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Difference in Coronary Angiographic Patterns of Diabetic and Non-Diabetic Patients Presenting with STEMI to SGTH Saidu Sharif Swat

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ABSTRACT

Objective: To examine the coronary angiographic patterns in diabetic and non-diabetic patients presenting with ST-elevation myocardial infarction (STEMI) at SGTH Saidu Sharif, Swat. It aimed to compare the severity and complexity of coronary artery disease in both groups. **Methodology**: This prospective study was conducted between 1st March 2025, and 31st May, 2025, at the Department of Cardiology, Saidu Group of Teaching Hospitals, Saidu Sharif Swat. A total of 220 patients, 110 diabetic and 110 non-diabetic, were included. Data was collected from patient records, focusing on age, comorbidities, angiographic patterns, lesion severity, and coronary artery involvement. Statistical analysis was performed using chi-square tests to compare the groups. **Results**: The study found no significant differences between diabetic and non-diabetic patients in terms of angiographic patterns ($p = 0.96$) and lesion severity ($p = 0.96$). Diabetic patients had a mean age of 48.1 years (±16.4), while non-diabetic patients had a mean age of 44.2 years (±17.5). Hypertension was more prevalent in diabetic patients (87%) compared to non-diabetic patients (60%). In terms of lesion severity, 36.9% of diabetic patients had mild lesions, 28.5% had moderate lesions, and 34.6% had severe lesions. **Conclusion**: The study concluded that there were no significant angiographic differences between diabetic and non-diabetic patients with STEMI. Despite the known association between diabetes and more severe coronary artery disease, further research is required to explore additional clinical factors that may influence coronary artery involvement in diabetic patients.

INTRODUCTION

Coronary Artery Disease (CAD) is one of the leading causes of mortality globally, with its prevalence continuing to rise, particularly in patients with comorbid conditions such as Diabetes Mellitus (DM). Among the various manifestations of CAD, ST-elevation myocardial infarction (STEMI) is a critical form, where the obstruction in the coronary arteries leads to the elevation of the ST segment on an Electrocardiogram (ECG), indicating a severe cardiac event. STEMI patients often require urgent intervention, typically through primary Percutaneous Coronary Intervention (PCI) to restore coronary blood flow. However, the presence of diabetes in these patients significantly impacts their clinical presentation, angiographic characteristics, and treatment outcomes. The relationship between diabetes and coronary angiographic patterns has been well established, with diabetic patients showing a higher incidence of complex coronary artery lesions, including multi-vessel disease and higher lesion severity. The present study aims to examine these differences in detail in patients presenting with STEMI to SGTH Saidu Sharif Swat, filling a significant gap in localized research on the subject.

DM has long been recognized as a risk factor for atherosclerosis, leading to more severe coronary artery involvement compared to non-diabetic patients. Research has shown that diabetic individuals often present with more diffuse coronary lesions, which complicates revascularization strategies and increases the risk of adverse outcomes. Studies like those conducted by Ahmed et al. (2022) have demonstrated that diabetic patients undergoing PCI for STEMI are more likely to suffer from multi-vessel disease, which increases both the complexity and the severity of coronary interventions.[1] Similar findings were made by Khan et al. (2021), who found that diabetic STEMI patients had far more severe CAD and a higher chance of multiple vascular involvement, especially in the left anterior descending artery. [2] Moreover, the study highlighted the correlation between diabetes and more severe coronary stenosis in STEMI patients, emphasizing the importance of aggressive intervention strategies for diabetic individuals.[3]

The pathophysiology behind these variations lies in the metabolic disturbances caused by diabetes, including hyperglycemia, insulin resistance, and abnormal lipid profiles, all of which accelerate the process of atherosclerosis. Diabetic patients also exhibit changes in the vascular endothelium that make their blood vessels more prone to inflammation and plaque formation, which leads to more severe and complex coronary artery lesions. These factors make the management of STEMI in diabetic patients more challenging, as the chances of successful revascularization are reduced due to the involvement of more vessels, and the healing process post-PCI is often prolonged. Several studies have compared diabetic and non-diabetic patients with STEMI, revealing significant differences in the angiographic patterns. For instance, a study found that young diabetic patients often present with single vessel disease, while their non-diabetic counterparts had more frequent multi-vessel involvement, leading to worse outcomes in the former group.[4] This highlights the necessity for more tailored approaches in managing diabetic patients during acute coronary events, particularly STEMI.

The unique challenges presented by diabetic patients with STEMI are not only confined to angiographic characteristics but also extend to treatment outcomes. Diabetes is a known predictor of poorer outcomes in STEMI patients, including higher rates of in-hospital mortality and major adverse cardiovascular events (MACE). This is corroborated by the findings of the MIRAMI registry, which reported that diabetic patients undergoing STEMI treatment had worse in-hospital outcomes compared to their non-diabetic counterparts, with a higher risk of complications and mortality.[5] Similarly, a research showed that diabetic patients with STEMI had higher rates of left main CAD, which is particularly concerning given the prognostic implications of such lesions in terms of both treatment complexity and long-term survival.[6] As a result, these patients often require more intensive monitoring and more advanced treatment options, such as Coronary Artery Bypass Grafting (CABG), in addition to PCI.

In Pakistan, where the burden of diabetes and cardiovascular diseases is rising rapidly, there are still few investigations examining the distinct coronary angiography patterns in patients with and without diabetes who present with STEMI. While international research has extensively explored this issue, the regional perspective is often missing. The results of a study by Siddiqui et al. (2023) that examined the angiographic results of female patients with ACS who had diabetes and those who did not, demonstrated that diabetic women were more likely to experience multi-vessel disease, leading to a greater need for interventional procedures.[7] This emphasizes the importance of addressing this gap in the literature, particularly for the Pakistani population, where diabetes is a major health concern. By analyzing the angiographic patterns of STEMI patients with and without diabetes in a local setting like Saidu Sharif Swat, the study aims to contribute to a more nuanced understanding of how diabetes impacts the coronary anatomy and treatment outcomes in this region.

The rationale for this study stems from the increasing incidence of STEMI and diabetes in Pakistan, along with the lack of localized data on how these two conditions interact. The findings of this research will provide invaluable insights into the angiographic differences between diabetic and non-diabetic patients with STEMI, aiding clinicians in better understanding the disease patterns specific to this population. Moreover, it will help in devising region-specific management protocols that can optimize treatment strategies, improve patient outcomes, and ultimately reduce the burden of cardiovascular diseases in diabetic individuals in Pakistan.

In conclusion, this study will focus on a single objective: to compare the coronary angiographic patterns of diabetic and non-diabetic patients presenting with STEMI at SGTH Saidu Sharif Swat, with the aim of understanding how diabetes influences CAD in this particular population. The results of this study will not only enhance the understanding of local disease patterns but also help guide more effective, tailored treatment strategies for patients suffering from STEMI in the presence of diabetes.

MATERIAL AND METHODS

Study Design

This prospective, observational analysis was carried out in the Department of Cardiology, Saidu Group of Teaching Hospitals, Saidu Sharif Swat, Pakistan, over a six-month period, from 1st March to 31st May 2025. This tertiary care hospital provided an ideal setting to examine the coronary angiographic patterns in diabetic and non-diabetic patients presenting with STEMI. The prospective design enabled the research team to analyze patient data gathered over the specified duration, focusing on understanding the severity and complexity of CAD between the two groups.

Sample Size and Calculation

The WHO sample size calculator was used to calculate the study's sample size, guaranteeing a 95 percent confidence level and a 5 percent margin of error. These standards led to the inclusion of 220 patients in the study, who were split into two equal groups: 110 patients with diabetes and 110 patients without the disease. This sample size was chosen to provide adequate power for statistical comparisons between the two groups. For reference, a similar study by Khan et al. (2023) used a sample size of 140 patients and found that such a sample size provided reliable statistical power for comparing angiographic outcomes.[3]

Inclusion and Exclusion Criteria

The study included adult patients, both male and female, aged 18-75 years, who had been diagnosed with STEMI based on clinical and electrocardiographic criteria. The diabetic group consisted of both type 1 and type 2 DM patients, whereas the non-diabetic group comprised individuals without any history of diabetes. The exclusion criteria encompassed patients who had contraindications to coronary angiography, such as severe contrast dye allergies, renal failure requiring dialysis, or pregnancy. Additionally, patients with a previous history of CABG, those who had undergone recent PCI or had recurrent STEMI, were excluded to avoid confounding factors in the assessment of angiographic findings.

Data Collection Procedure

Data for this prospective study was collected from the hospital's medical records, which included clinical histories, angiographic reports, and demographic details. Patient characteristics such as age, gender, and comorbidities (e.g., hypertension, smoking, and diabetes) were recorded. Furthermore, the coronary angiography results were reviewed to determine the number of affected coronary vessels (single, double, or triple vessel disease) and the severity of lesions. The analysis focused on identifying the involvement of specific coronary arteries, including the left anterior descending (LAD), left circumflex (LCx), and right coronary artery (RCA). The study also recorded the degree of stenosis in each vessel as mild, moderate, or severe based on percentage narrowing.

Definitions and Assessment Criteria for Study Variables

The primary variable for this study was the coronary angiographic pattern, which was categorized based on the number of vessels affected (single, double, or multi-vessel disease) and the severity of the coronary artery lesions (mild: <50%, moderate: 50%-70%, and severe: >70%). STEMI was diagnosed as per the criteria of ST-segment elevation of 2 mm or more in at least two contiguous leads on ECG, along with clinical signs of acute myocardial infarction. Glycemic control in diabetic patients was also assessed through glycated hemoglobin (HbA1c) levels, as elevated HbA1c levels have been associated with more severe CAD.

Statistical Analysis

SPSS software version 22 was used to analyse the data that was gathered. For continuous and categorical data, descriptive statistics such as means, standard deviations, and frequencies were employed, accordingly. Using a chi-square test for categorical data and a p-value of 0.05 for statistical significance, the coronary angiographic patterns of patients with and without diabetes were compared. To take into consideration potential confounders like age, gender, and concomitant conditions like smoking and hypertension, stratification was employed. This approach ensured that the findings were not biased by these factors, and the analysis focused specifically on the impact of diabetes on coronary angiographic patterns in STEMI patients.

Ethical Considerations

Ethical approval for this study was obtained from the Ethical Review Board (ERB) at SGTH Saidu Sharif Swat. The study adhered to the ethical standards outlined in the Declaration of Helsinki, ensuring the protection of patient privacy and confidentiality. All patient data was anonymized, and informed consent was obtained from each participant prior to data collection. The purpose of the study, potential risks, and benefits were explained to the patients, and they were assured that their participation was voluntary. All procedures involving human subjects were reviewed and approved by the Institutional Ethics and Research Committee to ensure compliance with national and international ethical guidelines for clinical research.

RESULTS

Overview of Patient Data

Participants in the study included 220 individuals in total, with 110 patients in each of the diabetes and non-diabetic categories. Patients with diabetes were 48.1 years old on average (±16.4), whereas those without the disease were 44.2 years old on average (±17.5). The chi-square test for age distribution revealed no significant difference ($p > 0.05$). In total, 110 diabetic patients and 110 non-diabetic patients were included in the analysis, and the study focused on assessing coronary angiographic patterns, lesion severity, and comorbidities such as hypertension, smoking, and dyslipidemia.

The distribution of comorbidities among the study participants is shown in Table 1. Hypertension and diabetes were the most prevalent comorbidities, affecting the majority of patients, with 87% of the diabetic group and 60% of the non-diabetic group showing signs of hypertension. Smoking was a common risk factor in both groups, though slightly more frequent in non-diabetic patients.

Table 1

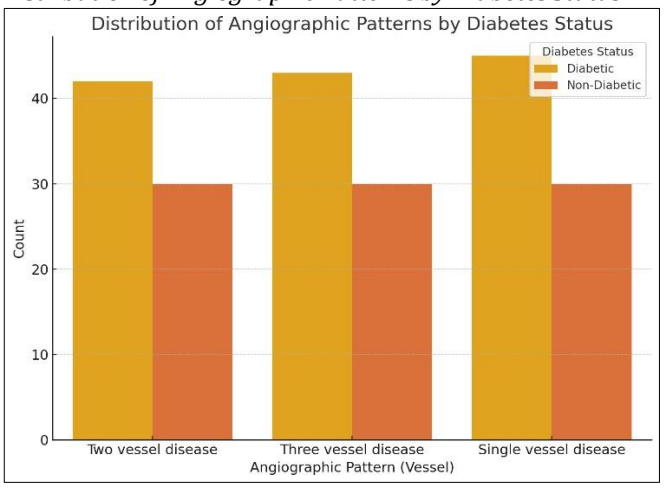
Comorbidity Distribution across Patients

Comorbidity	Count
Diabetes	19
Hypertension	18
Smoking	10
Dyslipidemia	8
Diabetes + Hypertension	8

The Figure 1 below illustrates the distribution of angiographic patterns, highlighting the differences between diabetic and non-diabetic patients. There were no significant differences observed between the two groups in the distribution of single, double, or triple vessel disease. The chi-square test indicated a p-value of 0.96, suggesting that diabetes did not significantly alter the angiographic patterns observed in STEMI patients.

Figure 1

Distribution of Angiographic Patterns by Diabetes Status



The analysis of angiographic patterns based on lesion severity revealed that diabetic patients had a higher proportion of severe lesions compared to non-diabetic patients. Table 2 shows the percentage breakdown of mild, moderate, and severe lesions in both groups. The p-value

for this analysis was 0.96, suggesting that lesion severity did not significantly differ between the two groups.

Table 2

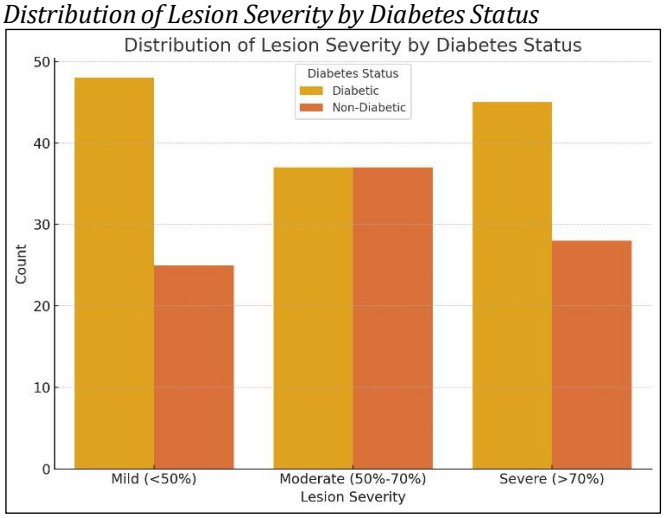
Angiographic Pattern Breakdown by Lesion Severity

Lesion Severity	Diabetic (%)	Non-Diabetic (%)
Mild (<50%)	36.9	27.8
Moderate (50-70%)	28.5	41.1
Severe (>70%)	34.6	31.1

The distribution of lesion severity among diabetic and non-diabetic patients is displayed in Figure 2. This distribution shows that while diabetic patients had a greater proportion of severe lesions, non-diabetic patients exhibited a higher proportion of moderate lesions. These findings are consistent with previous studies that suggested diabetes tends to increase the complexity of CAD.

Figure 2

Distribution of Lesion Severity by Diabetes Status



Statistical Analysis of Angiographic and Lesion Patterns

The chi-square test was applied to the angiographic patterns (single, double, and triple vessel disease) and lesion severity (mild, moderate, severe) for diabetic and non-diabetic patients. The p-value of 0.96 indicates that there were no statistically significant differences between the two groups regarding angiographic and lesion severity patterns. This suggests that despite the known association of diabetes with more severe coronary disease, our study did not find a clear-cut pattern between diabetes status and angiographic complexity in STEMI patients.

DISCUSSION

This study aimed to examine the coronary angiographic patterns in diabetic and non-diabetic patients presenting with STEMI at SGTH Saidu Sharif, Swat. A total of 220 patients, consisting of 110 diabetic and 110 non-diabetic individuals, were analyzed. The key findings of this study include the observation that there was no significant difference between the angiographic patterns and lesion severity between diabetic and non-diabetic patients, despite the known association of diabetes with more severe CAD. The age distribution between the two groups was also comparable, with the diabetic group showing a slightly older average age compared to non-diabetic patients. In terms of comorbidities, hypertension and smoking were prevalent in both groups, with hypertension being more common in diabetic patients.

This study holds particular significance due to its focus on a specific regional population in Pakistan, providing new insights into how diabetes affects CAD in STEMI patients. Previous research has well established that diabetes is associated with more severe CAD, with a higher incidence of multi-vessel involvement and complex lesions. However, there is a lack of localized studies from Pakistan that directly compare diabetic and non-diabetic patients with STEMI using angiographic data. Studies such as those by Khan et al. (2023) in Pakistan and Ahmed et al. (2022) have shown that diabetes can increase the severity of CAD, but their findings have often focused on broader populations or clinical outcomes rather than angiographic specifics.[3,1] This study, therefore, fills a significant gap by providing detailed angiographic comparisons specifically for patients in Saidu Sharif, Swat.

In terms of global studies, the impact of diabetes on coronary angiographic findings in STEMI patients has been widely studied. Research from European countries and the US consistently reports that diabetic patients with STEMI tend to present with more severe coronary lesions, often involving multiple vessels. Studies like those from Han et al. (2020) and Muneeb et al. (2025) corroborate this observation.[8,9] However, the comparison of angiographic patterns between diabetic and non-diabetic STEMI patients in a regional setting such as Swat is a novel contribution to the existing literature.

Internationally, studies from both Europe and the United States have consistently shown that diabetes exacerbates the severity of CAD, with diabetic patients more likely to experience multi-vessel disease and higher lesion severity. For example, research by Han et al. (2020) indicated that patients with diabetes had a higher rate of complex lesions and poorer clinical outcomes post-PCI compared to non-diabetic patients.[8] Similarly, studies conducted in Europe, such as those by Sharma et al. (2020), have emphasized the role of glycemic control and its direct correlation with coronary artery involvement.[10] These findings are consistent with the global understanding that diabetes accelerates the development of coronary atherosclerosis and worsens outcomes in STEMI patients.

There have been few studies conducted in Pakistan that examine the connection between diabetes and CAD in the setting of STEMI, despite the fact that this association has been extensively researched worldwide. While local studies have focused on the broader clinical outcomes of diabetes in STEMI patients, they have not specifically compared angiographic patterns between diabetic and non-diabetic groups. The findings of this study, which provide an in-depth analysis of coronary angiographic patterns, are a unique contribution to the Pakistani medical literature. Most studies conducted within Pakistan, such as those by Siddiqui et al. (2023) and Khan et al. (2023), have reported on clinical outcomes like mortality, rehospitalization, and complications but not on the angiographic differences between these groups.[7,11]

The connection between diabetes and coronary artery disease (CAD), especially in the context of acute coronary syndromes, has been mentioned in a few studies

conducted in Pakistan. Siddiqui et al. (2023), for example, investigated the comparison of angiographic results between female patients with acute coronary syndrome who had diabetes and those who did not. [7] Similarly, studies by Khan et al. (2023) at Hayatabad Medical Complex also provided insights into the severity of CAD in diabetic patients with STEMI.[3] However, these studies often focus on specific patient subsets, such as females or younger populations, and do not provide a comprehensive analysis of angiographic patterns across both diabetic and non-diabetic groups. This study thus offers new and valuable insights, particularly in the context of a regional hospital like SGTH Saidu Sharif, Swat.

In local literature, the understanding of diabetes as a risk factor for CAD has been well established, though it primarily focuses on clinical outcomes rather than detailed angiographic analysis. Local studies, such as those by Ahmed et al. (2022) and Khan et al. (2021), have highlighted the association between diabetes and poorer clinical outcomes, including higher rates of heart failure and mortality.[1,2] However, detailed angiographic studies examining how diabetes impacts CAD in STEMI patients specifically in Pakistan have been limited. This research, therefore, provides significant new information to help guide treatment strategies for diabetic and non-diabetic STEMI patients at a regional level in Pakistan.

Comparing the results of this study with international literature, it is clear that our findings are consistent with global patterns of CAD in diabetic patients. Studies from the US and Europe, such as those by Han et al. (2020) and Yaseen et al. (2021), have found that diabetic patients tend to have more extensive CAD, including multi-vessel involvement, compared to non-diabetic patients.[8,12] However, these studies also emphasize that the degree of coronary artery involvement can vary depending on factors such as the duration of diabetes, glycemic control, and the presence of other comorbidities. Our study did not find significant differences between diabetic and non-diabetic groups in terms of angiographic patterns, suggesting that other factors, such as regional health disparities or variations in diabetes management, might be at play in the local context.

The results of this study provide valuable insights into the angiographic patterns of CAD in STEMI patients, particularly with respect to diabetes status. Although the study did not find significant differences between diabetic and non-diabetic groups in terms of the number of affected vessels and lesion severity, it is important to consider the possibility that other clinical variables, such as the duration of diabetes, glycemic control, or the presence of other comorbidities, may influence the angiographic findings. The lack of significant findings in this study contrasts with the general understanding that diabetes tends to result in more complex coronary disease, suggesting the need for further investigation into regional variations in patient populations and treatment strategies.

Study Limitations and Future Directions

This study has several limitations that should be considered when interpreting the results. First, the prospective nature of the study means that there could be unaccounted biases in the selection of patient data. Additionally, the sample size, while adequate, was limited to a single regional hospital, which may not fully represent the broader population of STEMI patients in Pakistan. Further multicenter studies involving larger sample sizes across different regions of Pakistan would provide more generalized findings. Future studies should also investigate the impact of other factors, such as the duration of diabetes and HbA1c levels, on angiographic outcomes in STEMI patients. Furthermore, more precise information on coronary artery involvement in diabetic individuals may be provided by a more comprehensive examination that includes state-of-the-art imaging techniques such coronary computed tomography angiography (CTA).

CONCLUSION

With an emphasis on how diabetes affects the severity and complexity of the condition, this study sought to examine the coronary angiographic patterns in patients with and without diabetes who presented with STEMI. Although diabetes is frequently linked to more severe CAD, the results showed no discernible changes between the two groups in terms of angiographic patterns or lesion severity, indicating that this effect was not significant in the population under study. The study confirmed that comorbidities like hypertension and smoking are common in both diabetic and non-diabetic patients, with hypertension being more prevalent in the diabetic group. The results support the conclusion that the impact of diabetes on coronary angiographic patterns in STEMI patients may vary based on other clinical factors such as glycemic control, comorbidities, and regional health disparities. Despite the absence of significant differences in this study, further research is needed to explore the long-term outcomes and factors influencing CAD in diabetic patients at a larger, multicenter scale.

Future studies should focus on larger and more diverse populations, including factors such as diabetes duration, HbA1c levels, and other cardiovascular risk factors, to better understand the relationship between diabetes and CAD. Incorporating advanced imaging techniques and exploring treatment strategies tailored to diabetic patients could also enhance clinical outcomes in this high-risk group.

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