Glycoslated Haemoglobin as A Diagnostic Marker of Diabetes Mellitus in Acute Myocardial Infarction and Association with Obesity

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Abstract

This study is an attempt to evaluate the diagnostic value of glycated hemoglobin (HbA1c) for diabetes in acute myocardial patients and to assess the presence of obesity in them. It is meant to improve the prognosis in patients of acute myocardial infarction. Most of the acute myocardial patients presents with stress induced hyperglycemia. HbA1c estimation is useful tool and accurate interpretation of hyperglycemia following AMI. HbA1c estimation at the time of admission clearly differentiates stress hyperglycemia from hyperglycemia of undiagnosed diabetes mellitus. This is hospital based cross-sectional study. 100 patients with acute myocardial infarction admitted to coronary care units, during October 2013 to September 2014 were studied .Patients during admission blood glucose >140mg/dl with no past history of diabetes mellitus were included in the study. Serum blood glucose and HbA1c were estimated at admission. History and examination carried out. Patient's body mass index was calculated. These patients were followed up after 15 days to assess their blood glucose. Their diabetic status was confirmed as per WHO criteria. Data were analyzed using SPSS-20 software. Statistically significant association between HbA1c and diabetes was found. Obesity was also found significantly associated with HbA1c level.

Keywords: Glycosylated haemoglobin, diabetes mellitus, myocardial infarction, hyperglycemia, obesity.

Introduction

Diabetes mellitus becomes the most common non communicable, life style associated disease worldwide[1,2] most dreadful part is large number of patients remains unrecognized.

It is of great concern because of the devastating effect of its complications. Diabetes mellitus has been recognized as a risk factor for coronary heart disease since ages[3]. Hyperglycemia is associated with large infarct size[4]. Mortality due to coronary heart disease is very high in diabetics[5]. Hence early diagnosis and control of diabetes mellitus is important. It is to improve the prognosis of patients with AMI and to prevent the adverse outcome.

At the time of admission most of the patients of AMI have hyperglycemia. This hyperglycemia could simply be a marker of preexisting, not yet diagnosed diabetes, impaired glucose tolerance or may be stress induced hyperglycemia.

This differentiation is important because any attempt to lower stress induced hyperglycemia may cause hypoglycemia leading to tachycardia and cause deleterious effects[6]. HbA1c estimation provides an average blood glucose level for a period of 8-12 weeks.[7] HbA1c proves useful for diagnosis of D.M. in AMI. Stress induced hyperglycemia is a confounding factor. HbA1c is unlikely to rise with stress induced acute hyperglycemia. HbA1c concentration can be used to distinguish stress induced hyperglycemia from diabetes mellitus for early appropriate treatment to prevent morbidity and mortality. Obesity can be considered as root of most of the non communuicable diseases, called New World Syndrome[8].

The World Health Organization has described obesity as one of today's most neglected health problem, affecting every region of globe. Earlier, developing countries, including India had focused scarce health resources on the high prevalence of under nutrition. However, these nations are currently facing the double burden of under nutrition as well as over nutrition. Data regarding the nutritional status of adults was determined by body mass index (BMI). Under nutrition is more prevalent in rural areas, whereas overweight and obesity are more in urban areas.

Material and Methods

This study is carried out in Government NSCB Medical College, Jabalpur. Department of Pathology and ICCU. 100 M.I. patients admitted in ICCU during October 2013 to September 2014 fulfilling the inclusion criteria.

Inclusion criteria's: Patients diagnosed AMI confirmed by electrocardiogram or cardiac marker (CPK-MB). Patients not known or diagnosed as diabetic. Patients whose admission glucose level found >140mg/dl.

Exclusion criteria's: Patients died of AMI and its complications during hospital stay. Patients unavailable for

follow up after 15 days. Venous blood was taken at the time of admission for estimation of blood sugar and HbA1c before starting treatment. History and examination was carried out. Weight and height was taken. BMI was calculated using height and weight. Patients were classified into two groups according to BMI. One is normal whose BMI is <25, other is abnormal whose BMI is >25. These patients were further followed up after 15 days .Their fasting blood sugar was estimated. Patients with HbA1c ≥6.5% as cut off were analyzed for diabetes as per WHO criteria[13].

The majority of studies conducted included HbA1c ≥6.5% as cut off for diabetic diagnosis as per American Diabetic Association and WHO.

Patients with HbA1c <6.5% were considered non diabetics and patients with ≥ 6.5% were considered as diabetics.

Specimen collection and preparation: We need preferentially venous blood using EDTA anticoagulant. Reagents should be at room temperature. Dilute the sample with lysing reagent in the 1:100 ratios. Wait for minimum 3 minutes; take care to avoid the formation of foam. Erythrocytes are lysed by low osmotic pressure. Greenish-brown color develops as per the hemoglobin concentration of sample.

HbA1c is determined immunoturbidometrically. The final result is expressed as percent HbA1c.

Method and Test principle: Test is based on immunoturbidometry performed by auto analyser. It is based on interaction between antigen molecule (HbA1c) and HbA1c specific monoclonal antibodies coated on latex bead. This cross link reaction results in change in the solution turbidity. HbA1c was estimated by auto analyser Biosystem S.A. COD 22044, serum total cholesterol and HDL COD21557, serum triglyceride and LDL COD 21528,CK-MB by Randox, RX CK3813.

Advantages: HbA1c is stable after collection of sample. Their levels do not fall on storage prior to test. Sample can be obtained at any time. It requires no patient's preparation. Their levels do not vary between meals like blood sugar[9].

Statistical test applied: Statistical analyses were carried out by using SPSS 20 software. The results obtained are statistically analyzed. Sensitivity of the test was 98.6, specificity was 62.5, and positive predictive value 89.28, negative predictive value was 93.75. The results were considered significant with p<0.05.

Results and Discussion

Out of 100 patients, 84 patients had value of HbA1c in the diabetic range (≥ 6.5%), rest 16 patients had HbA1c (<6.5%) in non diabetic range. During follow up after 15 days, out of 84 patients, 75 patients (89.28%) were confirmed to be diabetic previously unrecognized cases of diabetes mellitus, come to light after HbA1c estimation. And only 9 patients (10.72%) were found to be non diabetic according to WHO criteria. Statistically this was highly significant (p<0.0001). Rest 16 patients who were in stress induced hyperglycemia possibility to be considered as diabetic, HbA1c values prevented them to be treated for diabetes. Time also saved in preventing repeated testing of blood sugar. Time is critical in AMI patients which affect prognosis.

In present study 27 cases were found with increased BMI and 73 cases were in normal range of BMI category. Among the increased BMI group 96.3%were found with increased HbA1c level. Statistically this was significant suggesting increase risk of diabetes in those with high BMI. However out of 84 diabetic cases high BMI was observed in only 31 % (26) and 69% (58) had normal BMI. This showed BMI had no significant association with diabetes. Similar finding was observed by other authors[10,11].

Table–1 shows that in the present study mean age for diabetic patients was 58.76 years and mean age for non diabetic patients was 53.46 years which is comparable with the studies done by Naseem et al and others[12-16]. Diabetic patients were susceptible to AMI at an earlier age compared to non diabetics.

Table-1
Association between HbA1c value and age, sex, dietary habit and habitate

Characteristics		HbA1c Value		χ2 value	P value	95%confidence interval	
		<6.5%	>6.5%				
Age	<40years	3	1	10.9	<0.01	-.017055	.368246
	>40years	13	83				
Sex	Male	8	68	7.06	<0.05	-.568511	-.050536
	Female	8	16				
Habitate	Rural	11	35	3.96	<0.05	.0204388	.5212279
	Urban	5	49				
Dietary habit	Non veg.	2	32	3.92	<0.05	-.448422	-.063482
	Veg.	14	52				

In present study male subjects were predominantly higher. Male to female ratio in diabetic is higher (4.5:1) as compared to ratio in non diabetics, which is comparable with studies done by Iqbal MJ et al[17].

Obesity was seen in 30.9% of diabetic patients and 6.2% of non diabetic patients which is consistent with the findings of Iqbal MJ et al[13,17]. Obesity and diabetes have several abnormalities in common like abnormal carbohydrate metabolism, increased insulin resistance, high free fatty acid levels and high incidence of Hypertension.

In the present study table-2 shows modifiable risk factors like Smoking was found more common in diabetic patients (96.4%) than non diabetic patients (37.5%) which is in concurrence with the observation made by Iqbal MJ et al[17].

Habit of alcohol intake was associated with increased incidence of diabetes which was consistent with study done by W.H. Linda[18]. In present study there was found significant association between diabetes and consumption of alcohol consumption (χ2=4.90 p<0.05)

Conclusion

HbA1c estimation at the time of admission to ICCU clearly and quickly differentiates stress induced hyperglycemia in M.I. patients from hyperglycemia in undiagnosed diabetic patients with AMI.

HbA1c is more sensitive and specific diagnostic test for diabetes mellitus in patients with AMI than serum blood glucose.

Prognosis in cases of AMI improves by early identification of diabetic and nondiabetic cases by HbA1c evaluation and effective management. Incidence of diabetes and cardiovascular disease in obese is more.

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Table-2
Association between HbA1c, tobacco consumption and body mass index

Characteristics		HbA1c Value		χ2 value	P value	95%confidence interval	
		<6.5%	>6.5%				
Tobacco chewing	Present	5	49	3.37	<0.05	-.521227	-.020438
	Absent	11	35				
Smoking	Present	6	54	4.02	<0.05	-.526258	-.009456
	Absent	10	30				
Alcohol intake	Present	2	35	4.90	<0.05	-.484993	-.098339
	Absent	14	49				
BMI	<25normal	15	58	4.16	<0.05	.092616	.401430
	>25	1	26				

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