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Severity of Coronary Artery Disease in Diabetic and Non-Diabetic Patients Presenting with Non-ST Elevation Myocardial Infarction

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ABSTRACT

Diabetes mellitus accelerates coronary artery disease (CAD) and may worsen outcomes in non–ST–elevation myocardial infarction (NSTEMI). However, data from South Asia comparing lesion complexity and left ventricular function in diabetic vs non-diabetic NSTEMI patients remain limited. **Objectives:** To compare angiographic complexity (SYNTAX score), lesion severity, and left ventricular ejection fraction (LVEF) between diabetic and non-diabetic NSTEMI patients. **Methods:** This analytical cross-sectional study was conducted over 2 months (June -August, 2025) and included 83 consecutive NSTEMI patients (41 diabetics, 42 non-diabetics). All underwent coronary angiography for SYNTAX scoring and echocardiography for LVEF. Continuous variables were compared using t-tests with 95% confidence intervals and Cohen's d, and categorical data were analyzed using Chi-square/Fisher's exact test with Cramér's V. **Results:** Diabetics had significantly higher SYNTAX scores (24.1 ± 5.9 vs 19.2 ± 5.0; mean difference 4.86, 95% CI 2.46–7.25, Cohen's d = 0.87) and more frequent severe stenosis (61.0% vs 33.3%; p=0.012, Cramér's V = 0.28). LVEF was significantly lower in diabetics (46.9 ± 7.6% vs 53.7 ± 6.2%; mean difference −6.84, 95% CI −9.87 to −3.81, Cohen's d = 0.97). Rates of heart failure, arrhythmia, and mortality did not differ significantly (p>0.05). **Conclusions:** Diabetic NSTEMI patients demonstrate greater anatomic complexity and impaired ventricular function compared to non-diabetics, yet short-term outcomes remain comparable when standardized guideline-directed therapy is applied. These findings underscore the importance of early risk stratification and consideration of adjunctive prognostic markers such as inflammatory indices in this high-risk group.

INTRODUCTION

Coronary artery disease (CAD) remains the leading cause of morbidity and mortality worldwide [1, 2], and its burden is amplified in patients with diabetes mellitus (DM). Non–ST–elevation myocardial infarction (NSTEMI) accounts for nearly two-thirds of acute coronary syndrome presentations and is associated with substantial risk of recurrent ischemic events and death [3]. Diabetes is a powerful risk modifier in this setting, as chronic hyperglycemia accelerates atherosclerosis, promotes multi-vessel disease, and contributes to worse left ventricular remodeling after infarction. Understanding the interplay between diabetes and angiographic complexity is crucial to guide optimal revascularization strategies and improve outcomes in this high-risk group [4]. The SYNTAX score, derived from coronary angiography, is an established tool for quantifying the anatomical complexity of CAD and informing revascularization decisions [5]. Comparative data evaluating SYNTAX scores specifically in diabetic vs. non-diabetic NSTEMI cohorts remain sparse in South Asia, despite the region's rising prevalence of both CAD and diabetes [6, 7]. This gap in evidence is notable given that South Asian populations develop CAD at younger ages, with more diffuse and severe lesions, yet region-specific angiographic data are limited. Similarly, left

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ventricular ejection fraction (LVEF) is a key prognostic marker in ACS but has been underreported in local comparative studies. Emerging inflammatory biomarkers such as the systemic immune-inflammation index (SII), calculated from platelet, neutrophil, and lymphocyte counts, have shown independent predictive value for major adverse cardiovascular events in ACS, including NSTEMI with diabetes [8, 9]. However, its application remains largely limited to research settings, and it has yet to be incorporated into routine risk stratification models or clinical guidelines. This represents an opportunity for future work to integrate systemic inflammatory status with angiographic risk scores to refine prognostic assessment. By addressing both anatomical and functional indices, this study aims to provide regionally relevant evidence that may inform decision-making and contribute to improved risk stratification in this high-burden population.

This study aims to compare angiographic complexity as measured by SYNTAX score and left ventricular function between diabetic and non-diabetic NSTEMI patients presenting to a tertiary care center in Pakistan.

METHODS

This analytical, comparative, cross-sectional, observational study was conducted in the Department of Cardiology, Ayub Teaching Hospital, Abbottabad. The study focused on patients presenting with Non-ST Elevation Myocardial Infarction (NSTEMI) and compared angiographic complexity and left ventricular function between diabetic and non-diabetic groups. Institutional ethical approval was obtained (Approval No. RMC-RC-EA/2025/149). The study was conducted over two months, from 4 June to 4 August, 2025. All consecutive eligible patients were enrolled to avoid selection bias. Sample size for comparing two independent means was calculated as: n (per group) = $[2 \times (Z1\text{-}\alpha/2 + Z1\text{-}\beta)^2 \times \sigma^2] \div \Delta^2$ with $Z1\text{-}\alpha/2 = 1.96$ (95% confidence) and $Z1\text{-}\beta = 0.84$ (80% power). Using a pooled standard deviation of $\sigma = 5.5$ (from prior regional data reporting SYNTAX-score variability around 5–6) [10] and an expected difference $\Delta = 4.0$–4.9 points between diabetics and non-diabetics, the required sample size was 30–36 per group (total 60–72). Written informed consent was taken. To ensure adequate precision, 41 diabetics and 42 non-diabetics were included. These assumptions were informed by studies showing greater angiographic complexity in patients with diabetes (SYNTAX framework) and higher angiographic severity in related cohorts [10, 11]. This yielded a minimum sample of 80 participants (40 per group). To strengthen statistical power, 83 patients were finally included (41 diabetics, 42 non-diabetics). Patients aged between 30 and 75 years who presented with Non-ST Elevation Myocardial Infarction (NSTEMI) were considered eligible. NSTEMI was defined based on typical chest pain, electrocardiographic changes (ST-segment depression or T-wave inversion), and elevated cardiac biomarkers. Diabetic status was confirmed either through a known diagnosis, current use of anti-diabetic medication, or an HbA1c value ≥6.5%. Patients were excluded if they had a history of prior coronary artery bypass graft surgery (CABG), severe valvular heart disease, non-ischemic cardiomyopathies, terminal illness, or incomplete angiographic or echocardiographic data that could compromise the analysis. The consecutive sampling technique was used to ensure representativeness of NSTEMI cases during the study period. Demographic and clinical data (age, sex, BMI, smoking, hypertension, dyslipidemia, family history of CAD, previous MI, prior PCI/CABG, CKD) were recorded. Laboratory tests included random blood sugar and HbA1c. Coronary angiography was performed, and the SYNTAX score was used to classify lesion complexity. LVEF was measured using Simpson's biplane method. Two senior interventional cardiologists independently performed SYNTAX scoring while blinded to patients' diabetic status. Disagreements were resolved by consensus. LVEF was measured by two echocardiographers and averaged to minimize inter-observer variation. An inter-class correlation coefficient (ICC = 0.91) from a pilot calibration confirmed high inter-rater reliability. Patients with incomplete angiographic data were excluded (complete-case analysis). For partially missing laboratory variables, pairwise deletion was used to maximize data retention. All data were analyzed using SPSS version 26. Continuous variables such as age, BMI, random blood sugar, HbA1c, SYNTAX score, left ventricular ejection fraction (LVEF), and hospital stay were expressed as mean ± standard deviation (SD). Categorical variables such as gender, smoking status, hypertension, dyslipidemia, family history, previous myocardial infarction (MI), previous PCI/CABG, chronic kidney disease (CKD), vessel involvement, severe stenosis, and in-hospital outcomes (heart failure, arrhythmia, mortality) were presented as frequencies and percentages. Before selecting the appropriate statistical tests, normality of continuous variables was examined using both the Kolmogorov–Smirnov test and the Shapiro–Wilk test, along with inspection of histograms, Q-Q plots, and skewness/kurtosis values. In this study, all key continuous variables (Age, BMI, Random Blood Sugar, HbA1c, SYNTAX Score, LVEF, and Hospital Stay) were found to be normally distributed (Shapiro–Wilk $p>0.05$ for both diabetic and non-diabetic groups). Since the assumptions of normality and homogeneity of variances (tested using Levene's test) were satisfied, comparisons of continuous variables between diabetic and non-diabetic groups were made using the Independent Samples t-test. This parametric test was

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selected because it provides a robust comparison of group means when normality is met. For categorical variables, Chi-square tests were applied; Fisher's exact test was used when expected cell counts were less than 5. Effect sizes were also calculated to enhance the interpretation of results. Cohen's d was reported for continuous variables, with values ≥ 0.8 considered large effects. For categorical variables, Cramér's V was calculated, with values between 0.2 and 0.3 indicating moderate associations. A p-value<0.05 was taken as statistically significant.

RESULTS

Before conducting group comparisons, the distribution of continuous variables was assessed. Normality testing using the Shapiro–Wilk test confirmed that age, BMI, random blood sugar, HbA1c, SYNTAX score, LVEF, and hospital stay were normally distributed (p>0.05 for both groups). Histograms and Q–Q plots confirmed symmetry, and Levene's test verified equality of variances (p>0.05). Therefore, the Independent Samples t-test was used for continuous variables and Chi-square (χ^2) or Fisher's exact test for categorical variables. Effect sizes were calculated (Cohen's d for continuous, Cramér's V for categorical) to quantify association strength. The mean age was higher in diabetics (58.2 ± 8.6) than in non-diabetics (55.9 ± 9.7), but this was not statistically significant (Mean diff = 2.32, 95% CI –1.66 to 6.31, t (81) = 1.16, Cohen's d=0.25, small). BMI and smoking were also similar (p=0.60 and p=0.746). Hypertension was significantly more frequent in diabetics (73.2% vs 47.6%, χ^2 (1) =5.655, p=0.017, Cramér's V=0.26, moderate)(Table 1).

Table 1: Baseline Demographic Characteristics of Diabetic and Non-Diabetic Patients Presenting with NSTEMI (n=83)

Variables	Diabetic (n=41)	Non-Diabetic (n=42)	Statistic (95% CI / Effect Size)	p-Value
Age (Years)	58.2 ± 8.6	55.9 ± 9.7	t(81)=1.16, MD=2.32 (–1.66 to 6.31), d=0.25	0.25
Male Gender (%)	20 (48.8%)	20 (47.6%)	χ^2 (1)=0.011, V=0.012	0.916
BMI (kg/m^2)	26.2 ± 2.9	26.5 ± 3.3	t(81)=–0.52, MD=–0.36 (–1.72 to 1.01), d=0.11	0.60
Smokers (%)	20 (48.8%)	19 (45.2%)	χ^2 (1)=0.105, V=0.035	0.746
Hypertension (%)	30 (73.2%)	20 (47.6%)	χ^2 (1)=5.655, Δ=25.6% (95% CI: 5.0–43.5), V=0.26	0.017
Dyslipidemia (%)	19 (46.3%)	17 (40.5%)	χ^2 (1)=0.291, V=0.059	0.590
Family History CAD (%)	13 (31.7%)	8 (19.0%)	χ^2 (1)=1.759, V=0.146	0.185

Diabetics had markedly higher glycemic indices (very large effect sizes). Previous MI was more frequent in non-diabetics (χ^2 (1)= 5.53, p=0.019)(Table 2).

Table 2: Biochemical Parameters and Clinical History of Diabetic vs. Non-Diabetic NSTEMI Patients

Variables	Diabetic	Non-Diabetic	Statistic / CI / Effect Size	p-Value
RBS (mg/dL)	194.8 ± 46.2	110.0 ± 22.5	t(81)=10.67, MD=84.8 (68.9–100.6), d=2.34	<0.001
HbA1c (%)	8.26 ± 1.85	5.58 ± 0.72	t(81)=8.70, MD=2.68 (2.06–3.29), d=1.91	<0.001
Previous MI (%)	7 (17.1%)	17 (40.5%)	χ^2 (1)=5.53, V=0.26	0.019
Previous PCI/CABG (%)	6 (14.6%)	6 (14.3%)	χ^2 (1)=0.002, V=0.005	0.964
CKD (%)	2 (4.9%)	3 (7.1%)	χ^2 (1)=0.188, V=0.048	0.665

Diabetics had significantly higher SYNTAX scores (t (81) = 4.04, MD=4.86, 95% CI 2.46–7.25, d=0.87, large). Severe stenosis was significantly more common in diabetics (χ^2 (1) = 6.36, p=0.012)(Table 3).

Table 3: Angiographic Severity, Vessel Involvement, and Lesion Characteristics in Diabetic vs. Non-Diabetic NSTEMI Patients

Variables	Diabetic	Non-Diabetic	Statistic / CI / Effect Size	p-Value
SYNTAX Score	24.1 ± 5.9	19.2 ± 5.0	t(81)=4.04, MD=4.86 (2.46–7.25), d=0.87	<0.001
Vessel Disease (Overall)	–	–	χ^2 (2)=3.70, V=0.21	0.157
Single-Vessel	19.5%	38.1%	-	–
Double-Vessel	29.3%	26.2%	OR=2.18 (0.73–6.49)	0.157
Triple-Vessel	51.2%	35.7%	OR=1.89 (0.78–4.56)	0.157
Left Main Disease	7.3%	9.5%	χ^2 (1)=0.13, V=0.04	0.718
Severe Stenosis	61.0%	33.3%	χ^2 (1)=6.36, V=0.28	0.012

LVEF was significantly lower in diabetics (t (81) = –4.49, MD=–6.84, 95% CI –9.87 to –3.81, d=0.97, large). The hospital stay difference was small and non-significant. Outcomes (HF, arrhythmia, mortality) showed weak, non-significant associations (Table 4).

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Table 4: Left Ventricular Function, Length of Hospital Stay, and In-Hospital Outcomes in Diabetic vs. Non-Diabetic NSTEMI Patients

Outcomes	Diabetic	Non-Diabetic	Statistic (95% CI / Effect Size)	p-Value
LVEF (%)	46.9 ± 7.6	53.7 ± 6.2	t(81)=−4.49, MD=−6.84 (−9.87 to −3.81), d=0.97	<0.001
Hospital Stay (days)	4.6 ± 2.1	5.1 ± 1.8	t(81)=−1.23, MD=−0.52 (−1.35 to 0.32), d=0.27	0.221
Heart Failure	4 (9.8%)	7 (16.7%)	χ^2 (1)=0.86, V=0.10	0.353
Arrhythmia	3 (7.3%)	6 (14.3%)	χ^2 (1)=1.04, V=0.11	0.307
Mortality	1 (2.4%)	1 (2.4%)	χ^2 (1)=0.00, V=0.002	0.986

Distribution of SYNTAX scores between groups, showing a rightward shift among diabetics (Cohen's d=0.87, large effect), was done. This study shows the mean ± 95% confidence intervals for random blood sugar, HbA1c, SYNTAX score, LVEF, and hospital stay in diabetic and non-diabetic groups. Diabetic patients had significantly higher random blood sugar, HbA1c, and SYNTAX scores, and significantly lower LVEF compared with non-diabetics (p<0.001 for all). Hospital stay was slightly shorter in diabetics, but this difference was not statistically significant (p=0.221)(Figure 1).

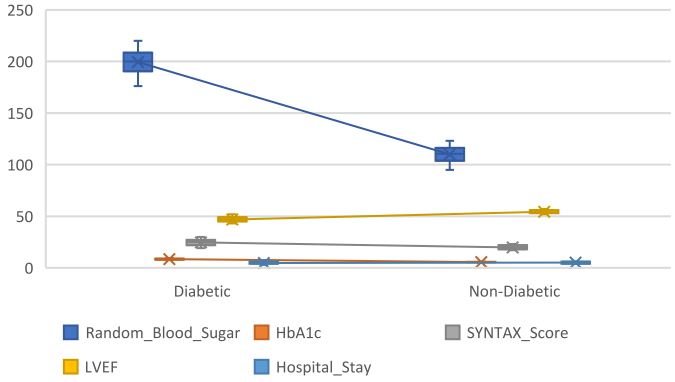

Figure 1: Comparison of Key Continuous Variables between Diabetic and Non-Diabetic NSTEMI Patients

DISCUSSIONS

In this cross-sectional study of NSTEMI patients, diabetes was associated with greater anatomic complexity as reflected by higher SYNTAX scores, a greater proportion of severe stenosis, and lower LVEF, whereas in-hospital complications, including heart failure, arrhythmia, and mortality, were not significantly different between groups. These findings were biologically consistent and in agreement with contemporary evidence from recent cohorts. Our results showed markedly higher random glucose and HbA1c levels in diabetic patients, which supports the strong link between chronic dysglycemia and diffuse, calcific atherosclerosis. Recent work by Ma et al. confirmed that time-in-range metrics are inversely related to coronary artery disease burden in type 2 diabetes [12]. Similarly, Koushki et al. reported that even non-diabetic STEMI patients with elevated HbA1c exhibit higher SYNTAX scores, emphasizing that hyperglycemia worsens lesion complexity across the clinical spectrum [13]. The nearly five-point higher mean SYNTAX score observed in the diabetic group, together with its moderate association with severe stenosis, was therefore both statistically and clinically meaningful. Several studies, including those by Yan et al. and Lawton et al. have demonstrated that SYNTAX and SYNTAX Score II retain strong prognostic value, particularly in diabetics with multi-vessel disease [14, 15]. Abdeldayem et al. reported that patients with high SYNTAX scores had substantially higher twelve-month mortality, underlining the clinical importance of anatomic complexity in diabetics [16]. The difference in mean SYNTAX score seen in our study, which showed a large Cohen's d effect size, was therefore not only statistically significant but also clinically relevant for risk stratification and treatment planning. The lower LVEF in diabetics found in our cohort was expected and consistent with the observations of Cole et al. who reported that diabetic patients presenting with NSTEMI more frequently have moderate-to-severe systolic dysfunction at baseline [17]. Our observed difference in LVEF, with a Cohen's d close to one, is in line with mechanistic studies linking diabetes to microvascular dysfunction, chronic inflammation, and myocardial fibrosis that contribute to depressed contractility. Moreover, LVEF strongly stratifies outcomes across ACS types, with lower LVEF portending higher early and late events [18]. Our study between-group LVEF gap (Cohen's d ≈ 1) was therefore consistent with mechanistic literature by Islam et al. linking diabetes to microvascular dysfunction, inflammation, and myocardial fibrosis that depresses contractility [19]. Both diabetic and non-diabetic patients were managed according to the same institutional NSTEMI protocol, which included dual antiplatelet therapy, anticoagulation, high-intensity statins, and early invasive revascularization. The application of standardized management pathways in both groups likely contributed to the absence of significant differences in short-term outcomes such as heart failure, arrhythmia, and in-hospital mortality, despite more complex coronary anatomy in diabetics. These findings are consistent with contemporary studies by Cole et al. and De-Miguel-Yanes et al. which reported that adherence to guideline-directed ACS management can mitigate early mortality differences between diabetic and non-diabetic patients, although long-term risk remains elevated in diabetics [17, 20]. Our study also demonstrated a trend toward more triple-vessel

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disease in diabetic patients, which did not achieve statistical significance, likely due to sample size limitations. However, the effect size measured by Cramér's V suggested a clinically relevant difference. Larger registries have consistently reported a higher prevalence of multi-vessel and diffuse CAD in diabetics, which influences revascularization strategy and often favors CABG when anatomical complexity is high. Beyond anatomical scores, emerging evidence highlights the value of inflammatory biomarkers such as systemic immune-inflammation index and high-sensitivity CRP, which independently predict major adverse cardiovascular events in diabetic patients with ACS. Incorporating these biomarkers into future studies could refine risk stratification and help target intensive secondary prevention and closer follow-up for the highest-risk patients. Taken together, these findings highlight that diabetes is a marker of higher anatomic complexity and worse left ventricular function, that comparable short-term outcomes can be achieved with standardized evidence-based care, and that future research should integrate angiographic assessment with inflammatory biomarkers to enhance risk prediction and guide tailored therapies.

CONCLUSIONS

Diabetic patients with NSTEMI exhibited higher SYNTAX scores, more severe stenosis, and lower LVEF, confirming greater anatomical and functional disease burden. Despite this, short-term outcomes were similar between groups, likely due to standardized guideline-based management. These results highlight the need for early risk identification, strict control of cardiovascular risk factors, and timely revascularization. Future studies should combine angiographic scores with inflammatory biomarkers to improve risk prediction and personalize care in diabetic NSTEMI patients.

Authors Contribution

Conceptualization: AB
Methodology: AB, MA, MQ, UI, MI
Formal analysis: MK, BA, UI
Writing review and editing: AB, MQ, UI, MI

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

All the authors declare no conflict of interest.

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