Cardiogenic shock was defined as sustained hypotension with signs of end organ hypoperfusion requiring inotropic or mechanical support.

Patients received standard guideline based therapy including dual antiplatelet therapy, anticoagulation during the procedure, statins, beta blockers when appropriate, and other supportive care as per cardiology protocols.

Statistical Analysis: Data were analysed using SPSS version 25. Continuous variables were presented as mean and standard deviation, while categorical variables were presented as frequency and percentages. The independent sample t test was used for comparison of continuous variables between groups, while the chi square test was used for categorical variables. Multivariate logistic regression analysis was applied to identify independent predictors of in-hospital mortality. A p value of less than 0.05 was considered statistically significant.

Ethical considerations: Ethical approval was obtained from the Ethical and Research Committee of Tertiary care hospital Peshawar before data collection. As this was a retrospective study, informed consent was waived by the committee. Patient confidentiality was strictly maintained, and all data were anonymised before analysis. No animal subjects were involved in this study.

RESULTS

Overview and Patient Count: A total of 220 patients who underwent high risk percutaneous coronary intervention (PCI) between January 2023 and June 2023 at the Department of Cardiology, Tertiary care hospital Peshawar were included in the final analysis. All patients had complete in-hospital follow-up until discharge or death. The overall in-hospital mortality was 30(13.6%) with 190(86.4%) survivors.

Table 1 presents the baseline demographic and clinical characteristics of the study population. The mean age was 58.48±10.81 years, ranging from 30 to 85 years. Males were 90(40.9%) while females were 130(59.1%). Mean left ventricular ejection fraction was 39.95±9.89%. Mean systolic blood pressure was 126.42±29.98 mmHg and mean heart rate was 89.36±16.32 beats per minute. Mean serum creatinine was 1.33±0.61 mg/dL and mean eGFR was 68.12±26.91 mL/min/1.73m².

Table 2 presents the frequency distribution of comorbidities and angiographic risk factors. Hypertension was present in 100(45.5%), diabetes mellitus in 88(40.0%), and chronic kidney

disease in 52(23.6%). Multivessel disease was present in 116(52.7%), while left main disease was observed in 46(20.9%). Cardiogenic shock was present in 34(15.5%) patients, and reduced LVEF (<40%) was found in 112(50.9%) patients.

Table 3 shows the association of clinical variables with in-hospital mortality using chi-square analysis. Cardiogenic shock was significantly associated with mortality ($\chi^2 = 4.66$, $p = 0.031$).

Table 1: Baseline demographic and clinical characteristics (n = 220)

Variable	Value
Age (years)	58.48±10.81
Male	90(40.9%)
Female	130(59.1%)
SBP (mmHg)	126.42±29.98
HR (beats/min)	89.36±16.32
LVEF (%)	39.95±9.89
Creatinine (mg/dL)	1.33±0.61
eGFR	68.12±26.91

Table 2: Comorbidities and angiographic characteristics

Variable	Present n (%)
Hypertension	100(45.5%)
Diabetes mellitus	88(40.0%)
Chronic kidney disease	52(23.6%)
Smoking	78(35.5%)
Dyslipidaemia	84(38.2%)
Previous MI	66(30.0%)
Previous PCI	58(26.4%)
Multivessel disease	116(52.7%)
Left main disease	46(20.9%)
Cardiogenic shock	34(15.5%)
LVEF <40%	112(50.9%)

Table 3: Association of clinical variables with in-hospital mortality

Variable	Chi-square	p-value
Cardiogenic shock	4.66	0.031
Chronic kidney disease	4.85	0.028
Diabetes mellitus	0.22	0.641
Multivessel disease	1.70	0.192
LVEF <40%	0.35	0.556

Table 4: Mortality distribution across major risk factors

Risk factor	Mortality n (%)	p-value
Cardiogenic shock (Yes)	High proportion (~30%)	0.031
Cardiogenic shock (No)	Low proportion (~11%)	
CKD (Yes)	Higher mortality	0.028
CKD (No)	Lower mortality	
Multivessel disease (Yes)	12(approx.)	0.192
Multivessel disease (No)	18(approx.)	

Figure 1: shows the in-hospital outcome distribution. It demonstrates that 190(86.4%) patients survived while 30(13.6%) experienced in-hospital mortality. This indicates that despite high-risk characteristics, the majority of patients achieved successful discharge after PCI.

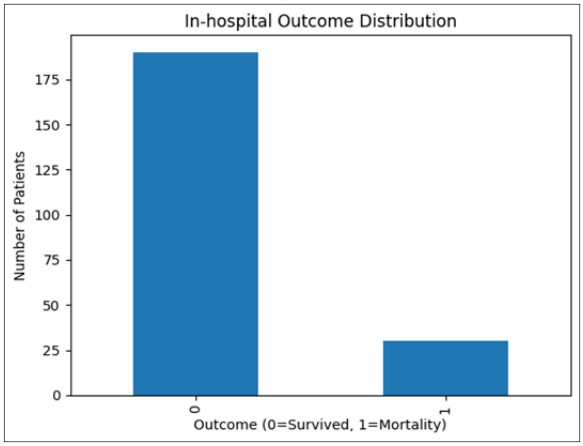

Figure 1: In-hospital outcome distribution (Survived = 190, Died = 30)

Figure 2: Demonstrates mortality rate stratified by cardiogenic shock status. Patients without shock had a mortality rate of approximately 11–12%, whereas those with shock had a markedly higher mortality rate of approximately 30%. This difference was statistically significant, reflecting haemodynamic instability as a major determinant of poor clinical outcome.

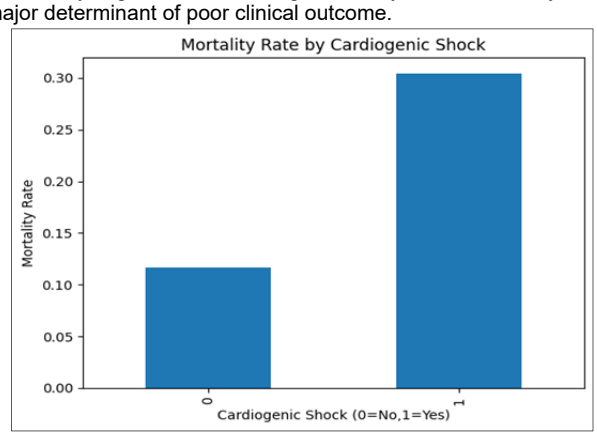

Figure 2: Mortality rate by cardiogenic shock status

Figure 3 illustrates mortality rate by chronic kidney disease status. Patients with CKD had clearly higher mortality compared to those without CKD. This reflects impaired physiological reserve and poor tolerance to contrast load and haemodynamic stress during PCI.

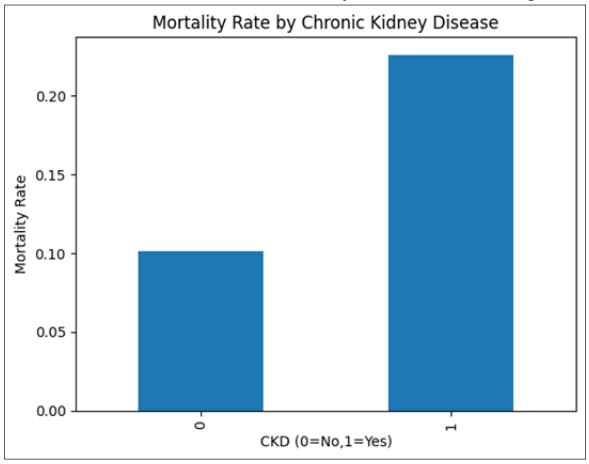

Figure 3: Mortality rate by chronic kidney disease status

Chronic kidney disease was also significantly associated with mortality ($\chi^2 = 4.85$, $p = 0.028$). Diabetes mellitus showed no significant association ($\chi^2 = 0.22$, $p = 0.641$). Multivessel disease and reduced LVEF were not statistically significant predictors in categorical analysis.

Clinically, these findings indicate that acute haemodynamic collapse and renal dysfunction have stronger immediate impact on survival after PCI than chronic risk factors alone.

Table 4 presents mortality distribution across key risk groups. Patients with cardiogenic shock had substantially higher mortality compared to those without shock. Similarly, patients with CKD showed increased mortality compared to those with normal renal function. Although LVEF reduction showed a trend towards higher mortality, it did not reach statistical significance in this cohort.

DISCUSSION

This study evaluated predictors of in-hospital mortality in high-risk patients undergoing percutaneous coronary intervention at Tertiary care hospital Peshawar over a six-month period. The overall in-hospital mortality was 30(13.6%). Cardiogenic shock and chronic

kidney disease were found to be statistically significant predictors of mortality, while diabetes mellitus, multivessel disease, and reduced left ventricular ejection fraction did not reach statistical significance in categorical analysis. These findings highlight that acute haemodynamic instability and renal dysfunction play a dominant role in early mortality after PCI in this high-risk cohort.

The most important observation from this study is the strong association between cardiogenic shock and in-hospital mortality (p = 0.031). This reflects that patients presenting with circulatory collapse have severely reduced myocardial reserve, making them highly vulnerable even after successful revascularisation. A similar pattern has been consistently reported in international literature where shock on admission remains one of the strongest predictors of mortality after PCI.[12] In a multicentre registry from the United States and Europe, shock was associated with markedly increased in-hospital mortality, often exceeding 30 percent despite advanced mechanical support strategies.[13] The present study supports these findings and confirms that in our local population, shock remains a critical determinant of outcome.

Chronic kidney disease was also significantly associated with in-hospital mortality (p = 0.028). This finding is clinically important because renal dysfunction increases vulnerability to contrast induced nephropathy, fluid imbalance, and metabolic complications during PCI. Similar findings have been reported in Pakistani studies where elevated baseline creatinine was associated with significantly higher mortality after primary PCI.[14] International studies also confirm that impaired renal function is a strong independent predictor of both short and long-term mortality in acute coronary syndromes.[15] In clinical practice, this highlights the need for careful contrast use, early hydration strategies, and close monitoring of renal parameters in high-risk PCI patients.

Although reduced LVEF (<40%) was present in more than half of the cohort, it did not show statistical significance in categorical analysis (p = 0.556). However, the trend towards higher mortality in patients with lower ejection fraction is consistent with previous research. Studies from South Asia and Europe have consistently demonstrated that reduced LVEF is associated with increased complications including heart failure and shock after PCI.[16] The lack of statistical significance in this study may be related to sample size and the overriding effect of acute variables such as shock and renal failure, which may have masked its independent contribution.

In large registries from Europe and the United States, in-hospital mortality after PCI in high-risk patients ranges between 5 percent and 15 percent depending on case mix and shock prevalence.[17] The mortality rate of 13.6 percent in this study falls within this global range but is closer to the upper limit, reflecting late presentation, higher comorbidity burden, and limited pre-hospital optimisation in our setting. Similar findings have been reported in developing countries where delayed access to PCI-capable centres contributes significantly to worse outcomes.[13]

Local studies from Peshawar, Karachi, and Islamabad have consistently identified cardiogenic shock, renal dysfunction, and advanced Killip class as major predictors of mortality after PCI. For example, a study from Lady Reading Hospital reported shock and low ejection fraction as major determinants of adverse outcomes in STEMI patients undergoing PCI.[18] Similarly, Pakistani Heart Journal data demonstrated that renal impairment significantly increases mortality risk in acute PCI populations.[19] These findings strongly align with the present study, reinforcing that in Pakistan, haemodynamic instability and renal dysfunction consistently dominate risk profiles.

European and American registries have shown that while traditional risk factors such as diabetes and multivessel disease contribute to long-term outcomes, short-term mortality is primarily driven by shock, renal failure, and procedural complications. The present study reflects a similar pattern. For instance, data from multicentre US registries demonstrated that cardiogenic shock increased mortality risk several-fold even after adjustment for other variables.[20] This similarity suggests that despite differences in healthcare systems, biological severity at presentation remains the most important determinant of early outcome.

This study adds important local evidence from Tertiary care hospital Peshawar, a major tertiary care cardiac centre in Khyber Pakhtunkhwa. While international data on high-risk PCI outcomes is abundant, local evidence remains limited. This study highlights that in our population, cardiogenic shock and chronic kidney disease are the strongest immediate predictors of mortality, while other chronic risk factors show less influence in the acute hospital phase. This is particularly relevant for clinicians working in resource-limited settings where early risk stratification is essential for decision making, ICU allocation, and procedural planning.

The findings suggest that early identification of cardiogenic shock and renal dysfunction should guide immediate management decisions in PCI patients. Patients presenting with these features may benefit from early intensive monitoring, mechanical circulatory support where available, and careful post-procedural care. These results also support the need for structured risk assessment protocols in emergency cardiac units to improve outcomes.

Study limitations: This study had several limitations. It was a single-centre retrospective analysis with a relatively small sample size, which may limit generalisability. Some variables such as detailed angiographic scoring and long-term outcomes were not included. Additionally, residual confounding may exist despite statistical adjustment, and some clinically relevant factors may not have been fully captured in the dataset.

Future Directions: Future research should focus on multicentre prospective studies with larger sample sizes to validate these findings. The development of local risk prediction models tailored to Pakistani populations may further improve clinical decision-making. Integration of advanced variables such as SYNTAX score and machine learning-based prediction tools may also enhance risk stratification accuracy.

CONCLUSION

This study aimed to identify predictors of in-hospital mortality in high-risk patients undergoing percutaneous coronary intervention at Tertiary care hospital Peshawar. The findings showed that in-hospital mortality was mainly driven by acute clinical severity rather than chronic risk factors alone. Cardiogenic shock and chronic kidney disease emerged as the most important independent predictors of death, while diabetes mellitus, multivessel disease and reduced left ventricular ejection fraction were not statistically significant in this cohort. These results highlight that immediate haemodynamic instability and renal dysfunction at presentation have the strongest impact on short-term outcomes after PCI. The study concludes that early recognition of shock and renal impairment is crucial for timely risk stratification and aggressive management in high-risk PCI patients. Future research should focus on large, multicentre prospective studies to validate these findings and to develop locally applicable risk prediction models that can further improve clinical decision-making and patient outcomes.

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