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EFFECT OF DIABETES MELLITUS ON CLINICAL OUTCOMES AND ST SEGMENT RESOLUTION IN PATIENTS WITH ST SEGMENT ELEVATION MYOCARDIAL INFARCTION TREATED WITH STREPTOKINASE

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ABSTRACT

Background: Diabetes mellitus (DM) has a major impact on clinical outcomes for coronary artery disease (CAD), which continues to be a major source of morbidity and mortality worldwide. Diabetes mellitus (DM) worsens atherosclerosis and hinders myocardial recovery in patients with ST-segment elevation myocardial infarction (STEMI), which may have an impact on the results of streptokinase thrombolysis. **Aim:** The study aimed to examine the clinical outcomes and ST-segment resolution in diabetic STEMI patients receiving streptokinase treatment patients. **Materials and Method:** This cross-sectional study examined the clinical outcomes and ST-segment resolution of 50 diabetic and 50 non-diabetic STEMI patients receiving streptokinase treatment at Mymensingh Medical College Hospital between December 2016 and November 2017. Direct interviews, Electrocardiographs (ECGs), echocardiograms, and laboratory tests were all used in the data collection process. There were three categories for ST-segment resolution: unsuccessful (<30%), partial (30–70%), and complete (>70%). The statistical analysis was conducted using SPSS version 20, with a significance threshold of $p<0.05$. **Results**: The diabetes group had greater rates of unsuccessful resolution (42% vs. 12%, $p=0.001$) and considerably lower rates of complete ST-segment resolution (28% vs. 52%, $p=0.001$). Diabetics had a considerably reduced mean left ventricular ejection fraction (LVEF) (46.54±10.17 vs. 51.64±8.48, $p=0.008$). Longer hospital stays (60% vs. 40%, $p=0.006$) and cardiogenic shock (44% vs. 24%, $p=0.005$) were more common in diabetics. Overall, diabetic patients fared poorly, even though anterior myocardial infarction was the most frequent site in both groups. These results are consistent with earlier studies that linked diabetes mellitus to worse cardiac recovery and systemic outcomes following thrombolysis.**Conclusion:** In STEMI patients receiving streptokinase treatment, diabetes mellitus substantially compromises ST-segment resolution, myocardial function, and clinical results. For diabetes patients to recover as best they can, tailored interventions are crucial. To confirm these results and investigate more sophisticated diagnostic and treatment strategies, more multicenter research is required.

Keywords: Coronary artery disease, ST-segment elevation myocardial infarction, Diabetes mellitus, Streptokinase.

INTRODUCTION

Coronary artery disease (CAD) is a pathological condition marked by the buildup of atheromatous plaques in the coronary artery walls, resulting in diminished blood flow to the heart.

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It has emerged as a significant global health issue, representing the foremost cause of illness and mortality globally [1,2]. Acute coronary syndrome (ACS), encompassing diseases such as ST-Segment Elevation Myocardial Infarction (STEMI), Non-STEMI, and Unstable Angina (UA), accounts for a substantial percentage of cardiovascular mortality in both industrialized and developing nations. By 2020, ischemic heart disease (IHD) is anticipated to be the primary cause of global disability [3]. In Bangladesh, CAD has emerged as a significant strain on healthcare services, with research indicating a prevalence rate of 6.56 per 1,000 individuals [4,5], and acute myocardial infarction identified as a primary cause of mortality, particularly among younger populations [6,7].

Diabetes mellitus (DM) is a significant risk factor for CAD, since it substantially contributes to the establishment and progression of atherosclerosis, hence serving as a robust predictor of CAD[8]. Diabetes, whether of type 1 or type 2, expedites the advancement of atherosclerosis and heightens the likelihood of coronary incidents. Diabetic individuals frequently exhibit silent myocardial ischemia, lacking awareness of ischemic discomfort, which markedly increases the risk of sudden cardiac death. Research indicates that diabetes roughly doubles the mortality risk after an acute myocardial infarction in comparison to non-diabetic individuals [9].

The primary treatment objective in STEMI care is the prompt recanalization of the infarct-related artery, generally accomplished via thrombolysis or percutaneous coronary intervention (PCI). Streptokinase is one of the most frequently utilized thrombolytic medicines. The effectiveness of thrombolytic therapy can be evaluated by analyzing ST segment resolution on a 12-lead electrocardiogram (ECG) 90 minutes post-streptokinase infusion[10]. Successful epicardial recanalization is essential; nevertheless, microvascular flow, shown by ST segment resolution, offers significant prognostic insights, demonstrating myocardial healing that extends beyond the findings of coronary angiography[11].

This study investigates the impact of diabetes mellitus on clinical outcomes and ST segment resolution in patients with ST segment elevation myocardial infarction treated with streptokinase. This study aims to ascertain if diabetes affects the degree of ST segment resolution, a critical marker of cardiac reperfusion and recovery after thrombolytic therapy.

MATERIALS AND METHOD

From December 2016 to November 2017, the Department of Cardiology at Mymensingh Medical College Hospital in Mymensingh carried out this descriptive cross-sectional study. With or without diabetes mellitus, the study sought to assess the clinical outcomes and ST segment resolution in individuals suffering from ST elevation myocardial infarction (STEMI). Purposive sequential sampling was used to choose 50 diabetic and 50 non-diabetic STEMI patients out of the 100 patients that were enrolled.

All STEMI patients who presented within 12 hours of the beginning of chest discomfort and were deemed eligible for thrombolysis met the inclusion criteria. Patients with left bundle branch block, previous coronary procedures, anticoagulant or antiplatelet medication, thrombolysis contraindications, or refusal to participate were among the exclusion criteria.

ST elevation at the J point in at least two contiguous leads on the ECG was used to diagnose STEMI. Resolution was classified as complete, partial, or failed based on the percentage decrease in ST elevation following 90 minutes of streptokinase infusion. ST segment measurement was done manually using calipers. Lead involvement in the ECG was used to identify the infarction site.

Direct in-person interviews and blood samples for laboratory tests including Troponin-I, lipid profiles, blood glucose, and glycated hemoglobin (HbA1c) were among the methods used to collect data. For additional evaluation, ECGs and echocardiograms were also conducted. Hypertension, diabetes, smoking, family history, lipid profile, Troponin-I, blood sugar, HbA1c, ST segment resolution, ST segment elevation, and left ventricular ejection fraction (LVEF) were among the factors included in the study.The study was approved by the Ethical Review Committee of Mymensingh Medical College Hospital. Written informed consent was obtained from all patients or their legal guardians. Confidentiality and anonymity were strictly maintained.

SPSS version 20 was used to analyze the data; continuous variables were represented by mean and standard deviation, while categorical variables were represented by frequency and percentage. Student's t-test and chi-square tests were used for statistical analysis; a *p*-value of less than 0.05 is regarded as statistically significant.

RESULTS

Table 1: Distribution of the respondents according to their age and sex

Age in years	Group-A STEMI with DM (n=50)		Group-B STEMI Without DM (n=50)		*p* value
	Count	%	Count	%	
35-45	7	14.0	14	28.0	0.368NS
46-55	17	34.0	16	32.0	
56-65	10	20.0	8	16.0	
>65	16	32.0	12	24.0	
Mean±SD	59.44±9.95		54.52±11.95		
Male	29	58.0	44	88.0	0.001**
Female	21	42.0	6	12.0	

NS means not-significant ($p>0.05$); ** means significant at 1% level ($p<0.01$); Data were analyzed using chi-square test; n-number of patients in each group.

Table 1 shows that the mean age was 59.44 in Group-A and 54.52 in Group-B. The difference between groups was not statistically significant ($p>0.05$). Data were evaluated using t-test. The highest number of respondents were male in both groups (Group-A: 58%; Group-B: 88%) male. Two groups showed a significant difference ($p<0.05$).

Table 2: Distribution of the respondents according to risk factors

Risk factors		Group-A STEMI with DM (n=50)		Group-B STEMI without DM (n=50)		P value
		Count	%	Count	%	
Smoking	Yes	36	72.0	24	48.0	0.005**
	No	14	28.0	26	52.0	
HTN	Yes	33	66.0	18	36.0	0.001**
	No	17	34.0	32	64.0	
Dyslipidemia	Yes	35	70.0	20	40.0	0.003**
	No	15	30.0	30	60.0	
Family History of pre mature of CAD	Yes	15	30.0	12	24.0	0.499 NS
	No	35	70.0	38	76.0	

** means significant at 1% level ($p<0.01$); NS means not-significant ($p>0.05$); n=number of patients in each group

DM effect on STEMI patient treated with streptokinase

As is depicted in Table 2 ,in Group-A 36(72%) had smoking history, 33(66%) were hypertensive, 35(70%) were dyslipidemic and 15(30%) had family history of premature CAD; On the other hand in Group-B 24(48%) were smoker, 18(36%) were hypertensive, 20(40%) were dyslipidemic and 12(24%) had family history of premature CAD. There was an association found between smoking, hypertension, dyslipidemia and two groups (p<0.05).

Table 3: Distribution of the respondents according to site of myocardial infraction, ST segment resolution and Left ventricular ejection fraction (LVEF)

Site of myocardial infarction	Group-A STEMI with DM (n=50)		Group-B STEMI without DM (n=50)		*p* value
	Count	%	Count	%	
Anterior MI	21	42.0	20	40.0	0.786 NS
Anteroseptal MI	7	14.0	5	10.0	
Inferior MI	18	36.0	17	34.0	
Lateral MI	4	8.0	8	16.0	
ST segment resolution					
>70% (Complete)	14	28.0	26	52.0	0.001
30-70% (Partial)	15	30.0	18	36.0	0.163
<30% (Failed)	21	42.0	6	12.0	0.001
Left ventricular ejection fraction (LVEF)					
≤25	1	2.0	-	-	0.008 **
26-40	11	22.0	5	10.0	
41-49	16	32.0	14	28.0	
≥50	22	44.0	31	62.0	
Mean±SD	46.54±10.17		51.64±8.48		

NS means not-significant (p>0.05);** means significant at 1% level (p<0.01);n=number of patients in each group

Anterior MI was the most prevalent in both groups, with a similar distribution of MI sites (42% in Group A vs. 40% in Group B, p = 0.786). Group B's ST segment resolution was substantially higher than Group A's, with 52% achieving complete resolution as opposed to 28% (p = 0.001). On the other hand, Group A had a considerably higher rate of unsuccessful resolution (<30%) (42% vs. 12%, p = 0.001). Group B showed superior cardiac function in terms of LVEF, with a greater percentage of participants reaching LVEF ≥50% (62% in Group B vs. 44% in Group A). Additionally, Group B's mean LVEF (51.64 ± 8.48) was substantially greater than Group A's (46.54 ± 10.17, p = 0.008) (Table 3).

Table 4: In-Hospital complications in Group-A (STEMI with DM) and Group-B (STEMI without DM) patients received streptokinase infusion.

		Group-A STEMI with DM (n=50)		Group-B STEMI without DM (n=50)		*p* value
		Count	%	Count	%	
ALVF	Yes	15	30.0%	14	28.0%	0.826 NS
	No	35	70.0%	36	72.0%	
Cardiogenic shock	Yes	22	44.0%	12	24.0%	0.005 **
	No	28	56.0%	38	76.0%	
Arrhythmia	Yes	7	14.0%	6	12.0%	0.766 NS
	No	43	86.0%	44	88.0%	
Prolong Hospital Stay	Yes	30	60.0%	20	40.0%	0.006 **
	No	20	40.0%	30	60.0%	

NS means not-significant (p>0.05);n=number of patients in each group; ALVF=acute left ventricular failure

Table 4 shows that during hospital stay, among the notable complications, acute left ventricular failure (ALVF) in 15 (30%) and 14 (28%), shock in 22 (44%) and 12 (24%), arrhythmia was noted in 7 (14%) and 6 (12%) STEMI patients with DM and STEMI patients without DM respectively. Hospital stay was prolonged in 30 (60%) STEMI with DM and 20 (40%) in STEMI without DM patients. Data were analyzed using chi-square test.

DISCUSSION

When streptokinase is used to treat ST segment elevation myocardial infarction (STEMI), diabetes mellitus has a substantial impact on both clinical outcomes and ST segment resolution. According to Shah et al., who documented comparable age disparities in Pakistani populations, the mean age of diabetes STEMI patients in this study was 59.44 years, while the mean age of non-diabetics was 54.52 years[12]. Similar to findings by Khan et al. in Bangladesh, the gender distribution showed a male predominance in all groups, but it was much larger in non-diabetics (88% male) than in diabetics (58% male)[13].

In line with Khan et al., risk variables such smoking, hypertension, and dyslipidemia were more common in diabetic individuals, emphasizing the metabolic abnormalities linked to the disease. After streptokinase therapy, the diabetic group showed noticeably worse ST segment resolution, with only 28% obtaining complete resolution as opposed to 52% in the non-diabetic group[13]. This observation is consistent with research by Shah et al. , who found that diabetics had much greater rates of failed resolution (68.4% vs. 18.2%; p<0.001) and much lower rates of complete resolution (19% vs. 50.4%; p<0.001)[12]. The intricacy of ST resolution as a marker is highlighted by Pourmousavi et al., who reported no significant difference when a lower threshold (≥50% resolution) was applied[14]. Other studies support these findings[3,9,15,16].

Patients with diabetes had a significantly lower mean ejection fraction (EF) (46.54±10.17) than those without the disease (51.64±8.48). This finding is in line

with previous study which found that diabetes is a predictor of decreased myocardial function[17]. In line with Iqbal et al., who found that diabetics had a 4.2-fold increased risk of arrhythmic consequences, diabetic patients also had a higher incidence of cardiogenic shock and arrhythmias. Ventricular tachycardia and bradyarrhythmias, which indicate poor myocardial recovery and reperfusion, were prevalent in diabetics, especially in those with failed ST resolution[16].

Due to greater complication rates (defined as >5 days for inferior MI and >7 days for anterior MI), diabetes individuals' hospital stays were noticeably longer. These results highlight how diabetes negatively affects cardiac recovery and systemic outcomes in STEMI patients receiving streptokinase treatment, highlighting the need for specialized therapeutic approaches to reduce these risks.

LIMITATIONS

The generalizability and precision of the findings may be impacted by the limitations of the study, which include its single-center design, relatively small sample size, and dependence on manual ST segment measurements. In order to validate these findings and investigate potential therapies to improve reperfusion efficacy and reduce the negative consequences of diabetes in STEMI, it is necessary to conduct further multicenter studies that utilize improved imaging techniques and involve populations that are larger and more diverse.

CONCLUSION

In this study of STEMI patients treated with streptokinase, those with diabetes mellitus had poorer clinical outcomes compared to non-diabetic patients. Specifically, diabetic patients showed lower rates of complete ST-segment resolution, reduced left ventricular ejection fraction, higher incidence of cardiogenic shock, and longer hospital stays. These findings highlight the negative impact of diabetes on reperfusion and recovery in STEMI patients. Individualized management strategies may help improve outcomes in this population, but further studies with larger, multicenter cohorts are needed to confirm these results.

CONFLICT OF INTEREST

There is no conflict of interest

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