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SIGNIFICANCE OF HBA1C IN DIABETES MELLITUS PATIENTS: A STUDY

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ABSTRACT: Diabetes mellitus is a group of metabolic diseases in which there are high blood sugar levels over a prolonged period.[1]Symptoms of high blood sugar include frequent urination, increased thirst, and increased hunger. If left untreated, diabetes can cause many complications.[2] Acute complications can include diabetic ketoacidosis, nonketotic hyperosmolar coma, or death. Serious long-term complications include heart disease, stroke, chronic kidney failure, foot ulcers, and damage to the eyes.[2]Diabetes is due to either the pancreas not producing enough insulin or the cells of the body not responding properly to the insulin produced.[3] There are three main types of diabetes mellitus: Type 1 DM results from the pancreas's failure to produce enough insulin.[2]Type 2 DM begins with insulin resistance, a condition in which cells fail to respond to insulin properly.[2]. The most common cause is excessive body weight and not enough exercise.[2] Gestational diabetes is the third main form and occurs when pregnant women without a previous history of diabetes develop high blood-sugar levels. Glycosylated haemoglobin is more sensitive parameter showing the glucose from the RBC[4] which provide better information of glucose level.
KEYWORDS: Diabetes mellitus, glucose, glycosylated haemoglobin.

INTRODUCTION:

Glycated hemoglobin is a form of hemoglobin that is measured primarily to identify the three-month average plasma glucose concentration. The test is limited to a three-month average because the lifespan of a red blood cell is four months (120 days). RBCs do not all undergo lysis at the same time, so HbA1C is taken as a limited measure of 3 months. It is formed in a non-enzymatic glycation pathway by hemoglobin's exposure to plasma glucose. HbA_{1c} is a measure of the beta-N-1-deoxy fructosyl component of hemoglobin.[5] The origin of the naming derives from Hemoglobin type A being separated on cation exchange chromatography. The first fraction to separate, probably considered to be pure Hemoglobin A, was designated HbA1c , the following fractions were designated HbA1a, HbA1b, and HbA1c, respective of their order of elution. There have subsequently been many more sub fractions as separation techniques have improved.[6] Normal levels of glucose produce a normal amount of glycated hemoglobin. As the average amount of plasma glucose increases, the fraction of glycated hemoglobin increases in a predictable way. This serves as a marker for average blood glucose levels over the previous three months before the measurement as this is the lifespan of red blood cells. In diabetes mellitus, higher amounts of glycated hemoglobin, indicating poorer control of neuropathy, and retinopathy. A trial on a group of patients with Type 1 diabetes found that monitoring by caregivers of HbA1c led to changes in diabetes treatment

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and improvement of metabolic control compared to monitoring only of blood or urine glucose.[7] The goal of this manuscript is to significance of HbA_{1c} in diagnosing diabetes. blood glucose levels, have been associated with cardiovascular disease, nephropathy,

MATERIALS AND METHODS:

The present study is based on HbA1c level estimation in which 30 non diabetic subjects studied as a control, which were proved to be non-diabetic from history, Fasting blood sugar (FBS), Post prandial blood sugar (PPBS) and urine sugar control group.

In study group, 50 diabetic patient including new & old cases, insulin depended diabetes mellitus (IDDM) and non-insulin depended diabetes mellitus (NIDDM) complicated & non-complicated cases having 62 NIDDM and 28 IDDM.

These all patients' data collected from the medicine OPD at Hospital Rio Mar, Rio de Janeiro, Brazil.

In all cases HbA1c measurement was done on the same day of Fasting Blood Sugar and Post Prandial Blood Sugar estimation. EDTA vials are used for collection of blood.

Blood sugar estimation done by chemical method with 100mg% glucose standard. Cation exchanger method used for estimation of HbA1c, commercially available kits used in present study.

HbA1c testing provides significant practical advantages over blood glucose measurement. It can be performed at any time of the day and does not require any special pre-test preparation by the patient. The blood sample is stable once collected – essentially in the same tube used for a full blood count. When access to an appropriate laboratory is limited, the test can be performed using a point-of-care testing machine. This may be particularly useful in rural and remote areas. For people without diabetes, the normal range for the hemoglobin A1c level is between 4% and 5.6%. Hemoglobin A1c levels between 5.7% and 6.4mean prediabetic. Levels of 6.5% or higher indicate of diabetes.

RESULTS:

30 non-diabetic Control Group and 50 diabetic patients including old & new cases, IDDM & NIDDM, complicated & non-complicated cases-Group were included in the study. In control group mean HbA1c level is 6.68%. In Study group mean HbA1c is 12.90% as shown in Table 1.

Table 1: Control and Study group with HbA1c

Control Group					
Group	**No**	**%**	**FBS (mean)mg**	**PPBS (mean)mg**	**HbA1c (mean)**
Total	30	100	83.72	103.02	6.68
Male	17	56	84.01	101.96	6.77
Female	13	44	83.31	104.62	6.54
Study Group					
Group	**No**	**%**	**FBS**	**PPBS**	**HbA1c (mean)**
Total	50	100	193.89	251.32	12.9
Male	31	62	178.68	226.52	12.64
Female	19	38	166.33	221.48	13.01

Well controlled DM, defined as blood sugar in range of FBS-less than 120mg/100ml and PPBS less than 180mg/100ml. Poorly controlled DM defined as blood sugar in range of FBS-more than 120mg/100ml and PPBS more tha180mg/100ml.The above tables show that HbA1c level is almost two times higher in study groups compare to control group.

Table2: Age distribution in patients

Age Group	No of cases	%	HbA1c %(mean)
10-20yrs	4	8	13.10
21-30yrs	8	16	13.32
31-40yrs	9	18	12.11
41-50yrs	15	30	11.83
51-60yrs	14	28	11.68

Table 2. Shows higher HbA1c in 10-40 years of age (younger patients) group. Highest HbA1c is in the 21-30 years age group.

Table 3: Duration of diabetes mellitus

Group	No of cases	%	HbA1c (mean)
Total	50	100	12.90
0-5years	23	55	12.79
5-10years	14	25	13.01
>10YEARS	13	20	13.18

Table 3 shows that the diabetes is increase with the increase in the years. As the time increase HbA1c is also increase.

Table4: Type of diabetes mellitus

Group	No of cases	%	HbA1c %(mean)
Control	30		6.68
Case	50		12.90
IDDM	28	32	14.43
NIDDM	62	68	12.20

Table 4 shows that level of HbA1c is higher in IDDM patients compare to NIDDM patient.

Table 5: Complication of diabetes mellitus

Group	No of	%	HbA1c %(mean)
Total	50	100	12.90
With complication	33	38	12.66
Without complication	17	62	12.98

Table 5 shows that there is no significant difference in HbA1c level with the complication. Complication of DM includes peripheral neuropathy, diabetic retinopathy, peripheral vascular disease and ischemic heart disease.

Table 6: Renal disease and diabetes mellitus

Group	No Of Cases	%	HbA1c % (mean)
Total	50	100	12.61
With Renal problem	7	14	6.91

Table 6 shows that in diabetic nephropathy there is chronic progressive renal failure and because of that RBC survival decreases. That is why level of HbA1c is low in DM with renal disease.

Table 7: Type of treatment and HbA1c level

Type of Treatment	No of Case	HbA1c %(mean)
Insulin	18	15.15
Medication	14	12.35
Dietary	10	7.43
Proton	8	7.1

Table 7 shows that Patient on insulin has higher mean HbA1c other than medication or dietary supplement. Medication are the Metformin, Sulfonylurea etc.

DISCUSSION:

As the case of diabetes continues to rise in the country, means of screening high-risk and hard-to-reach populations has become increasingly important. Because HbA1c levels have been associated with an increased risk of diabetes-related complications, and HbA_{1c} screening provides a convenient way to diagnose diabetes, guidelines have begun to advocate use of HbA_{1c} to diagnose diabetes[8,9]. Limitations include the prevalence of estimates based on HbA_{1c} differing from those of other methods of diagnosis, particularly among white patients. Moreover, the usefulness and validity of HbA_{1c} screening in certain populations has been questioned. Hence, for certain subgroups, multiple methods may be needed. Another disadvantage is that HbA_{1c} screening has been found to be less cost-effective than a 2-hour OGTT, a 1-hour glucose challenge test, or random glucose testing[10]. Hence, it might be useful to implement risk stratification, which has been shown to improve the predictive power of HbA_{1c} screening for diabetes and may be more cost-effective than opportunistic screening[11].

CONCLUSION:

The HbA1c testing will provide an additional tool to assist in the early diagnosis of diabetes. HbA1c assay also provides a better discrimination of diabetics from non-diabetics than a rapidly fluctuating variable like blood sugar.. There remains a very important role for blood glucose testing, and the medical practitioner needs to be aware of the benefits and limitations of both strategies. However, the HbA1c test does overcome many of the practical problems associated with the fasting blood glucose or oral glucose tolerance tests and its correct use should enhance the early diagnosis of diabetes.

REFERENCES:

1. "About diabetes". World Health Organization. Archived from the original on 31 March 2014. Retrieved 4 April 2014.
2. "Diabetes Fact sheet N°312". WHO. October 2013. Archived from the original on 26 August 2013. Retrieved 25 March 2014.
3. Shoback, edited by David G. Gardner, Dolores (2011). "Chapter 17". Greenspan's basic & clinical endocrinology (9th ed.). New York: McGraw-Hill Medical. ISBN 0-07-162243-8.
4. Sanjiv K Khullar etal.-journal of diabetic association of india,21,41-46,1984
5. Miedema K (2005). "Standardization of HbA1candOptimal Range of Monitoring". Scandinavian Journal of Clinical and Laboratory Investigation. 240:61–72. doi:10.1080/00365510500236143. PMID 16112961.
6. Peterson KP, Pavlovich JG, Goldstein D, Little R, England J, Peterson CM (1998). "What is hemoglobin A1c? An analysis of glycated hemoglobins by electrospray ionization mass spectrometry". Clinical Chemistry. 44 (9): 1951–1958. PMID 9732983.
7. Larsen ML, Hørder M, Mogensen EF (1990). "Effect of long-term monitoring of glycosylated haemoglobin levels in insulin-dependent diabetes mellitus". N. Engl. J. Med. 323 (15): 1021–doi:10.1056/NEJM199010113231503. PMID 2215560.
8. American Association of Clinical Endocrinologists Board of Directors. American College of Endocrinologists Board of Trustees American Association of Clinical

Endocrinologists/American College of Endocrinology statement on the use of hemoglobin A1c for the diagnosis of diabetes. Endocr Pract. 2010;16:155–156.
9. The Endocrine Society The Endocrine Society statement on the use of A1c for diabetes diagnosis and risk estimation. [Accessed September 4, 2014].
10. Wu EL, Kazzi NG, Lee JM. Cost-effectiveness of screening strategies for identifying pediatric diabetes mellitus and dysglycemia. JAMA Pediatr. 2013;167:32–39.
11. Ginde AA, Cagliero E, Nathan DM, Camargo CA., Jr Point-of-care glucose and hemoglobin A1c in emergency department patients without known diabetes: implications for opportunistic screening. Acad Emerg Med. 2008;15:1241–1247.

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