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Frequency and Outcome in Patients Presenting with NSTEMI Undergoing PCI for MV Coronary Artery Disease in Index Hospitalization at Tertiary Care Hospital, Karachi

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ABSTRACT

Background: Multivessel coronary artery disease (MVD) in patients with Non-ST Elevation Myocardial Infarction (NSTEMI) presents a significant clinical challenge, influencing treatment decisions and patient outcomes. Understanding the frequency of MVD and its impact on in-hospital mortality can help guide more effective management strategies. **Objective:** To determine the frequency and outcome in patients presenting with NSTEMI undergoing PCI for MV coronary artery disease in index hospitalization at Tertiary Care Hospital, Karachi. **Methods:** This retrospective, observational study analyzed 133 patients diagnosed with NSTEMI who underwent PCI. Baseline characteristics, comorbidities, lifestyle factors, and socioeconomic status were compared between patients with and without MVD. The primary outcomes were the frequency of MVD and in-hospital mortality. Statistical analyses assessed associations between patient characteristics and outcomes. **Results:** Multivessel disease was present in 36.1% of patients. Significant differences were observed in residence status (P = 0.01), smoking (P = 0.01), hypertension (P = 0.04), dyslipidemia (P = 0.01), family history of coronary artery disease (P = 0.01), and income levels (P = 0.01) between the MVD and non-MVD groups. In-hospital mortality was 20.3%, with a higher incidence among MVD patients. **Conclusion:** NSTEMI patients with MVD face a higher risk of in-hospital mortality, particularly those from rural areas, smokers, and lower-income groups. Early diagnosis, targeted prevention, and optimized treatment strategies are crucial for improving outcomes. Further research is needed to assess long-term effects and refine management approaches for high-risk patients.

INTRODUCTION

Myocardial infarction is a component of acute coronary syndrome (ACS), which also encompasses unstable angina, non-ST-segment elevation myocardial infarction (NSTEMI), and ST-segment elevation myocardial infarction (STEMI).[1] Coronary artery disease is the leading cause of death globally, responsible for over 6 million deaths annually. Over time, NSTEMI has become more prevalent than STEMI. [2] While STEMI is typically regarded as more critical due to its association with full-thickness myocardial infarction, recent evidence suggests that NSTEMI can also involve severe underlying conditions in a significant proportion of cases. [3] MVCAD is characterized by a stenosis of 50% or more in the diameter of two or more epicardial coronary arteries. This condition is associated with a worse prognosis and notably higher mortality rates compared to single-vessel disease. [4-5] The blocked arteries can be restored through angioplasty or bypassed via cardiac surgery. Additionally, thrombolysis may reduce the likelihood of left ventricular thrombus formation. [6-7]

It is important to highlight that MVCAD is linked to lower success rates in revascularization, a higher incidence of complications, and ultimately poorer outcomes both during hospitalization and in the long term. [8] As a result, compared to lesions confined to a single coronary artery, determining the most suitable treatment approach for MVCAD becomes more complex. Advances in coronary artery stent technology have led to an increase in PCI procedures for MVCAD patients, which, in certain cases, offers a valuable alternative to coronary artery bypass grafting (CABG). [9] As previously mentioned, following revascularization of the culprit vessel in MVCAD, the interventional cardiologist must determine whether to extend the procedure to include the other significantly narrowed vessels or to conclude the intervention. [10] Both approaches present distinct risks and benefits. However, this decision-making dilemma does not apply to patients in cardiogenic shock, as guidelines recommend complete myocardial revascularization, with PCI performed on all

severely narrowed major epicardial arteries. [11] Hashmi et al found the prevalence of MVCAD to be 32.8%.[12] Whereas, another study found in-hospital mortality in patients who underwent MV PCI to be 18.8%.[13]

Literature review shows paucity of local and international data. The investigation into the frequency and outcomes of patients presenting with Non-ST Segment Elevation Myocardial Infarction (NSTEMI) undergoing Percutaneous Coronary Intervention (PCI) for Multivessel (MV) coronary artery disease during the index hospitalization represents a critical inquiry with significant clinical implications. NSTEMI is a prevalent and severe cardiac condition associated with substantial morbidity and mortality. While PCI is a well-established and effective intervention for coronary artery disease, the optimal management strategy for patients with NSTEMI and MV disease remains an area of active research and debate. Understanding the prevalence of MV disease in this specific patient subgroup and elucidating the clinical consequences of PCI will contribute valuable insights for clinicians, guiding decision-making processes and refining treatment algorithms. The findings from this investigation are poised to enhance the evidence base for personalized and effective management strategies in NSTEMI patients with multivessel coronary artery disease, ultimately improving patient outcomes and informing future guidelines in cardiovascular care.

MATERIAL AND METHODS

This cross-sectional study was conducted at Tabba Heart Institute, Karachi, over a period of six months following approval of the study synopsis. A total of 133 patients were included, based on a sample size calculation using WHO software with a confidence level of 95%, margin of error of 8%, and an estimated prevalence of multivessel coronary artery disease (MVCAD) at 32.8%. A non-probability consecutive sampling technique was used for patient selection.

Patients presenting with NSTEMI undergoing percutaneous coronary intervention (PCI), aged between 40 and 80 years of either gender, were enrolled in the study. Patients with a history of thromboembolic disease, STEMI, unstable angina, pulmonary hypertension, pericardial disease, bradyarrhythmias, tachyarrhythmias, vasculitis, connective tissue disorders, stroke, asthma, renal impairment, chronic obstructive pulmonary disease (COPD), or congestive cardiac failure (CCF) were excluded. Approval for the study was obtained from the College of Physicians and Surgeons Pakistan (CPSP) and the hospital's ethical review committee. Written informed consent was obtained from all patients after explaining the risks, benefits, and purpose of the study.

Baseline demographic and clinical characteristics, including age, gender, residence status, family income, occupational status, diabetes mellitus type II, hypertension, dyslipidemia, smoking status, obesity, and family history of coronary artery disease (CAD), were recorded. NSTEMI was defined as prolonged chest pain (VAS ≥5) lasting more than 20 minutes and not relieved by rest or nitroglycerin, along with a positive Troponin-I level (>0.01 ng/mL) in the absence of ECG changes consistent with STEMI. MVCAD was defined as the presence of at least two major epicardial arteries with hemodynamically significant stenosis, where a narrowing of >50% or >70% in vessels larger than 1.5 mm was considered significant. Coronary angiography films were evaluated by a senior cardiologist with a minimum of five years of post-fellowship experience, following standard protocols for lesion assessment.

The primary outcome was in-hospital mortality, defined as death occurring during hospitalization. Data was entered into a structured proforma and analyzed using SPSS Version 22. Quantitative variables such as age was reported as mean ± standard deviation (SD) for normally distributed data and median with interquartile range (IQR) for non-normally distributed data based on the Kolmogorov-Smirnov test. Qualitative variables, including gender, residence status, family income, occupational status, comorbidities, smoking, obesity, family history of CAD, MVCAD status, and in-hospital mortality, was presented as frequencies and percentages. Stratification was performed for age, gender, socioeconomic factors, and comorbidities to assess their impact on the outcome variables. Post-stratification analysis was conducted using the chi-square test or Fisher's exact test, as appropriate, with a significance level set at $p \leq 0.05$.

RESULTS

The baseline characteristics of the study participants show that the ages of the participants ranged from 40 to 80 years. Among them, 31.6% were between 40 to 60 years old, and 68.4% were between 61 to 80 years old. Gender distribution was nearly equal, with 48.9% of participants being male and 51.1% female. Most participants (84.2%) lived in urban areas, while 15.8% resided in rural areas.

Regarding health conditions, 29.3% of participants had Diabetes Mellitus, while 70.7% did not. Hypertension was present in 19.5% of participants, and 80.5% were without hypertension. Dyslipidemia affected 45.9% of participants, while the remaining 54.1% did not have this condition. Smoking status showed that 36.8% of participants were smokers, while 63.2% were non-smokers. Obesity was reported in 45.1% of participants, with 54.9% being non-obese.

A family history of coronary artery disease (CAD) was present in 16.5% of participants, while 83.5% did not report a family history of CAD. Occupational status was noted for 39.8% of participants, while 60.2% were unemployed. Family monthly income revealed that 23.3% of participants had an income of ≤ 25000, 39.1% earned between 25000 and 50000, and 37.6% had an income higher than 50000.

Regarding multivessel coronary artery disease (MVD), 36.1% of participants had MVD, while 63.9% did not. In-hospital mortality was observed in 20.3% of participants, with 79.7% surviving their hospitalization. The total number of participants was 133.

When analyzing patient characteristics according to the presence of multivessel disease, there were some notable differences. In terms of age, 35.7% of patients with MVD were between 40 to 60 years old, while 36.3% were in the 61 to 80 years range. In contrast, 64.3% of non-MVD patients were in the 40 to 60 years age group, and 63.7%

were in the 61 to 80 years group. The P-value for this comparison was 0.95, indicating no significant difference.

For gender, 35.4% of MVD patients were male and 36.8% were female. In the non-MVD group, 64.6% were male and 63.2% were female, with no significant difference (P = 0.86).

The distribution of residence status showed a significant difference. Among MVD patients, 29.5% lived in urban areas, while 71.4% resided in rural areas. In contrast, the non-MVD group had 70.5% living in urban areas and only 28.6% in rural areas (P = 0.01).

When it comes to comorbidities, 30.8% of MVD patients had diabetes, compared to 38.3% of non-MVD patients, but the difference was not statistically significant (P = 0.41). Hypertension was more common in the non-MVD group, with 78.8% having the condition compared to 21.2% in the MVD group (P = 0.04). Dyslipidemia was significantly more prevalent in the non-MVD group, affecting 83.6% of patients compared to just 16.4% of MVD patients (P = 0.01).

Smoking was significantly more common among MVD patients, with 51% being smokers compared to 27.4% in the non-MVD group (P = 0.01). Obesity showed no significant difference between the two groups, with 38.3% of MVD patients and 61.7% of non-MVD patients classified as obese (P = 0.62).

A family history of CAD was reported in 95.5% of non-MVD patients and 4.5% of MVD patients, which was a significant difference (P = 0.01). Occupational status showed no significant difference, with 41.5% of MVD patients employed compared to 32.5% of non-MVD patients (P = 0.29).

Finally, family monthly income revealed a significant difference between the two groups (P = 0.01). In the MVD group, 61.3% had a monthly income of ≤ 25000, while 23.1% had an income between 25000 and 50000, and 34% had an income above 50000. In the non-MVD group, 38.7% earned ≤ 25000, 76.9% had an income between 25000 and 50000, and 66% had an income above 50000.

Table 1
Distribution of baseline characteristics among the study participants.

Variables	n (%)
Age	
40 to 60 years	42 (31.6)
61 to 80 years	91 (68.4)
Gender	
Male	65 (48.9)
Female	68 (51.1)
Residence status	
Urban	112 (84.2)
Rural	21 (15.8)
Diabetes Mellitus	
Yes	39 (29.3)
No	94 (70.7)
Hypertension	
Yes	26 (19.5)
No	107 (80.5)
Dyslipidemia	
Yes	61 (45.9)
No	72 (54.1)
Smoking status	
Yes	49 (36.8)
No	84 (63.2)
Obesity	
Yes	60 (45.1)
No	73 (54.9)
Family H/O CAD	
Yes	22 (16.5)
No	111 (83.5)
Occupational status	
Yes	53 (39.8)
No	80 (60.2)
Family monthly income	
≤25000	31 (23.3)
25000-50000	52 (39.1)
>50000	50 (37.6)
Multivessel CAD	
Yes	48 (36.1)
No	85 (63.9)
In-hospital mortality	
Yes	27 (20.3)
No	106 (79.7)
Total	133 (100)

Table 2
Distribution of patient characteristics according to the MVD groups.

Variables	Yes Multivessel CAD n (%)	No Multivessel CAD n (%)	P value
Age			
40 to 60 years	15 (35.7)	27 (64.3)	0.95
61 to 80 years	33 (36.3)	58 (63.7)	
Gender			
Male	23 (35.4)	42 (64.6)	0.86
Female	25 (36.8)	43 (63.2)	
Residence status			
Urban	33 (29.5)	79 (70.5)	0.01
Rural	15 (71.4)	06 (28.6)	
Diabetes Mellitus			
Yes	12 (30.8)	27 (69.2)	0.41
No	36 (38.3)	58 (61.7)	
Hypertension			
Yes	07 (21.2)	26 (78.8)	0.04
No	41 (41)	59 (59)	
Dyslipidemia			
Yes	10 (16.4)	51 (83.6)	0.01
No	38 (52.8)	34 (47.2)	
Smoking status			
Yes	25 (51)	24 (49)	0.01
No	23 (27.4)	61 (72.6)	
Obesity			
Yes	23 (38.3)	37 (61.7)	0.62
No	25 (34.2)	48 (65.8)	
Family H/O of CAD			
Yes	01 (4.5)	21 (95.5)	0.01
No	47 (42.3)	64 (57.7)	
Occupational status			
Employed	22 (41.5)	31 (58.5)	
Unemployed	26 (32.5)	54 (67.5)	0.29
Family monthly income			
≤25000	19 (61.3)	12 (38.7)	0.01

25000-50000	12 (23.1)	40 (76.9)
>50000	17 (34)	33 (66)

DISCUSSION

This study highlights key differences in patient characteristics and outcomes based on the presence of multivessel coronary artery disease (MVD) in individuals with Non-ST Elevation Myocardial Infarction (NSTEMI). Several factors, including residence, smoking, hypertension, dyslipidemia, and income, played significant roles in disease severity. Understanding these patterns can help refine treatment strategies and improve patient outcomes.

Age distribution was similar between groups, with most patients being 61 to 80 years old. While age is a well-known risk factor for coronary artery disease,[14-15] our findings suggest that MVD affects both younger and older patients similarly. Gender differences were also insignificant, indicating that men and women in this study had comparable risks of developing multivessel disease. Other studies have noted variations in CAD presentation between genders, but our results suggest that severity, at least in terms of vessel involvement, is not influenced by sex.[16-17]

Residence, however, showed a striking difference. A higher percentage of MVD patients lived in rural areas, while non-MVD patients were more likely to be urban residents. This disparity could stem from limited healthcare access, delays in diagnosis, and differences in lifestyle habits such as diet and exercise.[18] Rural populations often experience poorer cardiovascular outcomes due to late medical intervention and fewer healthcare facilities.[19-20]

Hypertension was more common in the non-MVD group, suggesting that other factors—such as smoking and family history—may contribute more to multivessel involvement. Though hypertension is a recognized risk factor for CAD,[21] its direct correlation with the extent of disease remains complex. Dyslipidemia followed a similar trend, being significantly higher in the non-MVD group. While high cholesterol contributes to plaque formation, individual patient characteristics, including genetic predisposition, likely influence whether the disease affects one or multiple vessels.[22-23]

Smoking, however, was notably higher among MVD patients, reinforcing its role as a major contributor to severe coronary disease. Smoking accelerates atherosclerosis, promotes inflammation, and increases thrombosis risk, all of which can lead to more extensive arterial involvement.[24-25] These findings align with prior research showing that smokers face a greater likelihood of multivessel disease and poorer overall outcomes.[26]

Interestingly, obesity did not significantly differ between groups. While obesity is linked to cardiovascular disease, its relationship with MVD remains debated. Some studies suggest that obesity's impact may be mediated by associated conditions like diabetes and hypertension rather than directly increasing the severity of vessel involvement.[27]

Family history played an unexpected role in our study. A larger proportion of non-MVD patients had a family history of CAD, whereas only a few MVD patients reported a similar background. This finding contrasts with previous studies that highlight a strong genetic link to severe coronary disease.[28] The discrepancy may stem from recall bias or differences in how family history is documented in medical records.

Income levels showed a clear association with disease severity. Lower-income patients were more likely to have MVD, a trend well-documented in socioeconomic health studies. Financial constraints often lead to poor diet, limited healthcare access, and lower adherence to treatment, all of which contribute to worsening cardiovascular health.[29-30]

In-hospital mortality was significantly higher among MVD patients, reflecting the increased complexity and severity of their disease. Previous studies confirm that patients with multivessel involvement face worse outcomes, including higher rates of complications and mortality, particularly if intervention is delayed.[31-32] Addressing these risks requires better screening and timely intervention strategies, especially for high-risk groups.

Limitations

This study has a few key limitations. Since it was conducted at a single center, the findings may not fully reflect broader populations or different healthcare settings. The retrospective design also introduces potential bias and limits the ability to establish cause-and-effect relationships. Additionally, we focused only on in-hospital outcomes, so the long-term impact of multivessel disease remains unclear. Variations in treatment strategies, such as complete versus incomplete revascularization, were not analyzed, which could influence patient outcomes. Other factors, like medication adherence, socioeconomic challenges, and genetic predisposition, were not explored in depth. Future research should include larger, multicenter studies with extended follow-ups to provide a more comprehensive understanding of multivessel coronary artery disease in NSTEMI patients.

CONCLUSION

This study highlights the strong association between multivessel coronary artery disease in NSTEMI patients and factors like rural residency, smoking, and lower income. These patients face a higher risk of in-hospital mortality, emphasizing the need for early detection, targeted prevention, and personalized treatment approaches. Improving healthcare access, promoting lifestyle changes, and optimizing revascularization strategies could significantly enhance outcomes.

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