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A Study on Prognostic Value of Admission Glycosylated Hemoglobin and Blood Glucose in Nondiabetic Patients with ST-Segment Elevation Myocardial Infarction

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ABSTRACT
In nondiabetic patients, HbA1c could be utilised for risk stratification of CAD and its severity., independent of traditional cardiovascular risk factors. These factors aroused curiosity which led into this study which probes into the prognostic significance of glycated haemoglobin and admission RBS in non-diabetics admitted with acute STEMI. A total of 127 patients were admitted in the ICU with STEMI during the study period, out of which only 50 patients met the inclusion criteria. Fifty non-diabetic patients admitted in the intensive care medicine unit with acute ST elevation MI diagnosed with 12 lead electrocardiogram were selected for the study. Among 12 patients with shock, 7 had anterior wall STEMI (58.3%) and 5 had inferior wall STEMI (41.7%) Among 15 patients with cardiac failure, 9 had anterior wall STEMI (60%) and 6 had inferior wall STEMI (40%) Two patients with pulmonary edema, one had anterior wall and one had inferior wall STEMI. 11 patients with arrhythmias, 1 had hyperglycemia (9.1%), 9 hadnormal glycemic status (81.8%) and 1 had hypoglycemia (9.1%). With the above primary data, analysis was done. Occurrence of cardiac failure was more in patients with elevated admission blood glucose >200mg/dl but not the other complications. Prior history of alcoholism was significantly more seen in the diabetic group. Admission blood glucose correlates well only with HbA1c in predicting Diabetes in the study population but not normoglycemia or prediabetic state.

INTRODUCTION

It is a well-known fact that Diabetes and cardiovascular diseases go hand in hand together. Many patients presenting with cardiovascular diseases are either suffering from diabetes or are in prediabetic state[1]. Many studies pointed out the fact that even milder abnormalities of blood glucose level (even below the diagnostic threshold of diabetes mellitus) are associated with increased cardiovascular risk[2-3]. It is well accepted that hyperglycemia is commonly present in patients admitted with acute STEMI. It is associated with increased risk of death or adverse cardiovascular events in patients both with and without previous history of diabetes mellitus[4]. Patients belonging to the prediabetes group often have other cardiovascular risk factors, including hypertension and dyslipidemia and are at increased risk for cardiovascular disease. The treatment goals for people with prediabetes are the same as for the general population. But since they are at risk for cardiovascular diseases, an increased vigilance is warranted to identify and treat these and other cardiovascular risk factors (e.g., smoking)[5-7]. In patients with no prior history of diabetes who present with a macrovascular complication that is., Myocardial infarction, hyperglycaemia might be due to a previously undiagnosed diabetes or due to stress hyperglycaemia or due to a prediabetic state. This can lead to a poor outcome in patients in the form of shock, failure or arrhymias. So both stress hyperglycaemia in non-diabetic patients and high random blood sugar in diabetic patients are having adverse prognostic effects in patients with ACS. However the effect of recently elevated blood sugar as measured by HbA1c has still not been consistently reported as a bad prognostic indicator. Though many studies have been done on this interesting subject, the results are not significantly conclusive on either side. Available data suggests that hyperglycaemia on admission is an indicator of short term mortality in patients admitted with acute STEMI but its efficacy in predicting the long term mortality is still unclear. It has been noted that among patients with high risk non ST elevation acute coronary syndrome [NSTE-ACS] also that a substantial proportion of patients admitted with high risk NSTE ACS had previously undiagnosed DM (12.2%) or prediabetes (10.8%) as defined by HbA1c or FBS after admission. In nondiabetic patients, HbA1c could be utilised for risk stratification of CAD and its severity., independent of traditional cardiovascular risk factors[8,9]. These factors aroused curiosity which led into this study which probes into the prognostic significance of glycated haemoglobin and admission RBS in non-diabetics admitted with acute STEMI. Moreover this study enables risk stratification. Early identification of high risk groups enables initiation of specific intervention strategies and it may help us to improve the prognosis in these patients. It also helps in identifying a previously undiagnosed group of diabetics. This is of importance because there is a global increase in the number of patients suffering from cardiovascular disease with underlying insulin resistance, prediabetes and overt diabetes mellitus which go unrecognized.

Aims and Objectives of the Study: To determine the association between both acute hyperglycemia or stress hyperglycemia if present, that is denoted by the admission blood glucose at the time of presentation and chronic hyperglycemia which is denoted by HbA1c and short term clinical outcome in non-diabetic patients with STEMI.

- Age and gender distribution of various HbA1c ranges and blood sugar.
- Any relationship between tobacco use, alcoholism and sedentary lifestyle with various ranges of HbA1c.
- Lipid profile normal or high and its relation with HbA1c.
- Occurrence of anterior wall (AW) or inferior wall (IW) and ranges of HbA1c and blood glucose.
- Correlation between admission blood glucose with various ranges of HbA1c
- Plaque stability.

MATERIALS AND METHODS

A total of 127 patients were admitted in the ICU with STEMI during the study period, out of which only 50 patients met the inclusion criteria. Fifty non-diabetic patients admitted in the intensive care medicine unit with acute ST elevation MI diagnosed with 12 lead electrocardiogram were selected for the study.

All Patients in the Study Underwent the Following Based on a Proforma:

- Detailed history of.
- **Chest Pain:** Whether present or absent. Duration was not noted.
- **Palpitation:** Whether present or absent.
- **Giddiness:** Her present or absent.
- **Breathlessness:** Whether present or absent.
- History of hypertension/Dyslipidemia/Coronary artery disease is considered present or absent based on patient history.
- History of sedentary life style.
- History of Smoking.
- History of Alcoholism.
- Family history of Coronary artery disease.

Patient with acute STEMI diagnosed with 12 lead ECG treated with fibrinolysis, Both males and females consider as inclusion criteria. Exclusion Criteria are Patients with Diabetes mellitus, Patients with Hb <7 mg/dl, Patients with Haemoglobinopathy or Hypothyroidism, Patient's refusal to participate., All the patients were admitted in the intensive care unit of

our hospital. They were included in the study based on the inclusion and exclusion criteria., Acute STEMI was diagnosed based on the ECG criteria as mentioned before, Random blood sugar sample (venous blood) at the time of admission was collected., HbA1c was done for the patient using standard laboratory techniques approved by DCCT. Statistical analysis was done using the statistical package for social sciences (SPSS). Different statistical methods were used as appropriate. Mean±SD was determined for quantitative data and frequency for categorical variables. The independent t-test was performed on all continuous variables. The normal distribution data was checked before any t-test. The Chi-Square test was used to analyze group difference for categorical variables. In logistic regression models, age was adjusted for estimation of each or all the independent effects of hypertension, ischemic heart disease and diabetes mellitus. A p-value <0.05 was considered significant.

RESULTS AND DISCUSSIONS

Data are expressed as mean with standard deviation. One way ANOVA with post hoc multiple comparison was used to test the level of significant difference. * indicates p<0.0001 when diabetic group is compared with normal group and # indicates p<0.0001 when prediabetes group is compared with the normal group. Out of 50 cases included in this study, 2 died and the rest 43 were discharged for further follow up. Both of the deaths were in the diabetic group (100%)Among the patients discharged, 18 were in the diabetic group (37.5%), 14 in the prediabetes group (14%) and 16 in the normal group (33.3%). Majority of the cases (54%) were in the age group 40-60 years. Among the age group 40-60 years, most were males (77.8%)Among males the majority 39% belonged to the diabetic group. Among females the majority 44.4% belonged to the diabetic group. History of chest pain was present in all the cases (100%) History of other cardiac symptoms were present in 13 patients in diabetic group (48.1%), 6 in prediabetes group (22.2%) and 8 in normal HbA1c group (29.6%). Family history of CAD was present in only 1 patient and had normal HbA1c. In the study population, only one case was a known case of CAD and had normal HbA1c. 10 cases in the study population were a known case of systemic hypertension (20%)[10]. Four patients in the diabetic group (40%), 3 in prediabetes group (30%) and 3 in normal group (30%)6 patients in the study population had history of sedentary lifestyle (12%). They were equally divided in normal, prediabetes and diabetic group with 2 patients each (33.3%). 23 patients gave history of cigarette smoking (46%). 10 in the diabetic group (43.5%), 5 in prediabetes group (21.7%) and 8 in normal group (34.8%)[11,12]. 12 patients gave history of alcoholism (24%). 8 in the diabetic group (66.7%) and 4 in the prediabetes group (33.3%). None in the normal group had history of alcoholism. According to RBS value at admission patients were divided in into hypoglycemia, normal RBS and hyperglycemia as previously mentioned. 4 patients in the diabetic group with high HbA1c had hypoglycemia on admission (26.7%)[13], 4 patients in the prediabetes group (26.7%) had hypoglycemia on admission. 12 patients in the diabetic group (40%) had normal blood sugar on admission, 10 patients in the prediabetes group (33.3%) had normal blood sugar on admission. 4 patients with hyperglycemia on admission had high HbA1c. 1 patient with high random blood sugar on admission (20%) had high HbA1c. 47.1% of patients with dyslipidemia had high HbA1c. 35.3% with dyslipidemia had normal HbA1c and 17.6% with dyslipidemia had prediabetes. 15 patients had cardiac failure (30%), 12 with cardiogenic shock (24%), 11 with arrhythmias (22%) and 2 with pulmonary edema (4%) making cardiacfailure the most common complication in the study population[14]. A total of 12 patients went in for Cardiogenic shock. Among them 75% were in the diabetic group, 16.7% in prediabetes group and 8.3% in normal group. A total of 15 patients had cardiac failure and among them 60% were in the diabetic group, 26.7% in prediabetes group and 13.3% in normal group. Two patients had Pulmonary edema. One in diabetic group and other in normal group. 11 patients had Arrhythmias in the study population. 54.5% in the diabetic group, 27.3% in the prediabetes group and 18.2% in the normal group. Ejection fraction was divided into normal, mild, moderate and severe based on degree of LV dysfunction mentioned previously. 9 patients had normal LV function (18%), 26 with mild LV dysfunction (52%), 12 with moderate (24%) and 3 with severe LVdysfunction (6%). Three patients had severe LV dysfunction. Two in diabetic group (66.7%) and 1 in prediabetes group (33.3%)12 patients had moderate LV dysfunction. 7 patients in diabetic group (58.3%), 1 in prediabetes group (8.3%), 4 in normal group (33.3%). 26 patients with mild LV dysfunction, 8 were in the diabetic group (30.8%), 10 in prediabetes group (38.5%) and 8 in normal group (30.8%)[15]. Anterior wall was involved in 27 patients (54%). 11 were in the diabetic group (40.7%), 9 in the prediabetes group (33.3%) and 7 in the normal group (25.9%). Inferior wall was involved in 23 patients (46%). 9 were in the diabetic group (39.1%), 5 in the prediabetes group (21.7%) and 9 in the normal group (39.1%). Complications of STEMI were compared to the wall of LV involved in STEMI. Among 12 patients with shock, 7 had anterior wall STEMI (58.3%) and 5 had inferior wall STEMI (41.7%) Among 15 patients with cardiac failure, 9 had anterior wall STEMI (60%) and 6 had inferior wall STEMI (40%) Two patients with pulmonary edema, one had anterior wall and one had inferior wall STEMI. Among 11 patients with arrhythmia, 8 had anterior wall STEMI (72.7%) and 3 had inferior wall STEMI

Table 1: Distribution of Complications of Myocardial Infarction Among the Groups of Abnormal and Normal HBA1C and RBS in the Study Population

S.No	Parameter		Complications of MI		P value
			Present	Absent	
1	HbA1c	Abnormal	21	1	
		Normal	4	12	
2	Admission RBS	Abnormal	4	2	Admission RBS
		Normal	21	24	

Data is Expressed in Absolute Numbers. *Indicates P<0.05 and Considered Statistically Significant.

Table 2: Complications of CAD vs Admission RBS

S.No	Parameter		Hypoglyce mia (n=16)		Normal (n=14)		Hyperglyce mia group (n=20)		P-value
			n	%	n	%	n	%	
1	Cardiogenic shock	Present	2	16.7	8	66.7	2	16.7	0.41 (NS)
		Absent	13	34.2	22	57.9	3	7.9	
2	Cardiac Failure	Present	0	0	12	80	3	20	0.007*
		Absent	15	42.9	18	51.4	2	5.7	
3	Pulmonary edema	Present	0	0	1	50	1	50	0.13 (NS)
		Absent	15	31.3	29	60.4	4	8.3	
4	Arrhythmias	Present	1	9.1	9	81.8	1	9.1	0.2 (NS)
		Absent	14	35.9	21	53.8	4	10.3	

Table 3: Comparison of Different Parameters Between the Groups in the Study Population

S.No	Parameter	Normal group (n=16)		Prediabetes group (n=14)		Diabetic group (n=20)		P value
		Mean	SD	Mean	SD	Mean	SD	
1	Average Blood Glucose (mg/dl)	87.3	17.2	125.6	0.68	182.9	35.7	<0.001*#
2	Random blood glucose at admission (mg/dl)	101.8	64.9	112.3	40.6	148.3	79.8	0.09 (NS)
3	Ejection fraction (%)	42.9	8.5	43	6.78	38.3	8.46	0.14 (NS)
4	HBA1C glycosylated	4.64	0.55	6.09	0.23	7.92	1.19	<0.0001*#

Table 4: Correlation of HBA1C Value with the RBS Value and Average Blood Glucose Value in Different Groups of the Study

S.No	Para meter	Overall (n=50)			Normal group (n=16)			Prediabetes group (n=14)			Diabetic group (n=20)		
		r value	95% CI	P value	r value	95% CI	P value	r value	95% CI	P value	r value	95% CI	P value

(27.3%)[16,17]. Complications of the study population were compared to the admission RBS. 15 patients with cardiac failure, all had normal or hyperglycemia. 3 had hyperglycemia (20%) and 12 with normal glycemic status (80%). 12 patients with cardiogenic shock, 2 had hyperglycemia (16.7%), 8 had normal glycemic status (66.7%), 2 had hypoglycemia (16.7%). Two patients with pulmonary edema, one had normal glycemic status, other with hyperglycemia. Among 11 patients with arrhythmias, 1 had hyperglycemia (9.1%), 9 had normal glycemic status (81.8%) and 1 had hypoglycemia (9.1%). With the above primary data, analysis was done.

CONCLUSION

This study suggests that the occurrence of complications following Acute STEMI is more in non-diabetic patients with HbA1c >6.5. The risk for cardiogenic shock is 12.27% more when compared to the normal population in non-diabetic patients with HbA1c >6.5. Occurrence of cardiac failure was more in patients with elevated admission blood glucose >200mg/dl but not the other complications. Prior history of alcoholism was significantly more seen in the diabetic group. Admission blood glucose correlates well only with HbA1c in predicting Diabetes in the study population but not normoglycemia or prediabetic state. Hence HbA1c should be availed in all patients presenting with STEMI irrespective of their glycemic status as it helps in risk stratification for complications and diagnosing Diabetes or prediabetic state. Further studies with larger sample size and comparative design are required to describe and reinforce the role of HbA1c in Nondiabetic patients with Acute STEMI.

Limitations of the Study:
- The sample size of the study population was small due to the less number of nondiabetic patients presented to the institution during the study period.
- A large sample multicentre study will have the power to stratify the risk of complications among the three groups in the study population.
- This was an observational and nonrandomised study.

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