

Frequency and Outcomes of Undiagnosed Diabetes Mellitus in Patients Presenting with Acute Myocardial Infarction

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ABSTRACT

Objective: To find out frequency and outcomes of undiagnosed diabetes mellitus in patients presenting with acute ST elevation myocardial infarction (STEMI).

Study Design: Descriptive / Cross- Sectional Study

Place and Duration of study: This study was conducted at the Cardiology Department, Lady Reading Hospital, Peshawar from November 2018 to May 2019.

Materials and Methods: Patient of either gender having age ranging between 30-75 years old with acute STEMI who present within 12 hours of symptoms and with no past history of documented diabetes mellitus were included in the study. Venous blood samples for laboratory data, including random blood sugar, two fasting blood sugar and HBA1c using hitachi modular evo p800 machine was done.

Results: A total of 158 patients having acute STEMI were studied. Males were 68.4% (n=108). The mean age was 59.65 ±10.80 years. Frequency of undiagnosed diabetes mellitus was 31.64 % (n = 50). In non-diabetics stress hyperglycemia was found in 51.85 % (n=56) patients. Among various types of STEMI, anterior STEMI was more common presentation 34.1 % (n=54. p= 0.85). Mean HBA1C was 6.19 ± 1.87%. Frequency of Ventricular tachycardia (VT) was 22.2 % in which undiagnosed diabetics were n=18 (p=0.004). Ventricular fibrillation was present in 13.3 % patients with undiagnosed diabetics were n=14 (p=0.001). Frequency of AF was 13.9% (n=22) with undiagnosed diabetics having AF in n=13 (p=0.003). SVT was present in 5.7% (n=9) patients with not significant difference between two groups (p=0.017).

Among various mechanical complications VSR was present in 10 % (n=16) of patients (p=0.001), cardiogenic shock in 11.1 % (n=18) patients (p=0.004), acute LVF was present in 15.8 % patients (p=0.017).

Conclusion: In our study we concluded that one third of patients having acute ST elevation myocardial infarction have undiagnosed diabetes mellitus (31.64 %, n = 50). The most common complication was ventricular tachycardia among electrical complication and LVF among mechanical complication.

Key Words: Diabetes Mellitus (DM), ST Elevation Myocardial Infarction (STEMI), Electrical Complications (EC), Mechanical Complications (MC)

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INTRODUCTION

Diabetes is one of the most important health problem world is facing today. It gives rise to wide range of Complications including Coronary Artery Disease,

Cerebral Vascular Disease, Renal Disease, Ophthalmopathy and Neuropathies, if not effectively treated. In 2010, an estimated 6.4% of the world's adult population had diabetes, the prevalence is projected to increase to 7.7% by 2030¹. In addition to known diabetics a significant portion of world population has undiagnosed Diabetes, and are at high risk of serious complications. One Study in Pakistan showed 62 % of the subjects with elevated serum glucose level at the time of admission had deranged glucose metabolism and 27.78 % of the total study population were diagnosed as having undiagnosed diabetes.²

Acute myocardial infarction is one of the serious and life threatening complications and occur very frequently in diabetic population. Numerous studies have identified an association between diabetes mellitus (both diagnosed and undiagnosed) and the incidence or development of coronary heart disease (CHD), including acute myocardial infarction.^{2,3}

Diabetic individuals having coronary heart disease have poorer outcomes in terms of morbidity and mortality as

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compared to non-diabetic CHD patients, prior identification of such patients for the development of de novo DM is expected to improve to overall outcomes in post-AMI patients³. Elevated blood glucose levels are common in patients presenting with Acute Myocardial Infarction and are associated with a higher incidence of adverse clinical outcomes compared with normoglycemic patients^{4,6}. Patients with undiagnosed diabetes also have notably increased risk for moderate or severe GI bleeding post thrombolysis with increased need of in-hospital transfusion as compared non diabetics. These patients also have higher rates of all cause mortality at 30 days^{1,6}. Raised glucose level both at admission and fasting raises death, congestive heart failure, and cardiogenic shock in acute MI patients⁶. Higher Fasting glucose levels at presentation were associated with a higher risk of post discharge mortality up to 6 months both after STEMI and NSTEMI⁶.

In patients having no prior diabetes, insulin-based regimen of hyperglycemia after AMI is linked with better clinical outcomes. Randomized, controlled trials (RCTs) of intensive, insulin-based blood glucose treatment during hospitalization with AMI showed survival benefit.⁷

Persistence of hyperglycemia in acute AMI patients in 24–48 h after AMI results in worst prognosis. There is a strong association between diabetes and elevated glucose and short term and long term mortality^{5,7}.

Patients with DM having AMI have about a 2 fold higher risk of short-term mortality as compared to non diabetic.^{5,6} Newly diagnosed glucose intolerance (IFG or AGT) after AMI have worse long-term adverse outcomes. Its adverse prognostic effect is as large as that of already diagnosed DM. Therefore clinicians should take into account the presence or absence of hyperglycemia for risk stratification of patients admitted with Acute Myocardial Infarction.

Taking into account the adverse effects of hyperglycemia and newly diagnosed diabetes in acute myocardial infarction, study is designed to find out the frequency and its outcomes in acute myocardial infarction patients.

MATERIALS AND METHODS

This descriptive cross sectional study was carried out at Cardiology Department, Postgraduate Medical Institute, Lady Reading Hospital, Peshawar from 11 November 2018 to 11 May 2019. Patient with age range between 30-75 years old and either gender were studied. Patients having acute myocardial infarction who present within 12 hours of symptoms with no past history of documented diabetes mellitus were included in the study. Whereas patients of myocardial infarction having past history of diabetes mellitus, chronic renal failure (raised serum creatinine of more than 1.2mg/dl) or on chronic hemodialysis were excluded.

ST elevation myocardial infarction was defined as patients presenting with chest pain and new onset ST elevations in two contiguous chest leads or limb leads or patients with chest pain and new onset LBBB i.e patients with no past history of documented LBBB and positive Trop T or raised Trop I levels. Whereas undiagnosed diabetes mellitus was defined as patients with no past history of documented diabetes mellitus and anti-diabetic treatment with admission blood glucose level equal to or greater than 180 with following HBA1c equal to or greater than 6.5.

Sample size was determined using WHO software for sample size determination with 95% confidence level and 7% margin of error under. Non probability consecutive sampling technique was used.

The study was carried out after approval from hospital's research committee. After informed consent, all patients meeting the inclusion criteria were included in the study. All patients were subjected to detailed history, complete routine examination and baseline investigations. Venous blood samples for laboratory data, including random blood sugar, two fasting blood sugar and HBA1c using hitachi modular evo p800 machine was done. All patients were kept in ward till clinically stable and management protocol was observed for all included patients. In hospital complications like arrhythmias and structural complications were recorded during the hospital stay. All the above mentioned information including demographic features were recorded in a pre-designed proforma. Exclusion criteria were followed strictly to control confounders and bias in the study results.

Mean + SD was calculated for numerical variables like age, random blood sugar, fasting blood sugar and HBA1c. Frequencies and percentages were calculated for categorical variables like gender and undiagnosed diabetes mellitus. Undiagnosed diabetes mellitus was stratified among age and gender to see effect modification. All results were presented in the form of tables and graphs. Statistical analysis was done with the Statistical Package for the Social Sciences software (SPSS 20.0) for Windows.

RESULTS

Total of 158 patients having acute ST elevation myocardial infarction with no past history of documented diabetes mellitus were studied. Among these patients, males were 68.4% (n=108) and female were 31.6% (n= 50)(p=0.5). The mean age was 59.65 ±10.80. (Figure 1)

Among various types of STEMI, anterior STEMI was present in 34.1 % (n=54, p= 0.85), anterolateral STEMI in 19.6 % (n=31, p=0.66), inferior wall STEMI in 23.4% (n=37, p=0.42), inferioposterior STEMI in 5.1 % (n=8, p=1). Inferiolateral in 7.59% (n=12, p=0.55), inferior and RVMI in 4.4% (n=7, p=0.70), and lateral wall STEMI in 5.7 (n=9, p=0.27) (Figure 2).

Mean RBS was 191.36 ± 70.04 mg/dl, mean HBA1C was 6.19 ± 1.87 , mean 1st FBS was 115.8 ± 48.71 mg/dl while 2nd FBS was 107.59 ± 36.04 mg/dl. Frequency of undiagnosed diabetes mellitus was 31.64 % (n = 50). Out of them 36 were males (p=0.58). Frequency of non-diabetics was 68.4% (n=108) with 72 were males.

In electrical complications frequency of Ventricular tachycardia (VT) was 22.2 % in which undiagnosed diabetics were 36% (n=18/50), non-diabetics were 15.7% (n=17/108) (p=0.004). Ventricular fibrillation was present in 13.3 % patients (n=21) with undiagnosed diabetics were 28% (n=14/50) and non-diabetic patients were 10.18 % (n=11/108) (p=0.001). Total frequency of AF was 13.9 % (n=22), Undiagnosed diabetics had AF in 26% (n=13/50), while non-diabetics had 8.3% (n=9/108) (p=0.003). SVT was present in 5.7% (n=9) patients. Out of them 14% (n=7/50) were undiagnosed diabetics while 1.8% (n=2/108) were non diabetics (p=0.002). CHB was present in 15.8 % (n=25) patients [(Undiagnosed diabetics 26% (n=13/50) (p=0.033) while non-diabetics 11.11 % (n=12/108) (p=0.017)] (Figure 3).

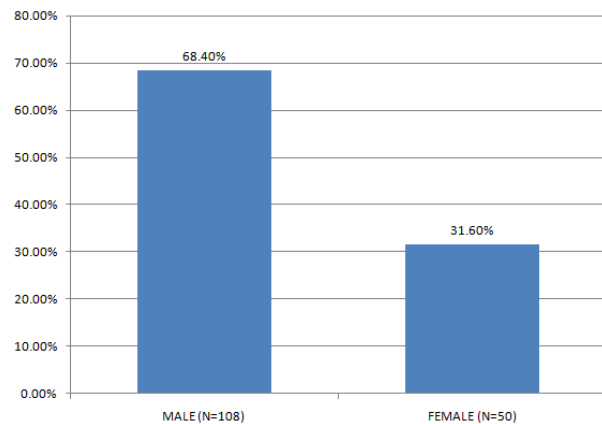


Figure No.1: Gender wise distribution of total population (n=158).

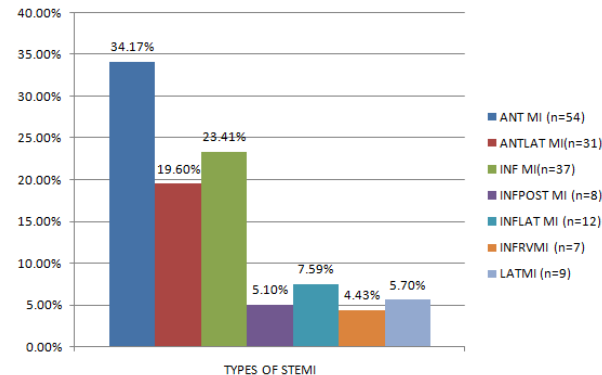


Figure No.2: Frequency of different types of acute STEMI in undiagnosed diabetics and non-diabetics (n=158)

Among various mechanical complications VSR was present in 10 % (n=16) of patients [Undiagnosed diabetics 22% (n=11/50), non diabetics 4.6 %

(n=5/108) (p=0.001)]. Cardiogenic shock was present in 11.1 % (n=18) patients, with undiagnosed diabetics 22% (n=11/50) and non-diabetics 6.4 % (n=7/108) (p=0.004). Acute LVF was present in 15.8 % (n=25) patients. Out of them 26% (n=13/50) were undiagnosed diabetics while 11% (n=12 /108) were non diabetics (p=0.017) (Figure 3).

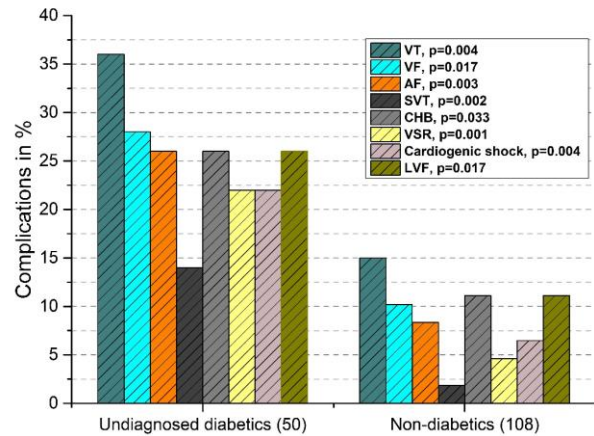


Figure No.3: Frequency of electrical and mechanical complications in undiagnosed diabetics and non-diabetics patients (n=158).

DISCUSSION

Acute ST elevation myocardial infarction (MI) is a common medical emergency having higher mortality worldwide^{2,8}. Hyperglycemia is frequent in patients with acute myocardial infarction deteriorating cardiac function and increases in-hospital and long term morbidity and mortality irrespective of diabetic status⁹. Hyperglycemia which is encountered in up to 50% to 60% of patients with AMI is linked with higher occurrence of major acute cardiac events (MACE) such as significant arrhythmias (supraventricular tachycardia (SVT), AF, VT, VF or heart blocks), cardiac pulmonary edema, hypotension and cardiogenic shock^{2,10,11}.

In this study, frequency of undiagnosed diabetes mellitus in patients presenting with ST elevation myocardial infarction and related complications were studied. The frequency of undiagnosed diabetes in patients presented with acute ST elevation myocardial was found to be 31.6 % which is almost same as that found by Shafique Ahmed et al i.e. 27.78%². Electrical and mechanical complications of acute ST elevation myocardial infarction were much more frequent in patients having undiagnosed diabetes mellitus as compared to patients who were diagnosed as non-diabetics at presentation as reported by Ghulap NN et al and Sinnaeve et al^{4,6}. Among electrical complications of acute ST elevation myocardial infarction atrial fibrillation was 13.9% with patients having undiagnosed diabetes having frequency of 26% and those with no diabetes had frequency of 8.33%. Koracevic et al studied 543 patients of acute myocardial infarction, reporting hyperglycemia in 200 patients with

15% of atrial fibrillation¹². Similarly in a large cohort study, Kadri and coworkers reported AF 17.8% in patients with acute MI and underlying hyperglycemia. Frequency of atrial fibrillation in our study is almost in line with the international research work.

Ventricular arrhythmia including ventricular tachycardia and ventricular fibrillation was 22.2% and 13.3% respectively. In our study population, VT in undiagnosed diabetics and patients with no diabetes was 36%, and 15.74% respectively. Also VF in patients with undiagnosed diabetes and without diabetes was 28% and 6.48% respectively. Kadri et al reported ventricular fibrillation, which is less than half of the incidence of ventricular fibrillation in this study. The probable reason might be their large sample size and secondly, not all of our patients presented to hospital in time for proper thrombolysis, due to poor knowledge of acute MI and logistic problem, so the chances of ventricular arrhythmia were more in our patients, while Meisenger et al reported almost two third of incidence of ventricular fibrillation i.e. 9.5% as that in my study¹³. Khan et al studied our local population and reported the frequency of complete heart block as 6.4% as compared to 15.8 % total incidence in the present study including incidence in undiagnosed diabetics and patients without diabetes as 26% and 11.11% respectively¹⁴. The sample size of my study was approximately same as that of Khan et al, but we reported different frequencies of complete heart block in our respective study. Supra ventricular tachycardia (SVT) was experienced as 14% in undiagnosed diabetics and 1.85 % in patients without diabetes mellitus.

Mechanical complications are well recognized complications of AMI. In patients with increased plasma blood glucose levels, the incidence of these complications increases with increasing severity of hyperglycemia¹⁵. Cardiogenic shock occurred frequently among the mechanical complications, with frequency of 22%, and 6.48% in undiagnosed diabetics, and those with no diabetes respectively. Naber et al documented cardiogenic shock with incidence of 17.2 %¹³.

Cardiac pulmonary edema, one of the mechanical complication included in our study was reported in 15.8% patients with undiagnosed diabetics and non-diabetics were 26% and 11.11 % respectively. While Meisenger et al reported 7.1%¹³. On the other hand Ishihara et al reported almost half prevalence of cardiac pulmonary edema in patients of acute myocardial infarction with hyperglycemia. Ventricular septal rupture (VSR) which is one of the dread full complication of acute STEMI had total incidence of 10.18% in undiagnosed diabetics while it was 4.62% in non-diabetics.

The complications of STEMI i.e. electrical and mechanical complications didn't have any significance when compared between undiagnosed diabetics and non

diabetics. When these complications were further analyzed in term of age and gender, there was no significant statistical difference.

Conventional risk factors associated with coronary artery disease like hypertension, smoking, dyslipidemia, obesity and family history were not considered in my study and there inclusion might have effect the outcome of patients presented with acute ST elevation myocardial infarction. Anemia, location and size of myocardial infarction were not considered which has significant effects on outcomes of myocardial infarction. The status of patient being non diabetic was decided on the basis of history given by patient or attendant. Oral glucose tolerance test was not used to decide about the diabetic status of patient.

In future if the conventional risk factors for coronary artery disease are taken in to account in patients of acute ST elevation myocardial infarction and comparative study is carry out between patients with risk factors and without risk factors, the results might be more controlled. The diabetic status of patient should be properly decided because the presence of diabetes in patients with acute ST elevation myocardial infarction is itself a bad prognostic factor.

CONCLUSION

In this study one third of patients having acute ST elevation myocardial infarction have undiagnosed diabetes mellitus (31.64 %, n = 50). Increased blood glucose levels in AMI patients are associated with increased adverse outcomes. The most common complication was ventricular tachycardia among electrical complication and LVF among mechanical complication.

Author's Contribution:

Concept & Design of Study:	Tanveer Ahmad
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Data Analysis:	Syed Tahir Shah, Abad Khan, Noor ul Hadi
Revisiting Critically:	Tanveer, Umair Ali, Syed Tahir Shah
Final Approval of version:	Tanveer Ahmad

Conflict of Interest: The study has no conflict of interest to declare by any author.

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