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Original Research Article

Peculiarity of Diabetes in Presentation Characteristics and Outcomes in Patients With Acute Myocardial Infarction Undergoing Primary Percutaneous Coronary Intervention in Tertiary Care Cardiac Centre

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Abstract: *Diabetes mellitus (DM) is a major risk factor for cardiovascular diseases. Atypical and late presentations in people with diabetes pose a danger of delayed diagnosis, treatment, interventions, and, as a result, worse outcomes. In patients with AMI undergoing Primary PCI(PPCI), people with diabetes are prone to high thrombus burden and procedural complications. A registry revealed to have a high thrombus burden, high mortality, and delays in interventions. Studies have shown that patients with type 2 diabetes mellitus (T2DM) combined with AMI are in a high-risk group for no-reflow Phenomena because these patients usually have complex coronary artery diseases.* ***Objective:*** *This study aims to systematically assess the presentation characteristics and outcomes of diabetic patients who presented with AMI Undergoing Primary PCI.* ***Method:*** *A retrospective cohort study was conducted on 422 patients admitted with AMI who underwent PPCI. Patients' data were taken from electronic health records (HMIS)-demographics, presentation, and PPCI data. The Primary outcomes evaluated were in-hospital mortality and PPCI-related complications.* ***Results:*** *Out of 422 patients, 33.6% were diabetic and 66.3% were non-diabetic. Diabetic patients had a higher mean age, longer symptoms to hospital visit duration (9.11 hours vs 8.84 hours), more multivessel disease (28% vs 16.7%), and a higher heavy thrombus burden. Despite presenting later, door-to-balloon times were similar. People with diabetes had lower TIMI-III flow rates (23.4% vs 30.36% in nondiabetics), lower complete revascularization rates, and higher MACE incidence.* ***Conclusion:*** *Diabetic patients with AMI show distinct clinical characteristics and significantly worse outcomes compared to nondiabetics, highlighting the need for heightened clinical suspicion, rapid diagnostics, aggressive early management, and future interventions to improve timely access to care and optimize long-term management for this high-risk population.*

Keywords: Diabetes, multivessel disease, primary percutaneous interventions

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Introduction

Acute Myocardial Infarction and related mortalities have been the leading health challenges in both developed and developing nations. (1) The best treatment strategy for patients with acute myocardial infarction remains the timely reperfusion therapy with Primary percutaneous intervention (PPCI).

Diabetes mellitus (DM) is one of the leading contributing factors for atherosclerotic cardiovascular diseases, but it comes with a package of a variety of problems. Patients with diabetes often have nonspecific symptoms and thus are at risk for delayed presentation of AMI, which then leads to a delay in the initiation of life-saving treatments, posing a greater risk. (2)Diabetes mellitus (DM) is also thought to be a notable predictor of adverse outcomes periprocedural and post-procedural among many others. (3) Great progress has been made regarding acute coronary syndromes (ACS) treatments, specifically in interventions. Diabetes mellitus remains a challenging culprit behind the increased complication risks post myocardial infarction. (4)

In a National Polish Registry from 2014-2020, among STEMI patients, those who had diabetes mellitus were 17%. It was responsible for a significant delay from the time of onset to first medical contact (FMC). (3)These findings are further supported by a local investigation in which diabetes was the most common comorbidity in patients with STEMI. Those with diabetes had poor in-hospital and long-term outcomes, the commonest being cardiogenic shock and heart failure. These findings help identify the burden of the problem; however, they never looked into the procedural details of Primary PCI and its related complications. (5) A study in JACC specifically investigating the impact of DM on PCI outcomes in patients with AMI suggests that patients with diabetes have a higher prevalence of triple-vessel coronary artery disease, and post-procedural TIMI flow grade 3 was not achieved in the majority of patients with diabetes than in non-diabetics. (6)

Along with other existing complications related to diabetes with MI, mortality rates in diabetes have been well described as higher than in non-diabetics in a well-known meta-analysis. (7) This has not been the news of today, as this has been demonstrated in older studies dating back as far as 1998, where mortality with MI in WHO MI registries (MONICA and FINMONICA) was significantly higher in people with diabetes than in non-diabetics after the first myocardial infarction. (8)

To the best of our knowledge, most of the available literature, specifically local literature, has focused on the complication profile of diabetes in the context of MI and long-term complications. The available data lacks detailed analysis of the problem, like specified presentation characteristics, the difference in symptomatology and related procedural success, peri-procedural and post-procedural complications, and angiographic findings in patients with diabetes presenting with AMI. It is the need of the hour to explore the above-stated aspects in detail, given the high burden of diabetes in our population and its well-researched roles in cardiovascular complications. By identifying these factors, this study will not only aid in risk stratification. Still, it will also help in exploring strategies for timely interventions and thus achieve the goal of improved management in diabetic patients with MI.

This study, therefore, aims to bridge this knowledge gap by evaluating the presentation characteristics, angiographic findings, procedural details, and in-hospital outcomes of diabetic patients undergoing PPCI in a high-volume tertiary care cardiac center.

Thus, the objective of the study was to assess and analyze the clinical presentation characteristics of diabetic patients admitted with Acute Myocardial Infarction (AMI) undergoing PPCI in a tertiary care cardiac center, focusing on the prevalence of delayed presentation and to investigate the Angiographic severity of lesions with a focus on heavy thrombus burden, TIMI flow, and Residual syntax score. To assess outcomes, including mortality and MACE, in diabetic patients with AMI undergoing Primary PCI.

Methodology

This retrospective cohort study was conducted in the adult Cardiology Department of MTI, Punjab Institute of Cardiology (PIC), over six months from 1st February 2024 to 31st July 2024. The study focused on patients who underwent primary percutaneous coronary intervention (PPCI) during this timeframe. All patients included in the analysis met specific inclusion and exclusion criteria, ensuring a well-defined cohort for meaningful analysis.

Eligible participants were adults aged between 18 and 80 years who presented with acute myocardial infarction (AMI) and had diabetes mellitus as a comorbidity. These patients must have undergone PPCI as the primary mode of reperfusion therapy. Several exclusion criteria were applied to minimize confounding variables and ensure the reliability of outcome measures. Patients who received fibrinolytic therapy rather than PPCI were excluded to maintain consistency in intervention type. Additionally, those with a history of previous myocardial infarction or prior coronary artery bypass grafting (CABG) were omitted from the study to focus exclusively on individuals experiencing their first AMI event. Patients who presented beyond the clinically acceptable time window for PPCI were also excluded, as delayed intervention could significantly impact outcomes. Furthermore, patients with other serious comorbidities such as advanced renal disease or malignancies, which might independently influence prognosis, were not considered. Finally, patients with incomplete medical records were excluded to maintain the integrity and accuracy of the data analysis.

As a part of Good clinical practice in research, approval is sought from the Institutional Review Board of MTI, PIC. A formal and informed consent of the study was waived off as the study was retrospective; however, the IRB committee was considered as the authority for the consent of the study, and the confidentiality of the participants was maintained by strict anonymization.

The data collection for this retrospective cohort study was conducted at the Adult Cardiology Department of MTI, PIC. After obtaining ethical approval from the IRB, data were retrieved from HMIS, and a detailed proforma was used for the daily morning audit of PPCI of all patients after rigorous application of Inclusion and Exclusion criteria. Data collection was focused on patients' demographics like age, gender, AMI details (type, location, severity), PPCI procedure details (time to intervention, number of vessels treated, procedural and post-procedural early complications), and In-hospital outcomes.

Data was analyzed using STATA version 14.2. Demographics and clinical characteristics were summarized using descriptive statistics. Continuous variables were expressed as means ± standard deviations or medians with interquartile ranges, depending on the distribution of the data. After a normality check by the Shapiro-Wilk test, Continuous variable was demonstrated as means ± standard deviations, and comparisons were determined using an independent t-test, while categorical variables were presented as frequencies and percentages, and their groups were compared using chi-square tests. A p-value < 0.05 was considered statistically significant for all analyses.

Results

Out of the total 422 patients presenting with Acute myocardial infarction (AMI) undergoing Primary percutaneous intervention (PPCI), 142 (33.6%) were diabetic, while 280 (66.3%) were non-diabetic. Mean age in years among people with diabetes was slightly higher than that of non-diabetics (59.18±8.80 years vs 57.80±12.10 years, respectively. Demographics overview is given in Table 1

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Table 1: Baseline Characteristics of the Study Population (n = 422)

Description	Frequency (n)	Percentage (%)
Age (Mean ± SD in years)		
• Diabetics	–	59.18 ± 8.80
• Non-Diabetics	–	57.80 ± 12.10
Gender		
• Male	317	75.12
• Female	105	24.88
Comorbidities		
• Diabetes	142	33.60
• Hypertension	236	55.92
• CVA	7	1.66
• Smokers	31	7.34
• Family History of IHD	15	9.09
Types of MI Presentation		
• AWMI	84	50.91
• IWMI	56	33.94
• Others	25	15.15
Access Site for Angiography		
• Radial	393	93.13
• Femoral	29	6.87
No. of Vessels Involved		
• SVCAD	194	45.97
• DVCAD	141	33.41
• TVCAD	87	20.60
Culprit Lesion		
• LAD	219	51.90
• LCX	46	10.90
• RCA	157	37.20

Coronary Dominance		
• Left Dominant	23	13.94
• Right Dominant	130	78.79
• Co-dominant	12	7.27

Table 2 Comparison of Symptom-to-Hospital Presentation Time and Door-to-Balloon Time between Diabetic and Non-Diabetic Patients with AMI

Variable	Diabetic patients	Non-Diabetics patients	P value
Symptom to hospital presentation (time mean in hours)	9.11	8.84	0.1
Door-to-Balloon time (DTB) (time mean in minutes)	74.88	74.18	0.08

As demonstrated in Table 2, there was an interesting trend of delayed presentation to the hospital after symptom onset observed in patients with diabetes, with a mean duration of 9.11 hours as compared to 8.84 hours in non-diabetic patients with AMI. Although there was a delayed presentation, it did not have any impact on the door-to-balloon time (DTB), which remained comparable between the two groups (74.88 minutes in diabetes vs 74.18 minutes in non-diabetics). The hospital stay was significantly longer in diabetic patients (mean 37.40 hours) compared to non-diabetics (26.15 hours), p-value <0.001, depicted in Figure 1 below.

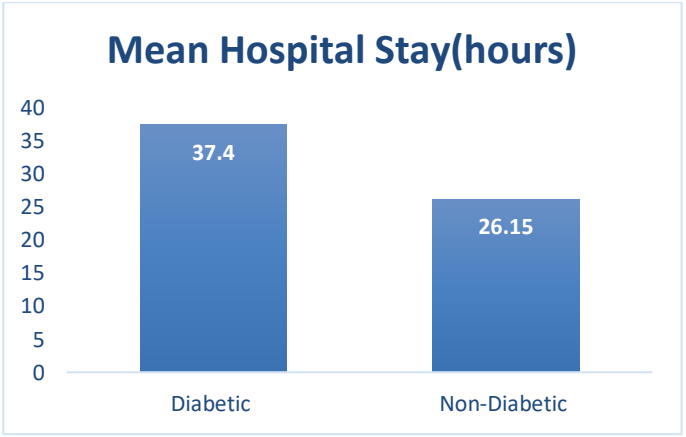

Figure 1 Comparison of Mean Hospital Stay (Hours) between Diabetic and Non-Diabetic Patients undergoing Primary PCI

Angiographic findings revealed a significantly higher prevalence of multivessel disease, particularly triple vessel coronary artery disease (TVCAD), among diabetic patients (28%) compared to non-diabetics (16.7%). Furthermore, a heavy thrombus burden (TIMI thrombus grade 5) was seen more frequently in people with diabetes (41.55%) as opposed to non-diabetics (37.14%). These findings are well presented in Figure 2 below.

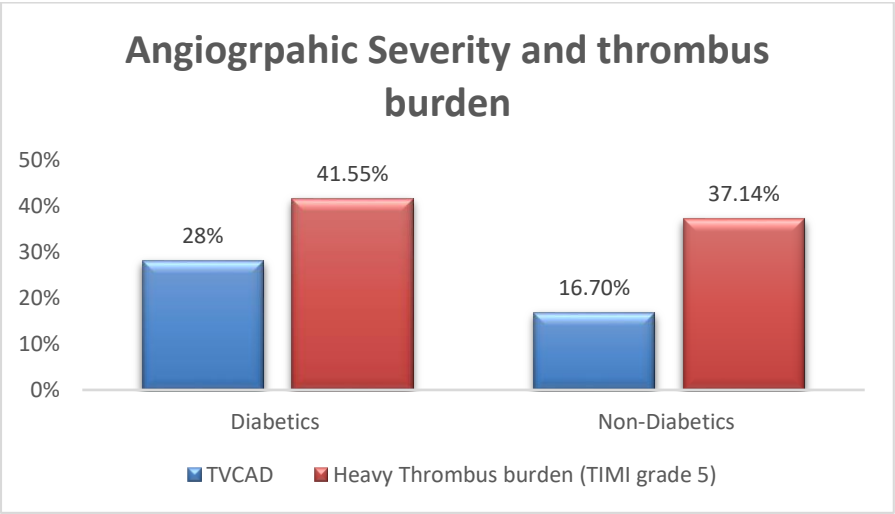

Figure 2: Angiographic severity and thrombus burden comparison.

A key finding was the lower achievement of optimal post-procedural TIMI III flow in diabetic patients (23.4%) when compared to non-diabetics (30.36%), with a p-value of 0.03, highlighting procedural challenges in this subset. Additionally, the rate of complete revascularization during PPCI was significantly lower in diabetic patients (11.97%) versus non-diabetics (16.85%).

Table 3Major Cardiovascular Adverse Events

MACE	Diabetics	Non-Diabetics	P Value
Present	20(14.08%)	33 (11.79%)	0.501
Absent	122(85.92%)	247(88.21%)	0.501

In terms of in-hospital adverse events, Major Adverse Cardiovascular Events (MACE) were seen in a total of 53 patients, with a higher proportion among people with diabetes (14.08%) as compared to non-diabetics (11.79%).

Discussion

As shown in our study, patients with concomitant diabetes and myocardial infarction are presented late and have extensive coronary artery disease with a high thrombus burden and greater adverse outcomes than their counterparts. Our study has focused on those groups of patients who are treated with primary percutaneous coronary intervention (PPCI).

The results of our study in terms of comorbidities for Acute myocardial infarction can be seen mirroring those of other studies. (6–9)Where the prevalence of AMI is higher in people with diabetes than in non-diabetics, similar findings were also appreciated in the VALIANT Trial, where the prevalence of DM in AMI patients was 23%.(10)

In addition to that, our study has outlined an age peculiarity. Interestingly, patients with MI and diabetes had a mean age greater than that of non-diabetics, but these findings are not limited to our study. In a study published in JACC, although statistically insignificant as in our research, it is evident that the mean age was higher in patients with MI plus diabetes than in those without. (6) These findings are supported by the fact that younger people are less likely to have classic comorbidities for cardiovascular diseases. The study supporting this stance is a specifically age and gender-based survey in which there are statistically significant findings that support that diabetes mellitus follows a trend of older age presentation as compared to those without diabetes. (11)

Our study could not prove significance for delayed presentation of Myocardial infarction in patients with diabetes as compared to non-diabetics; however, it did show a delay in presentation to the hospital from the symptom's onset greater than in non-diabetics. This contrasts with a study in Leeds, UK, where there was a significant delay in presentation from symptom onset (249 minutes in people with diabetes vs 211 minutes in non-diabetics, with a p-value of <0.001. This study has also shown a considerable delay in door-to-balloon time (DTB) with a p-value of 0.002 in patients with diabetes. (9) The significant delayed presentation of patients with diabetes has been attributed to atypical symptoms related to diabetes with MI. This can further complicate timely diagnosis and the total DTB time, which later alters outcomes. This concept has also been investigated thoroughly in both acute coronary syndrome and chronic coronary artery disease. Such a study in line with such findings was done in Canada, exploring the association of diabetes with atypical presentation of MI.(12)

Mean hospital stay is considered one of the elements of prognosis and early outcomes. This has been a widely accepted concept now owned by many researchers. In our study, as a marker for the early outcome, the mean hospital stay has been demonstrated to be higher in patients with diabetes than without, which could be because of delayed presentation, high thrombus burden, and a higher frequency of slow flow requiring tirofiban maintenance dose. Coherent results are seen in many studies. (9,13,14). One notable study, a report from the national Cardiovascular Registry, has mentioned diabetes in many other risk factors lists, causing the prolonged length of hospital stays. (15)

As for as angiographic severity is concerned, diabetes has been linked to be a cause of angiographically complex coronary artery disease specifically TVCAD as evident from the results of our study, patients with diabetes and MI have 28% of TVCAD as compared to 16.7% (0.006) in non-diabetics, this aligns with many national and international research studies including registries suggesting an intricate association of the diabetes with advance atherosclerosis through a variety of mechanisms. A Nepali study proved a statistically significant association between diabetes and the prevalence of TVCAD as compared to patients without diabetes. (16)

Thrombus burden in patients with diabetes mellitus has been attributed to the inflammatory process following endothelial injury and dysfunction, and the interplay between the inflammatory mediators and the platelets. Irrespective of the underlying pathophysiology, diabetes in combination with MI poses a high threat regarding prognosis, as patients with diabetes have been demonstrated in a wide range of studies to have heavy thrombus burden (quantified by the TIMI thrombus grading system, TIMI grade 5 as shown by our research.

Myocardial infarction is known to be a leading cause of mortality worldwide. (9), with diabetes on top, is like adding fuel to the fire. The increased MACE is seen in our study, which is in line with many mortality data and mortality trends for MI. In a well-reputed research, it was shown that short- and long-term mortality after MI remains higher in diabetic patients compared with individuals without diabetes. However, the effect sizes were small in this contemporary MI cohort, which meant better CVD treatment facilities and interventions for both groups of patients. (17)

Our Study has some important strengths and limitations. An observational retrospective study design, single center, prone to bias and unexpected confounders; however, MACE is a good outcome for such a type of study, but it does not reflect the true mechanism of adverse outcomes. The main strength of the study is the search for unique characteristic features of diabetes with Acute myocardial infarction-like presentation delays and door-to-balloon time. The sample size, however, didn't meet the calculated number; it provided adequate clinical information, which provided strong statistical power to the study.

Conclusion

Diabetic patients presenting with AMI in a tertiary care cardiac center have distinct clinical characteristics and face significantly worse outcomes as compared to those without diabetes. The absence of chest pain, which is a cardinal symptom in acute myocardial infarction (AMI), leads to delayed presentations to seek medical help. These findings emphasize the need for heightened clinical suspicion, rapid diagnostic strategies, and aggressive early management in diabetic patients to improve prognosis and reduce mortality. Future interventions should focus on enhancing prompt access to care and improving long-term management for this high-risk population.

Declarations

Data Availability statement

All data generated or analysed during the study are included in the manuscript.

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The authors declared the absence of a conflict of interest.

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All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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