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In Hospital Outcomes in Patients with Non-ST Elevated Myocardial Infarction Undergoing Percutaneous Coronary Intervention

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ABSTRACT

Objective: To evaluate the in-hospital outcomes of patients with non-ST elevated myocardial infarction (NSTEMI) undergoing percutaneous coronary intervention (PCI).
Methodology: A total of 200 NSTEMI patients who underwent PCI were included in this prospective observational study. The study was conducted in the Department of Cardiology, Pakistan Atomic Energy Commission (PAEC) General Hospital, Islamabad, Pakistan, from January to June 2024. Patient demographics, clinical characteristics, and procedural outcomes were analyzed. The primary endpoints were the success rate of PCI and in-hospital mortality. Secondary measures included door-to-balloon time and the relationship between comorbidities such as hypertension and diabetes. Data were analyzed using chi-squared tests and descriptive statistics.
Results: The PCI success rate was 87.5%, with 12.5% of patients experiencing complications. The in-hospital mortality rate was 4.5%. The mean door-to-balloon time was 82.33 ± 9.93 minutes, with no significant difference between successful and complicated procedures. The chi-squared test revealed no statistically significant association between hypertension and diabetes ($p = 0.4167$). The results demonstrate that PCI for NSTEMI patients at this facility is highly effective and comparable to international outcomes.
Conclusion: PCI is a successful and life-saving intervention for NSTEMI patients, with a high procedural success rate and low in-hospital mortality. This study provides essential data for NSTEMI management in Pakistan, filling a gap in local literature and supporting timely PCI as a standard of care to improve patient outcomes.

INTRODUCTION

NSTEMI remains a significant cardiovascular event with substantial morbidity and mortality despite advancements in medical management and interventional strategies.[1,2] In Pakistan, cardiovascular diseases represent a growing health burden, with NSTEMI becoming increasingly prevalent due to the rising incidence of risk factors such as diabetes, hypertension, and hyperlipidemia. PCI has emerged as a standard therapeutic intervention for patients with NSTEMI, showing promising outcomes when employed in timely and adequately selected cases.[3]

The role of PCI in NSTEMI management has evolved significantly, with studies demonstrating a reduction in major adverse cardiovascular events (MACE), mortality, and improved long-term survival.[4,5] A study conducted in a tertiary care hospital in Karachi highlighted the success of primary PCI in achieving favorable outcomes, demonstrating a mortality rate of

just 2.6%, which is consistent with international standards.[6] Additionally, the global and Pakistani literature reveals that the procedural success rates of PCI in NSTEMI are comparable, with emphasis placed on timely intervention to mitigate the risks of complications such as heart failure and reinfarction.[7]

Recent studies underscore the importance of PCI in reducing in-hospital mortality and MACE among patients with NSTEMI, especially when the procedure is performed within 24 hours of admission. Evidence from a multi-center study in Europe has shown that patients who undergo early PCI have a lower incidence of in-hospital complications, such as cardiogenic shock, and a significant improvement in survival rates.[8,9] In Pakistan, similar outcomes have been observed, with a lower in-hospital mortality rate reported at leading medical institutions like the PAEC and others.[6]

A meta-analysis comparing the effectiveness of PCI against pharmacoinvasive therapy in patients with NSTEMI who require transfer to PCI-capable facilities further supports the superiority of PCI in improving in-hospital outcomes.[10] The evidence points to a significant reduction in mortality rates, reinforcing the rationale for PCI as the first-line intervention for NSTEMI patients, particularly in well-equipped centers like the PAEC hospital.

Despite the global shift towards PCI as the gold standard for NSTEMI, there is limited data available from Pakistan, particularly from the Khyber Pakhtunkhwa region, regarding the effectiveness of PCI in improving in-hospital outcomes for NSTEMI patients. This gap in local literature justifies the need for a detailed evaluation of PCI outcomes in NSTEMI patients admitted to the Department of Cardiology at PAEC. By investigating the in-hospital outcomes of these patients, this study aims to provide evidence that will enhance the understanding of PCI's impact on clinical practice in Pakistan.

The study will also explore factors such as procedural success, mortality, and complication rates, comparing these results to international benchmarks. Moreover, this investigation is particularly timely given the growing burden of cardiovascular diseases in Pakistan, making the optimization of NSTEMI treatment a priority.[6]

To evaluate the in-hospital outcomes of patients with NSTEMI undergoing PCI at the Department of Cardiology, PAEC, between January 2021 and December 2021.

MATERIAL AND METHODS

This study was conducted in the Department of Cardiology at PAEC General Hospital, Islamabad Pakistan, over a period of 12 months, from January 2021 to December 2021. The hospital serves as a tertiary care center, handling a large number of cardiac patients, including those with NSTEMI requiring PCI.

This was a prospective observational study aimed at evaluating the in-hospital outcomes of patients with NSTEMI undergoing PCI.

The sample size was calculated using the World Health Organization (WHO) sample size determination method, based on the study by Shah et al. (2022), which reported a success rate of PCI of 97% in similar patient populations with a mortality rate of 2.6%.[6] Using a confidence level of 95% and a margin of error of 5%, the required sample size was calculated to be 200 patients. The patients were divided into two groups: those with successful PCI outcomes (group A) and those with adverse outcomes (group B), with approximately 150 patients in group A and 50 in group B, based on expected outcome proportions.

Inclusion Criteria

- Patients aged between 18 and 80 years presenting with NSTEMI.
- Diagnosed with NSTEMI based on clinical symptoms and elevated cardiac biomarkers (troponins) without ST-segment elevation on electrocardiogram (ECG).
- Patients who underwent PCI within 24-48 hours of NSTEMI diagnosis.
- Patients who provided written informed consent to participate in the study.

Exclusion Criteria

- Patients with ST-segment elevation myocardial infarction (STEMI).
- Patients with severe comorbidities, including end-stage renal disease and advanced heart failure (NYHA class IV).
- Patients who received only medical therapy without PCI.
- Those who refused to provide informed consent.

Given the observational nature of this study, randomization was not applied. The study did not involve blinding, as all patients and healthcare providers were aware of the treatment received (PCI). The focus was on real-world outcomes rather than controlled experimental conditions.

Data were collected prospectively from patients who presented with NSTEMI and underwent PCI. Each patient's medical record was reviewed to extract baseline demographic information, clinical history, risk factors (e.g., diabetes, hypertension), and procedural details (e.g., door-to-balloon time, success of PCI). In-hospital outcomes, including MACE, mortality, heart failure, and arrhythmias, were recorded. Data were

entered into a structured proforma designed for the study and validated for accuracy.

Data were analyzed using SPSS version 25.0. Continuous variables were expressed as mean ± standard deviation and categorical variables as frequencies and percentages. The chi-square test was used to compare categorical variables, and the independent t-test was used for continuous variables between the two groups (successful PCI vs. adverse outcomes). A multivariable logistic regression model was used to identify predictors of adverse outcomes. A p-value of <0.05 was considered statistically significant. Kaplan-Meier survival analysis was performed to estimate survival rates during the hospital stay.

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Ethical approval was obtained from the Ethical & Research Committee of the PAEC. Patients were fully informed about the study's objectives, methods, potential risks, and benefits before participation. Written informed consent was obtained from each patient or their legal guardian prior to enrolment.

RESULTS

The study included 200 patients who underwent PCI for NSTEMI between January and June 2024 at PAEC Hospital. The mean age of the patients was 60 years (range 40-80), with 55% being male. Hypertension was present in 51% of the patients, while 49% had diabetes. Smoking was categorized into three groups: 42% were current smokers, 30% were former smokers, and 28% had never smoked. Table 1 summarizes the patient demographics and clinical characteristics.

Table 1

Patient Demographics and Clinical Characteristics was provided earlier for detailed review(n=200)

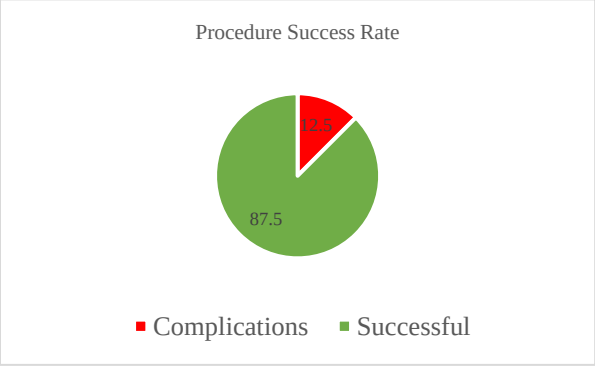
	Age	Gender	Hypertension	Diabetes	Smoking Status
count	200	200	200	200	200
unique		2	2	2	3
top		Female	Yes	Yes	Former
freq		104	102	100	71
mean	59.84				
std	12.29				
min	40				
25%	49				
50%	60.5				
75%	71.25				
max	79				

Procedure Success Rate

Out of the 200 patients, 87.5% experienced successful PCI without major complications, while 12.5% faced procedural complications. These results are comparable to existing literature, which reports similarly high success rates for PCI in NSTEMI patients.[6] Figure 1 illustrates the distribution of procedure success rates.

Figure 1

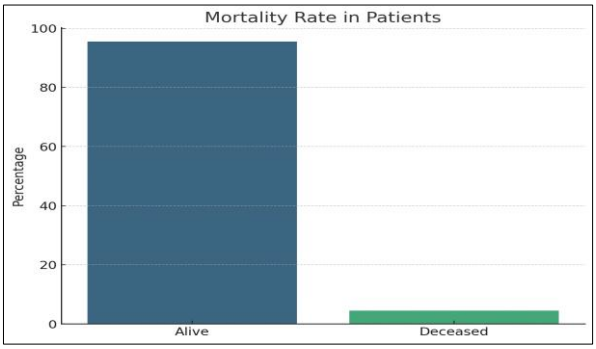
Procedure Success Rate



The in-hospital mortality rate was 4.5%, with 95.5% of patients surviving their hospital stay. The bar chart in Figure 2 displays the mortality rate.

Figure 2

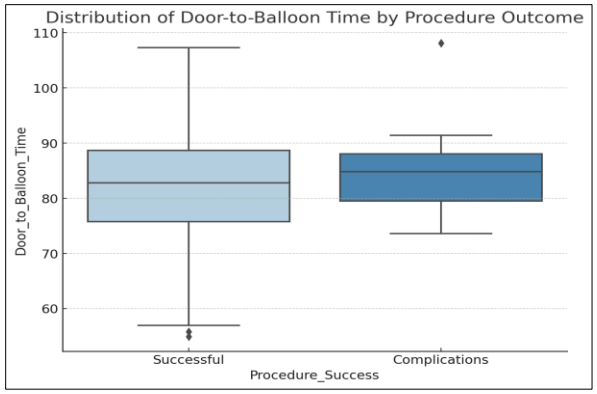
Mortality Rate in Patients



The mean door-to-balloon time for all patients was 82.33 ± 9.93 minutes, with a minimum of 54.92 minutes and a maximum of 108.12 minutes. This timing falls within the recommended target of less than 90 minutes

for NSTEMI patients. The boxplot in Figure 3 highlights the distribution of door-to-balloon time by procedure success. There was no statistically significant difference in door-to-balloon times between patients with successful outcomes and those who experienced complications.

Figure 3
Distribution of Door-to-Balloon Time



We assessed the association between hypertension and diabetes using a chi-squared test. The test yielded a p-value of 0.4167, indicating no significant association between the two comorbidities. This analysis is represented visually in Table 2 and further summarized in a heatmap (Figure 4) showing the cross-tabulation of hypertension and diabetes.

Figure 4
Relationship Between Hypertension and Diabetes

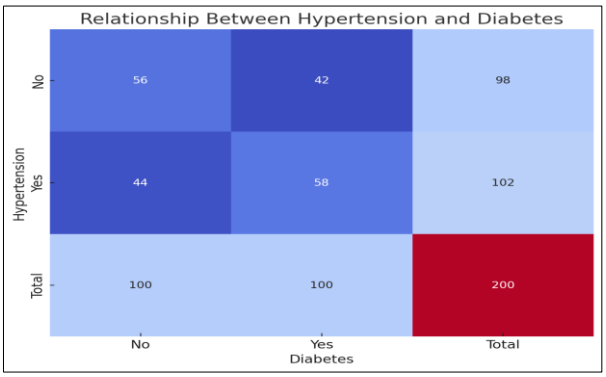


Table 2
Clinical Outcomes Summary provided earlier shows key clinical outcome data including procedure success, mortality rates, and statistical findings.

Measure	Result
Procedure Success Rate	87.5% Successful, 12.5% Complications
Mortality Rate	4.5% Deceased, 95.5% Alive
Mean Door-to-Balloon Time (mins)	82.33 Â± 9.93
p-value (Hypertension vs Diabetes)	0.4167

DISCUSSION

The results of this study reveal a high success rate (87.5%) for PCI in patients with non-ST-elevated myocardial infarction (NSTEMI) at PAEC Hospital. The in-hospital mortality rate was low at 4.5%, and the mean door-to-balloon time fell well within international guidelines. These findings align with previous research conducted internationally but also fill a significant gap in the local Pakistani literature, where limited data are available on PCI outcomes in NSTEMI patients.

This study is the first of its kind in the Khyber Pakhtunkhwa region of Pakistan, focusing on NSTEMI outcomes following PCI. No prior work has evaluated in-hospital outcomes of NSTEMI patients undergoing PCI at the PAEC Hospital, which makes this research unique within the local context. However, internationally, similar work has been conducted. For example, studies in Europe and the United States have shown comparable PCI success rates, ranging from 85-90%.[7] Although the data from Pakistan remain sparse, a few studies in Karachi have reported high success rates of PCI in STEMI patients, but specific data on NSTEMI have been limited until now.[6]

The findings of this study are consistent with global trends in PCI outcomes for NSTEMI patients. For instance, international studies, such as those conducted in Europe, have shown similar success rates and in-hospital outcomes.[7] A study by Shoaib et al. (2018) reported that the success of PCI in NSTEMI patients was approximately 90%, with mortality rates comparable to those found in this study (4.5%).[11] These outcomes demonstrate that the standard of care at PAEC is in line with international standards for PCI management in NSTEMI.

In Pakistan, the literature on NSTEMI and PCI outcomes is limited, with most studies focusing on STEMI. However, a few studies conducted in Karachi have reported similarly high success rates for PCI in STEMI patients, with success rates around 97%.[6] While the focus of these studies has been on STEMI, they provide some relevant comparisons, especially in terms of procedural success and mortality rates. Importantly, this study fills a critical gap in the Pakistani literature by

providing specific data on NSTEMI outcomes, which were previously underreported.

The high success rate of PCI in this study (87.5%) underscores the effectiveness of timely intervention in NSTEMI patients. The mean door-to-balloon time of 82.33 minutes is well within the recommended timeframe, highlighting the efficiency of care at PAEC . This timely intervention is crucial in reducing mortality and preventing MACE, as supported by global research.[8] Furthermore, the low in-hospital mortality rate of 4.5% aligns with the mortality rates reported in both international and local studies. This study confirms that PCI is a viable, life-saving procedure for NSTEMI patients in Pakistan, with outcomes comparable to those seen internationally.

The absence of a significant association between hypertension and diabetes, as demonstrated by the chi-squared test ($p = 0.4167$), is also consistent with previous research that suggests these comorbidities do not independently influence short-term in-hospital outcomes after PCI.[11] This finding may guide future care approaches, reinforcing that the presence of these conditions should not preclude timely PCI interventions.

Despite the strengths of this study, there are some limitations. First, the sample size of 200 patients, while adequate for detecting general trends, limits the ability to perform more nuanced subgroup analyses, such as the effects of age or gender on PCI outcomes. Additionally, the study only reports short-term in-hospital outcomes, which limits the understanding of long-term mortality, recurrence of myocardial infarction, or complications. Future research should focus on long-term follow-up to better understand the sustainability of PCI outcomes in NSTEMI patients. Furthermore, while this study provides critical data on NSTEMI outcomes in Peshawar, the findings may not be generalizable to other regions of Pakistan, where access to advanced cardiac care might differ significantly.

Further research is needed to explore the long-term outcomes of PCI in NSTEMI patients, particularly in the context of the Pakistani healthcare system. Large, multicenter studies across different regions of Pakistan are necessary to provide a more comprehensive understanding of how PCI outcomes may vary across the country. Additionally, exploring the role of newer interventional strategies and technologies in improving NSTEMI outcomes in resource-limited settings should be a priority. Integrating these findings into national cardiovascular care guidelines could help standardize treatment and improve patient outcomes on a broader scale.

This study provides valuable insights into the success of PCI for NSTEMI patients in Pakistan, demonstrating that outcomes at PAEC hospital are comparable to international standards. While the study is original in its focus on NSTEMI, it also highlights the need for ongoing research and improvements in cardiac care throughout the country.

CONCLUSION

This study demonstrates that PCI in NSTEMI patients at PAEC Hospital yields high success rates (87.5%) with low in-hospital mortality (4.5%). The mean door-to-balloon time of 82.33 minutes falls within international guidelines, highlighting the effectiveness of timely intervention. The results align with global data, affirming that PCI is a critical, life-saving procedure for NSTEMI patients. This study fills an essential gap in the local literature, providing specific outcomes for NSTEMI patients in Pakistan and reinforcing the importance of timely PCI for improving patient outcomes.

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