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Demographic and Clinical Profile of Patients with Non-ST Elevation Myocardial Infarction

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ABSTRACT

Background: *Non-ST elevation myocardial infarction (NSTEMI) is a significant cardiovascular condition requiring precise diagnostic and interventional strategies. Intravascular ultrasound (IVUS)-guided percutaneous coronary intervention (PCI) is widely utilized to optimize outcomes, particularly in calcified lesions. This study aimed to evaluate the demographic and clinical profile of NSTEMI patients undergoing IVUS-guided PCI in calcified lesions.* ***Methods:*** *This cross-sectional observational study was conducted at the National Institute of Cardiovascular Diseases (NICVD), Dhaka, Bangladesh, from May 2019 to April 2020. A total of 109 purposively selected NSTEMI patients undergoing IVUS-guided PCI during index hospitalization were included. Patients with cardiogenic shock, congestive heart failure, STEMI, stent thrombosis, in-stent restenosis, prior coronary artery bypass grafting (CABG), and lesions requiring balloon dilatation before imaging were excluded. Data were analyzed using MS Office tools.* ***Results:*** *The study demonstrated a predominance of male patients (88%), with a mean age of 53.4 years. Hypertension (56.5%) and diabetes mellitus (40.4%) were the most common comorbidities. Superficial calcification (91.7%) was the most common type of lesion. Most patients had anterior MI (54.1%) and three-vessel disease (46.8%). ECG findings showed ST elevation in 53.2% of cases.* ***Conclusion:*** This study identifies hypertension, diabetes mellitus, and three-vessel disease as predominant factors in NSTEMI patients undergoing IVUS-guided PCI. Superficial calcification and anterior MI are common, with ST elevation frequently observed. These findings highlight the need for optimized risk management and targeted interventions to improve patient outcomes.

Keywords: *Calcified Lesion, Clinical Characteristics, Demographic Profile, IVUS-Guided PCI, Non-ST Elevation Myocardial Infarction.*

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INTRODUCTION

Non-ST elevation myocardial infarction (NSTEMI) is a major manifestation of acte coronary syndrome (ACS) and is associated with substantial morbidity and mortality worldwide [1]. It is characterized by myocardial ischemia without ST-segment elevation on an electrocardiogram (ECG) but with elevated cardiac biomarkers indicative of myocardial injury [2]. NSTEMI accounts for a significant proportion of hospital admissions due to acute coronary events and poses a challenge in clinical decision-making, particularly regarding risk stratification and optimal interventional strategies [3]. Percutaneous coronary intervention (PCI) is a widely accepted treatment modality for NSTEMI patients with obstructive coronary artery disease [4]. Among these, patients with calcified coronary lesions present unique challenges due to increased procedural complexity, risk of stent underexpansion, and potential restenosis [5]. Intravascular ultrasound (IVUS)-guided PCI has emerged as an effective imaging modality that provides detailed assessment of lesion morphology,

plaque burden, vessel dimensions, and optimal stent deployment [6]. By offering real-time visualization, IVUS enhances procedural outcomes, especially in complex and calcified coronary lesions, leading to improved long-term prognosis [7]. Calcified coronary lesions are prevalent among NSTEMI patients, particularly those with risk factors such as diabetes mellitus, hypertension, dyslipidemia, and smoking [8]. These lesions contribute to increased procedural difficulty, requiring advanced techniques such as rotational atherectomy, lithotripsy, or high-pressure balloon inflation before stent placement [9]. IVUS guidance plays a pivotal role in assessing calcium distribution, optimizing stent expansion, and minimizing complications [10]. However, despite its benefits, IVUS utilization remains inconsistent, and there is a need for further research to establish its role in routine clinical practice [11]. The demographic and clinical characteristics of NSTEMI patients undergoing IVUS-guided PCI in calcified lesions have not been extensively studied in the Bangladeshi population [12]. Understanding these characteristics can provide valuable insights into patient risk profiles, disease burden, and procedural outcomes [13]. Moreover, identifying key risk factors and angiographic features in this subset of patients can aid in better clinical decision-making and personalized treatment approaches [14]. This study aimed to evaluate the demographic and clinical profile of NSTEMI patients undergoing IVUS-guided PCI in calcified lesions at a specialized cardiac care center in Bangladesh. By analyzing patient characteristics, risk factor prevalence, and procedural findings, the study sought to enhance the understanding of this high-risk population [15]. Additionally, the findings may contribute to evidence-based recommendations for the use of IVUS in managing calcified coronary lesions, ultimately improving patient outcomes in NSTEMI [16].

METHODOLOGY

This cross-sectional observational study was conducted at the National Institute of Cardiovascular Diseases (NICVD), Dhaka, Bangladesh, from May 2019 to April 2020. A total of 109 NSTEMI patients undergoing IVUS-guided PCI for calcified coronary lesions during index hospitalization were purposively selected. Inclusion criteria encompassed NSTEMI diagnosis with IVUS-guided PCI for calcified lesions, while exclusion criteria included cardiogenic shock, congestive heart failure, STEMI lesions, imaging failure, balloon dilation before imaging, poor image quality, stent thrombosis, in-stent restenosis, prior CABG, and coronary calcium arc ≥270°. Data were collected through a structured case record form, including demographics, cardiovascular risk factors (hypertension, diabetes mellitus, dyslipidemia, smoking, family history), clinical characteristics (symptoms, cardiac biomarkers, LVEF), and angiographic findings (lesion location, calcium burden, pre- and post-PCI minimal lumen diameter, stent expansion, complications). Ethical approval was obtained from NICVD's ethical review committee, and informed consent was taken from all participants, adhering to the Declaration of Helsinki. Data analysis was performed using MS Office tools, with descriptive statistics summarizing categorical variables as frequencies and percentages, while continuous variables were expressed as mean ± standard deviation. Comparative analyses were conducted using appropriate statistical tests, considering a p-value <0.05 as statistically significant.

RESULT

The mean age of the patients was 53.4±9.8 years, ranging from 25 to 75 years. The majorityof patients (55.0%) were aged ≥50 years, while 45.0% were <50 years. A significant male predominance was observed, with 96 (88%) males and 13 (12%) females among the 109 participants. A majority of the cases (91.7%) had superficial calcification, while 3.70% had deep calcification, and 4.60% had both superficial and deep calcifications. Hypertension was the most prevalent risk factor (56.5%), followed by diabetes mellitus (40.4%), dyslipidemia (36.7%), smoking (25.7%), and family history of CAD (29.4%). Diabetes mellitus was the most frequently recorded previous medical condition (34.9%), followed by current smoking (33.0%), hypertension (30.3%), hyperlipidemia (12.8%), and stroke (2.8%). More than half of the patients had anterior MI (54.1%), followed by posterior MI (22.0%), anterior-posterior MI (13.8%), and unspecified localization (10.1%). Nearly half of the patients (46.8%) had three-vessel disease, followed by two-vessel disease (18.3%) and single-vessel disease (13.8%). ST elevation was present in 53.2% of cases, followed by T-wave inversion (18.3%), ST depression (12.8%), and normal ECG (5.5%). The mean systolic blood pressure was 148±28 mmHg, while the mean heart rate was 84±22 bpm.

Table 1: Distribution of the study participants by age (N=109)

Age (Years)	n	%

< 50	49	45.0%
≥ 50	60	55.0%
Mean ±SD	53.4±9.8	

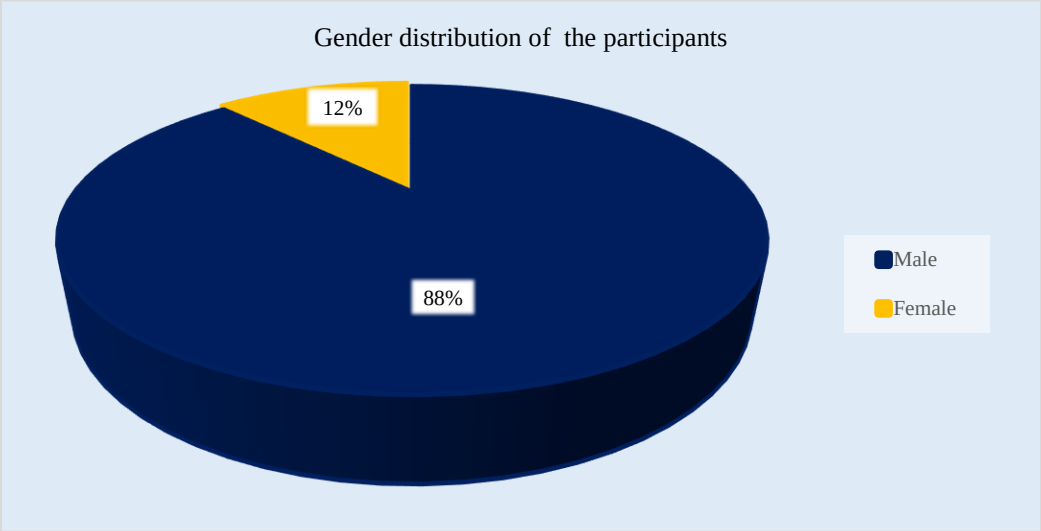

Figure I: Column chart showed gender wise participants distribution (N=109)

Table 2: Distribution of cases by location of calcification (N=109)

Location	n	%
Superficial	100	91.7%
Deep	4	3.7%
Both	5	4.6%

Table 3: Distribution of patients by risk factors (N=109)

Risk factors	n	%
Smoking	28	25.7%
Hypertension	61	56.5%
Diabetes mellitus	44	40.4%
Dyslipidaemia	40	36.7%
Family H/O CAD	32	29.4%

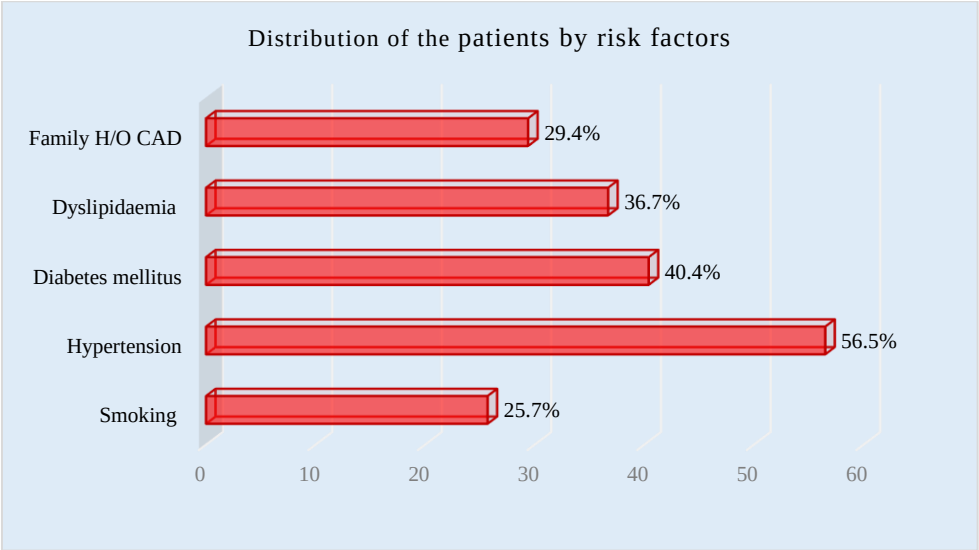

Figure II: Bar chart showed risk factors wise patients distribution (N=109)

Table 4: Previous medical history (N=109)

Medical history	n	%
Diabetes mellitus	38	34.9%
Current smoker	36	33.0%
Atrial fibrillation	3	2.8%
Hypertension	33	30.3%
Hyperlipidemia	14	12.8%
Dialysis	2	1.8%
Cancer	2	1.8%
Stroke	3	2.8%
Heart failure	2	1.8%

Table 5: Myocardial infarction localization (N=109)

MI localization	n	%
Anterior MI	59	54.1%
Posterior MI	24	22.0%
Anterior-posterior MI	15	13.8%
IM of unspecified localization	11	10.1%

Table 6: Vessel involvement (N=109)

Involvement	n	%
Single-vessel disease	15	13.8%
Two-vessel disease	20	18.3%
Three-vessel disease	51	46.8%

Table 7: ECG findings of cases (N=109)

ECG Findings	n	%

ST elevation	58	53.2%
Presumed new ST depression	14	12.8%
Presumed new T-wave inversion	20	18.3%
Normal ECG	6	5.5%
Transient ST elevation	3	2.8%
Others	8	7.3%

Table 8: Vital signs (N=109)

Vital Signs	Mean ± SD
Systolic blood pressure	148 ± 28 mmHg
Heart rate	84 ± 22 bpm

DISCUSSION

This study provides valuable insights into the demographic and clinical characteristics of NSTEMI patients undergoing IVUS-guided PCI for calcified coronary lesions. The findings align with existing literature on coronary artery disease (CAD) and its associated risk factors. The study observed a male predominance (88%), consistent with previous research indicating a higher prevalence of CAD in males due to hormonal differences and lifestyle factors [17]. The mean age of patients was 53.4 ± 9.8 years, which is comparable to global studies reporting NSTEMI cases predominantly in individuals over 50 years [18,19]. Aging is a well-recognized risk factor for coronary atherosclerosis, contributing to vascular calcification and plaque instability [20]. Hypertension (56.5%) and diabetes mellitus (40.4%) were the most common comorbid conditions in this cohort. These findings align with previous studies that have identified hypertension as a major contributor to endothelial dysfunction, leading to plaque formation and calcification [21]. Diabetes mellitus is strongly associated with accelerated atherosclerosis, increasing the risk of multi-vessel coronary artery disease (CAD) [22]. Additionally, 36.7% of patients had dyslipidemia, a well-established modifiable risk factor for CAD [23]. Smoking, reported in 25.7% of cases, is known to enhance oxidative stress, endothelial dysfunction, and vascular inflammation, all of which contribute to coronary artery calcification [24]. The study found that 91.7% of cases had superficial calcification, while 3.7% had deep calcification, and 4.6% had both. Superficial calcification is commonly associated with stable plaques, whereas deep calcification may indicate higher plaque burden and increased procedural complexity during PCI [25]. The distribution of myocardial infarction (MI) localization showed that 54.1% of patients had anterior MI, which is consistent with previous findings suggesting that anterior wall infarctions are more frequent due to the left anterior descending artery's (LAD) critical role in myocardial perfusion [26]. Nearly 46.8% of patients had three-vessel disease, indicating advanced coronary atherosclerosis, which is associated with poor outcomes and increased mortality risk in NSTEMI patients [27]. Multi-vessel disease is particularly concerning in diabetics and elderly patients, as it often necessitates more complex revascularization strategies, including coronary artery bypass grafting (CABG) [28]. ECG findings revealed that 53.2% of patients presented with ST elevation, even in an NSTEMI cohort, which may indicate transient ischemia, microvascular dysfunction, or underlying chronic total occlusions [29]. Additionally, 18.3% had T-wave inversion, and 12.8% had ST depression, which are hallmark ECG changes seen in NSTEMI patients [30]. The findings of this study emphasize the necessity of aggressive risk factor management in NSTEMI patients. Given the high prevalence of hypertension, diabetes, and three-vessel disease, early intervention with lifestyle modifications and guideline-directed medical therapy (GDMT) is crucial to improving outcomes [31]. Furthermore, the widespread presence of coronary calcification underscores the role of IVUS-guided PCI in optimizing stent placement and reducing complications [16]. Future studies should focus on long-term patient outcomes, comparing different revascularization strategies, and evaluating the impact of newer adjunctive imaging modalities such as optical coherence tomography (OCT).

LIMITATION OF THE STUDY

This study is limited by its cross-sectional design, small sample size, and single-center setting. Furthermore, the observational nature prevents establishing causal relationships, and long-term outcomes were not assessed, which may limit the generalizability of the findings.

CONCLUSION & RECOMMENDATION

This study highlights the demographic and clinical profile of NSTEMI patients undergoing IVUS-guided PCI for calcified coronary lesions. The findings reveal that the majority of patients are male, with a mean age of 53.4 years. Hypertension and diabetes mellitus remain the most prevalent risk factors, emphasizing the need for better management of cardiovascular comorbidities. Superficial calcification is the most common lesion type, and anterior MI is the predominant myocardial infarction localization. A significant proportion of patients present with three-vessel disease, indicating the severity of coronary artery involvement. ECG findings frequently show ST elevation, reinforcing the importance of early diagnosis and intervention. These results underscore the necessity of targeted preventive strategies and optimized therapeutic approaches for high-risk NSTEMI patients. Future research should focus on long-term clinical outcomes and the impact of advanced imaging modalities on PCI success and patient prognosis.

RECOMMENDATIONS

Future studies should focus on larger, multi-center cohorts with prospective designs to evaluate long-term clinical outcomes in NSTEMI patients. Additionally, exploring the role of advanced imaging techniques and individualized treatment strategies could further improve patient management and outcomes in coronary artery disease.

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