IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 23, Issue 9 Ser. 7 (September. 2024), PP 29-33
www.iosrjournals.org

Clinical and Angiographic Profile of Non-ST Elevation Myocardial Infarction Patients with Multivessel Disease: A Study in a Tertiary Care Hospital in Bangladesh

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Abstract
Background: *Non-ST elevation myocardial infarction (NSTEMI) is a type of acute coronary syndrome without ST-segment elevation on electrocardiography. Many non-ST elevation myocardial infarction patients have multivessel disease, which leads to worse outcomes compared to single-vessel disease. Their clinical and angiographic profiles provide valuable insightf into the nature, severity, and treatment of this common cardiac condition. This study aimed to evaluate the clinical and angiographic profiles of non-ST elevation myocardial infarction patients with multivessel disease.*
Methods: *This prospective study was conducted in the Department of Cardiology, National Heart Foundation Hospital and Research Institute, Dhaka, Bangladesh from September 2022 to August 2023. The study enrolled 270 consecutive patients with NSTEMI. Coronary angiography and electrocardiogram were used in assessing the disease condition. The data were analyzed using SPSS version 23.0.*
Results: *The mean age of total participants was 54.31 ±10.54 years and most of them were male (77.8%). Majority of the patients had hypertension (68.1%), diabetes mellitus (59.3%), and dyslipidemia (58.5%). In the clinical assessment, 89.6% of patients had femoral access, 31.1% had a bifurcation lesion, 8.1% showed calcification, and 22.6% had a left main lesion. Stents were used in 41.9% of cases, with a mean total stent length of 55.8 ±26.9 mm. The mean left ventricular ejection fraction was 49.10 ±7.3%. Among the major culprit vessel involvements identified, 6% involved the left main (LM) artery, 56% involved the left anterior descending (LAD) artery, 34% involved the left circumflex (LCX) artery, and 39% involved the right coronary artery (RCA). Regarding the final angiographic findings among the total participants, double vessel disease (DVD) was observed in 40% of cases, while triple vessel disease was observed in 60% of cases.*
Conclusion: *The increased prevalence of triple vessel disease among non-ST elevation myocardial infarction patients underscores the importance of heightened vigilance among healthcare providers and policymakers. Understanding the clinical and angiographic profiles of these patients is essential for effective management strategies.*

Keywords: *Clinical, Angiographic profile, Non-ST elevation myocardial infarction, NSTEMI MI, DVD, TVD*

Date of Submission: 11-09-2024 Date of Acceptance: 21-09-2024

I. Introduction

Coronary artery disease (CAD) stands as a foremost contributor to global mortality [1] In 2022, the global prevalence of coronary artery disease (CAD) was estimated at 315 million cases, with a 95% uncertainty interval ranging from 273 to 362 million. [2] CAD is a significant contributor to cardiovascular diseases (CVDs). Among South Asian countries, Bangladesh likely has the highest rates of CVD but remains one of the least studied. In the global fight against CVD, Bangladesh is notably 'missing in action [3]. A recent study [4] found that the prevalence of non-ST-segment elevation acute myocardial infarction (NSTEMI) with insignificant coronary artery disease was 14.2%. While the rate of ST-elevation myocardial infarction (STEMI) has decreased,

there's been a rise in the incidence of non-ST-elevation myocardial infarction (NSTEMI) [5]. This trend is attributed to several factors, such as the aging population with a higher prevalence of conditions like diabetes and chronic kidney disease, as well as the widespread use of troponin assays with increased sensitivity for detecting myocardial injury. These factors often lead to the reclassification of diagnoses from unstable angina to NSTEMI [6,7]. Risk stratification for patients with non-ST-elevation myocardial infarction (NSTEMI) can be achieved using various prognostic scores, such as the Thrombolysis in Myocardial Infarction (TIMI) and GRACE (Global Registry of Acute Coronary Events) scores [8]. These scores utilize clinical characteristics, electrocardiographic findings, and laboratory investigations conducted upon admission to assess risk. They are considered simple and practical tools for evaluating risk across a broad spectrum of patients with NSTE-ACS [9]. The initial management of patients with non-ST-elevation myocardial infarction (NSTEMI) involves assessing hemodynamic and electrical stability and determining the patient's overall risk to guide treatment decisions [10]. Two management strategies are commonly employed for NSTEMI: an early invasive strategy involving coronary angiography and revascularization (either percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG) as necessary), or a conservative approach focusing on medical therapy initially [11,12]. Regardless of the chosen strategy, effective risk assessment and appropriate medication use are essential components of care [13].

II. Methodology

This cross-sectional study took place at the Department of Cardiology, National Heart Foundation Hospital and Research Institute in Mirpur, Dhaka, Bangladesh, spanning from September 2022 to August 2023. Patients aged above 18 years diagnosed with NSTEMI and having multivessel coronary artery disease (MVD) on coronary angiography (CAG) were included. Patients presenting with NSTEMI and single vessel coronary artery disease, those with creatinine clearance <30 mL/min, and those with a history of previous PCI or CABG were excluded. Following the inclusion criteria, a total of 270 patients were successfully selected and enrolled in the study. Demographic data, risk factors, ECG, and echocardiographic parameters were collected alongside procedural variables related to Coronary Angiography (CAG). These included access site, number of vessels, bifurcation lesion, calcification, chronic total occlusion (CTO) lesion, culprit vessel identification, number, total length, and average diameter of stents. Therapeutic information such as medical treatment, culprit-only PCI, ad hoc complete multivessel PCI, and ad hoc incomplete multivessel PCI was also recorded. Two experienced cardiologists reviewed the coronary angiographies to evaluate the angiographic appearance of the lesion. Integration of information from angiographic images and ECGs followed common clinical practice to identify potential culprit lesion sites. Multivessel coronary disease was defined as the presence of a $\geq$ 50% diameter stenosis in at least two epicardial coronary arteries (>2.5 mm) as assessed by visual estimation [14]. A coronary lesion was identified as the culprit when at least two major angiographic findings were observed, as outlined in a reputable study [15]. Left bundle branch block (LBBB), right bundle branch block (RBBB), and diffuse ST/T wave changes were considered non-specific ECG changes. Ethical approval was obtained from the institutional ethical review committee, and written informed consent was obtained from all participants. Data collection utilized a structured questionnaire containing all variables of interest. Data analysis was performed using SPSS version 23.0.

III. Result

The mean age of our total participants was 54.31 ± 10.54 years and the mean ±SD BMI (Kg/m^2) was found 24.52±3.16. The majority (77.8%) were male, with the remaining 22.2% being female. The clinical, ECG, and echocardiographic findings of the study cohort are summarized as follows: 89.6% of patients underwent femoral access, 31.1% had a bifurcation lesion, 8.1% exhibited calcification, and 22.6% had a left main lesion. Stents were utilized in 41.9% of cases, with a mean total stent length of 55.8 ± 26.9 mm, a mean stent diameter of 2.8 ± 0.4 mm, an average of 1.8 ± 0.9 stents deployed per patient, and a mean ±SD left ventricular ejection fraction was found 49.10 ± 7.3%. The distribution of risk factors among the study participants is as follows: 28.1% were smokers, 68.1% had hypertension, 59.3% had diabetes mellitus, 58.5% had dyslipidemia, 12.6% had chronic kidney disease, and 34.1% had a family history of ischemic heart disease (IHD). Among the major culprit vessel involvements identified, 6% involved the left main (LM) artery, 56% involved the left anterior descending (LAD) artery, 34% involved the left circumflex (LCX) artery, and 39% involved the right coronary artery (RCA). As the final angiographic findings among total participants double vessel disease (DVD) was observed in 40% and triple vessel disease was observed in 60% of the cases.

Table 1: Demographic data of patients

Characteristics	Mean ±SD/n (%)
Age distribution	
Mean ±SD (Year)	54.31±10.54
BMI distribution	

Mean ±SD (Kg/m^2)	24.52±3.16	
Gender distribution		
Male	210	77.8%
Female	60	22.2%

Table 2: Clinical, ECG, and echocardiographic findings

Characteristics	Mean ±SD/n (%)	
Femoral access	242	89.6%
Bifurcation lesion	84	31.1%
Calcification	22	8.1%
Left main lesion	61	22.6%
Stent used	113	41.9%
Stent length (Total)	55.8 ± 26.9	
Diameter of stent	2.8 ± 0.4	
Number of stents	1.8 ± 0.9	
LVEF (%)	49.10 ± 7.3	

LVEF: Left ventricular ejection fraction

Table 3: Risk factors distribution

Characteristics	n	%
Smoking	76	28.1%
Hypertension	184	68.1%
Diabetes mellitus	160	59.3%
Dyslipidemia	158	58.5%
Chronic kidney disease	34	12.6%
FH of IHD	92	34.1%

FH: family history IHD: Ischemic heart disease

Table 4: Major culprit vessel involvement

Characteristics	n	%
LM	7	6%
LAD	106	56%
LCX	31	34%
RCA	40	39%

LM: Left main coronary artery, LAD: Left Anterior Descending Artery, LCX: Left circumflex artery, RCA: Right coronary artery

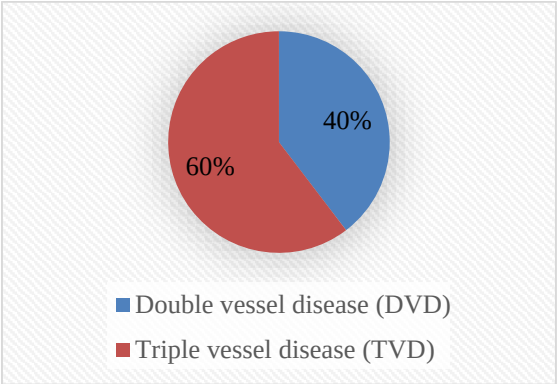

Figure 1: Final angiographic findings

IV. Discussion

The mean age of our total participants was 54.31 ±10.54 years, which was consistent with findings from another study [16]. The majority (77.8%) of our patients were male, while the remaining 22.2% were female, which aligns with observations in a similar study [17]. The clinical, ECG, and echocardiographic findings of this study revealed that 89.6% of patients underwent femoral access, 31.1% had a bifurcation lesion, 8.1% exhibited calcification, and 22.6% had a left main lesion. A recent study [18] reported that for patients with ST-segment elevation myocardial infarction (STEMI), radial access reduced the primary outcome compared to femoral access

(3.1% vs. 5.2%; p=0.026). However, for non-ST-segment elevation myocardial infarction (NSTEMI) patients, the rates were 3.8% and 3.5%, respectively (p=0.49). The use of newer-generation drug-eluting stents (NG-DESs) in patients with non-ST-segment elevation myocardial infarction (NSTEMI) treated with percutaneous coronary intervention is associated with a reduced risk of restenosis and the need for repeat revascularization compared to the use of bare-metal stents [19]. In our study, stents were used in 41.9% of cases, with a mean total stent length of 55.8 ± 26.9 mm, and an average of 1.8 ± 0.9 stents deployed per patient. All the stents used is this study were DES. Among our patients, the mean ±SD left ventricular ejection fraction was found to be 49.10 ± 7.3%. In another study [20], left ventricular ejection fraction (LVEF) was found to be abnormal (LVEF <50%) in 45.6% of patients, with 42.3% of NSTEMI patients and 50.5% of STEMI patients affected. Additionally, LVEF was moderate to severely impaired (LVEF <40%) in 22.6% of patients, with 21.9% of NSTEMI patients and 23.7% of STEMI patients affected. In evaluating the risk factors, we observed that the majority of our participants had hypertension, diabetes mellitus, and dyslipidemia. These findings are comparable with the findings of some other studies [21,22]. Among the major culprit vessel involvements identified, 6% involved the left main (LM) artery, 56% involved the left anterior descending (LAD) artery, 34% involved the left circumflex (LCX) artery, and 39% involved the right coronary artery (RCA). Deora et al. (2016) [23] showed similar findings indicating that LAD involvement was more common among the STEMI group of patients, while LCX and LMCA involvements were more common among the NSTEMI group of patients, with no significant difference observed in case of RCA involvement. Song et al. (2010) [24] also found similar findings. In this study, among the final angiographic findings, double vessel disease (DVD) was observed in 40%, and triple vessel disease was observed in 60% of the cases. In another study [25], single, double, and triple vessel disease occurred in 26%, 20%, and 32.4% of patients with non-ST-segment elevation acute coronary syndrome (NSTE-ACS) and chronic stable angina. On the other hand, Matthew et al. (2022) found double vessel disease (DVD) involvement in 67% of cases and triple vessel disease (TVD) in 33% of cases in their study [26]. All the findings of this study may be helpful in future similar studies.

Limitation of the study:

This single-centered study, with limited sample size and short duration, may not fully represent the broader scenario across the entire country. Consequently, caution is advised when interpreting its findings, as they may not accurately reflect the diversity and complexities present nationwide.

V. Conclusion

The elevated frequency of triple vessel disease cases among non-ST elevation myocardial infarction (NSTEMI) patients underscores the importance of heightened attention from both health professionals and health policy makers. Understanding the clinical and angiographic profiles of these patients is essential for effective management and resource allocation. Prior knowledge of the characteristics and risk factors associated with triple vessel disease can help clinical decision-making, guiding interventions & revascularization procedures, and secondary prevention strategies. By recognizing the unique challenges posed by triple vessel disease in NSTEMI patients and tailoring treatment approaches accordingly, healthcare providers can improve outcomes and reduce the burden of cardiovascular morbidity and mortality in this population. Moreover, health policymakers can utilize this information to develop targeted initiatives aimed at early detection, risk stratification, and optimized management of NSTEMI patients with multivessel disease.

Funding: No funding sources.
Conflict of interest: None declared.

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