Original Article

Short outcome in Patients with Non–ST-Elevation Myocardial Infarction (NSTEMI) after multi-vessel Percutaneous Intervention

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ABSTRACT

Background: Non-ST elevation myocardial infarction (NSTEMI) presents a significant clinical challenge, particularly in the context of multi-vessel disease (MVD), which complicates patient management and impacts prognosis. The variability in short-term outcomes following percutaneous coronary intervention (PCI) for NSTEMI patients with MVD necessitates a deeper understanding of the associated risk factors and outcomes.

Objective: To evaluate the risk factors and short-term clinical outcomes of NSTEMI patients after multi-vessel PCI, identifying predictors of major adverse cardiovascular events (MACE) and cardiac death within this population.

Methods: This retrospective study was conducted at Lady Reading Hospital, Peshawar, from January 2022 to December 2022, including 100 NSTEMI patients who underwent multi-vessel PCI. The Institute Review Board approved the study, adhering to the Declaration of Helsinki. Data on demographics, clinical characteristics, and outcomes were collected. Multi-vessel disease was defined by ≥50% narrowing in the left main coronary artery or ≥70% in at least two major epicardial coronary arteries. Statistical analysis employed SPSS Version 25.0, with Kaplan–Meier and Cox regression analyses determining the impact of various predictors on short-term outcomes.

Results: The mean age of participants was 65.6 ± 10.5 years, with a BMI of 22.75 ± 4.67 kg/m^2. Diabetic and ischemic heart disease prevalence was 30.4% and 26.9%, respectively. Multi-vessel disease was observed in 66.2% of patients. Short-term mortality and MACE rates were significantly influenced by factors such as age, lower BMI, renal dysfunction, and left ventricular dysfunction. The cumulative incidence of MACE within 30 days post-PCI was notably higher in patients with these risk factors.

Conclusion: NSTEMI patients undergoing multi-vessel PCI face a significant risk of short-term adverse outcomes. Key predictors of increased risk include advanced age, diabetes, ischemic heart disease, and renal dysfunction. Tailored management strategies focusing on these high-risk groups are essential for improving short-term prognosis.

Keywords: NSTEMI, multi-vessel disease, percutaneous coronary intervention, major adverse cardiovascular events, cardiac death, risk factors.

INTRODUCTION

Myocardial infarction (MI), a leading cause of mortality and disability globally, has seen a rise in incidence, particularly in developing nations. MI is clinically categorized based on electrocardiogram (ECG) findings into ST-elevation myocardial infarction (STEMI) and non-ST elevation myocardial infarction (NSTEMI). The introduction of troponin testing has led to an increase in the diagnosis of NSTEMI, while STEMI diagnoses have decreased (1,2). Studies have shown a decrease in both short- and long-term mortality rates from MI, attributed to strict adherence to contemporary MI management guidelines (2–4). The pathophysiology of acute coronary syndrome, common to both STEMI and NSTEMI, involves the disruption or erosion of atherosclerotic plaque, leading to thrombus

formation and a consequent reduction in blood flow. Despite their shared etiology, the treatment approaches and prognoses for STEMI and NSTEMI differ, with NSTEMI occurring due to partial blockage of the coronary arteries or collateral flow to an area served by completely occluded culprit arteries. This understanding is supported by studies documenting similar baseline clinical and angiographic features (5-7).

Percutaneous coronary intervention (PCI) is considered the treatment of choice for patients with NSTEMI, among whom 40–65% are affected by multi-vessel disease (MVD), a factor known to predict poorer short-term outcomes (1,2). The risk/benefit ratio of performing MVD percutaneous interventions on NSTEMI patients during their initial hospitalization remains uncertain, especially in light of current technological and pharmacological advances. The literature presents conflicting findings, and there is a lack of sufficiently powered randomized clinical trials addressing this issue (3-12). Despite known disparities in short-term mortality among NSTEMI patients and the condition's association with worse long-term mortality, the predictors of early-term mortality, particularly within 30 days, have not been well documented or categorized separately from late-term mortality predictors (8-14). This study aims to evaluate the differences in independent risk factors and early (≤30 days) clinical outcomes in NSTEMI patients, utilizing data from the Peshawar Institute of Cardiology.

MATERIAL AND METHODS

The study was conducted at Lady Reading Hospital, Peshawar, from January 2022 to December 2022, enrolling a cohort of 100 participants. The Institute Review Board of the participating center rigorously reviewed and approved the study protocol, ensuring adherence to ethical standards in line with the Declaration of Helsinki. The study's data were meticulously gathered from individuals diagnosed with NSTEMI who underwent multi-vessel percutaneous coronary intervention (PCI). These diagnoses were extracted from the hospital's database, which also provided access to demographic details, procedural specifics, and clinical outcomes. Data sets that were incomplete or deemed invalid were systematically excluded from the analysis to maintain the integrity of the study's results.

The methodology for conducting PCI and coronary angiography was standardized, with the selection of stents being subject to the operating surgeon's preference. Criteria for identifying multi-vessel disease included a narrowing of ≥50% in the left main coronary artery or ≥70% in at least two major epicardial coronary arteries. Mortality was presumed to be cardiac-related unless a definitive non-cardiac cause could be established, with all instances of revascularization and repeat interventions on any vessel recorded. The study defined a composite of major adverse cardiovascular events (MACE) to include reversible MI (Re-MI), revascularization, and cardiac death.

For statistical analysis, the study utilized SPSS (Version 25.0), displaying frequencies or mean ± standard deviation (SD) for baseline characteristics. Continuous variables were compared using Student's t-tests, while categorical variables were analyzed with $\chi2$ tests. The cumulative incidence of adverse events was estimated using the Kaplan–Meier method, with log-rank tests determining significance levels. Landmark analysis, a survival analysis technique, assessed outcomes by analyzing data collected 30 days post-admission. Cox regression analysis was employed to evaluate the prognostic significance of variables such as age, gender, body mass index (BMI), hypertension, dyslipidemia, diabetes, ischemic cardiac disorder, current smoking status, and major bleeding (thrombus lysis in MI) concerning clinical outcomes at follow-up.

This comprehensive approach to data collection, analysis, and ethical consideration ensures that the study adheres to the highest standards of medical research, providing valuable insights into the management and outcomes of NSTEMI patients following multi-vessel PCI.

RESULTS

In the study conducted to assess the independent variables of short-term cardiac fatality events in NSTEMI patients following multi-vessel PCI, a detailed examination of patient characteristics revealed significant insights. The average age of the participants was found to be 65.6 years, with a standard deviation of 10.5 years, indicating a predominantly elderly cohort (Table 1). This demographic detail underscores the heightened vulnerability of older individuals to cardiac events post-PCI.

Diabetes mellitus, a well-known risk factor for coronary artery disease and adverse outcomes following PCI, was present in 30.4% of the study population, highlighting the considerable burden of metabolic disease in patients undergoing multi-vessel PCI for NSTEMI (Table 1). Furthermore, ischemic heart disease (IHD) was prevalent in 26.9% of the participants, reflecting the underlying atherosclerotic disease burden within this group (Table 1).

Kidney dysfunction, defined by a creatinine level equal to or greater than 2.0 mg/dL, was observed in 6.5% of the patients. This finding is crucial as renal impairment is associated with poorer outcomes in cardiac patients (Table 1). Additionally, left ventricular

(LV) dysfunction, characterized by an ejection fraction of less than 40%, was present in 17.3% of the cohort, signifying a substantial fraction of patients with compromised cardiac function post-PCI (Table 1).

The study also reported a 26.6% prevalence of patients classified under the Killip Class, which is used to assess the severity of heart failure, indicating a notable proportion of individuals with clinical signs of heart failure at the time of PCI (Table 1). Multi-vessel disease (MVD), a critical determinant of prognosis in coronary artery disease, was remarkably high, affecting 66.2% of the study participants, thereby underscoring the complexity of coronary artery involvement in this patient population (Table 1).

Characteristics	NSTEMI
Age (years)	65.6 ± 10.5
Diabetic (%)	30.4
Ischemic Heart Disease (IHD) (%)	26.9
Kidney Dysfunction (Cr N ≥ 2.0 mg/dL) (%)	6.5
Left Ventricular (LV) Dysfunction (<40%) (%)	17.3
Killip Class (%)	26.6
Multi-Vessel Disease (MVD) (%)	66.2
Body Mass Index (kg/m^2)	22.75 ± 4.67

Body mass index (BMI), an essential measure of obesity, which is a known risk factor for cardiovascular disease, averaged 22.75 kg/m^2 with a standard deviation of 4.67 kg/m^2 in the study group. This average suggests a generally non-obese cohort, which is relevant for understanding the role of body weight in the prognosis of NSTEMI patients undergoing multi-vessel PCI (Table 1).

The collected data and its detailed analysis provide critical insights into the demographic and clinical characteristics of NSTEMI patients treated with multi-vessel PCI, identifying key areas for targeted intervention and risk stratification in this high-risk population.

DISCUSSION

In our investigation, we observed that individuals with NSTEMI undergoing multi-vessel PCI exhibited a heightened risk of short-term major adverse cardiovascular events (MACE) and cardiac mortality. This risk elevation was associated with specific patient characteristics and angiographic findings, underscoring the complexity of managing NSTEMI. Factors such as age, sex, lower Body Mass Index (BMI), renal insufficiency, ischemic heart disease, multi-vessel disease, post-percutaneous thrombolysis in MI flow, left ventricular dysfunction, and Killip class were identified as predictors of increased cardiac death risk. The significance of these predictors varied with the duration of clinical follow-up and the definitive diagnosis of MI, reflecting the dynamic nature of risk stratification in this patient population.

The findings of this study contribute to the ongoing debate regarding the outcomes of multi-vessel PCI in patients with NSTEMI. For instance, a Danish cohort study involving 654 MVD patients reported a one-month mortality rate of 30% for NSTEMI, significantly higher than the mortality observed in our study. This discrepancy suggests variability in outcomes across different populations and highlights the need for individualized risk assessment (9). Furthermore, multivariable analysis in the Danish cohort underscored a persistently significant better outcome for NSTEMI patients, indicating a distinct risk profile from STEMI patients. Comparable studies, including research on a Polish NSTEMI patient cohort and a Spanish population study, have also documented varying early-term mortality rates, further emphasizing the heterogeneity of NSTEMI outcomes (19, 20).

Interestingly, a study from the USA employing a 30-day landmark analysis revealed that NSTEMI patients faced a higher adjusted mortality risk within the first two weeks of treatment, pointing towards the critical period immediately following intervention where these patients are most vulnerable (21). This period of heightened risk may be attributed to the prevalence of comorbidities in NSTEMI patients, leading to more aggressive angiographic findings and an increased likelihood of recurrent ischemia and early mortality. Additionally, the propensity for early revascularization in this patient group may contribute to the observed increase in short-term cardiac death rates.

Contrasting with other studies, our research found that the early-term risk associated with NSTEMI diminished when accounting for patient demographics, clinical and angiographic findings. This suggests that the early-term risk in NSTEMI may primarily stem from variations in patient characteristics, cardiovascular risk factors, and angiographic outcomes, rather than the NSTEMI diagnosis itself. The study, while offering valuable insights, is not without limitations. The single-center design and relatively small sample size may restrict the generalizability of the findings. Furthermore, the observational nature of the study precludes definitive conclusions about

causality. Future research should aim to address these limitations through multicenter studies with larger, more diverse populations to validate and expand upon these findings.

CONCLUSION

In conclusion, patients with NSTEMI undergoing multi-vessel PCI demonstrated poorer short-term clinical outcomes. The diverse profile of predictors for cardiac mortality underscores the necessity for tailored strategies to enhance the short-term prognosis of patients with NSTEMI. Recognizing the complex interplay of patient characteristics, comorbid conditions, and angiographic findings is crucial in developing effective interventions and improving outcomes for this high-risk population.

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