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A STUDY OF EFFECT OF DIFFERENT FACTORS ON THE HBA1C LEVELS IN THE PATIENTS OF DIABETES MELLITUS IN A TERTIARY CARE HOSPITAL

Medicine

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ABSTRACT

Glycated haemoglobin (HbA1c) is a routinely used marker for long-term glycemic control in patients with diabetes mellitus. With HbA1C measurement we are able to assess the average blood glucose levels retrospectively. HbA1c levels correlates well with the risk of long-term diabetes complications. HbA1c values measurements are prone to diagnostic interference with many factors.

METHODOLOGY- The aim of this study is to present the numerous clinical scenarios in which the use of HbA1c levels alone for either diagnosis or as a marker of glycemic control, may lead to false assumptions.

RESULTS- People who are known alcoholic, known case of chronic liver disease and chronic kidney disease shows significant change in HbA1c level without a change in glycemic control.

KEYWORDS

INTRODUCTION

- The Diabetic pandemic is rapidly spreading all over the world. Diabetes Mellitus affects an estimated 422 million population worldwide.[1]
- India is one of the 6 countries of the IDF SEA region.
- There were over 7,29,46,400 cases of diabetes in India in 20172.
- Diabetes mellitus is characterized by the elevated glucose concentrations. The impact of diabetes mellitus on both the health of individuals and on the health care systems, results almost entirely in the long- term complications of diabetes affecting almost every system in the body including eyes, kidneys, heart, feet and nerves.
- Glycated hemoglobin (HbA1c) is a routinely used marker for long-term glycemic control in patients with diabetes mellitus. With HbA1C measurement we are able to retrospectively assess the average blood glucose levels. The exact process of biochemical transformation leading to glycation was described by Bunn and his colleagues in 1975.[3]
- HbA1c is formed by non-enzymatic glycation of globin, being the main component of hemoglobin. This process occurs without the participation ofspecialised enzymes and high energy compounds resulting in the HbA1clevels being proportional to blood glucose. In the glycation process, where glycated haemoglobin is a constant and irreversible product, the amino group of the protein is combined with the straight-line aldehyde group. Several glycated fractions of A1 hemoglobin do exist, however, HbA1c accounts for 75-80% of the total glycated hemoglobin pool. It is formed as a result of the link between D-glucose and the N-terminal valine of the β chain. HbA1c, due to its stability and its good correlation with the blood glucose concentration, found its best use as a marker of glycaemic control in patients with diabetes mellitus. Due to the specificity of this transformation, determining the level of glycated hemoglobin is a useful method of measuring the average glycaemia during a last 120 days period (i.e. the time interval corresponding to the average survival time of the erythrocyte).
- Currently, there are two leading methods for the standardization of the HbA1C result which have been established by the National Glycohaemoglobin Standardization Program (NGSP) and the International Federation of Clinical Chemistry (IFCC). Currently, the Polskie Towarzystwo Diabetologiczne (PTD) [Polish Diabetes Association] recommends using measurements in accordance with the certified methods of National Glycohaemoglobin Standardization Program (NGSP). However, it also recommends that Laboratories express HbA1c levels in SI units [mmol/mol], in accordance with the International Federation of Clinical Chemistry and Laboratory Medicine (IFCC) system.[4]
- HbA1C levels may sometimes be misleading as a reliable measure of glycemic control.
- HbA1c values measurements are prone to diagnostic interference with many factors.[5]

ADA 2019 Criteria For Diagnosis Of Diabetes Mellitus

i.Fasting plasma glucose > 126 mg/dl. Fasting is defined as no caloric intake for at least 8 hrs OR

ii.2-h Plasma glucose > 200 mg/dl during OGTT. The test should be performed as described by the WHO, using a glucose load containing the equivalent of 75-g anhydrous glucose dissolved in water OR

HbA1C > 6.5% OR

iii.In a patient with classic symptoms of hyperglycemia or a random plasma glucose > 200 mg/dl.[6]

AIMS & OBJECTIVE

To analyze the three clinical scenarios in which the use of HbA1c levels alone for either diagnosis or as a marker of glycemic control, may lead to false assumptions.

MATERIAL AND METHOD

- A cross-sectional study of Type 2 diabetic mellitus patients admitted in the SRMS – IMS, Bareilly was done.
- Patients underwent investigations like FBS, PPB, HbA1c, BLOOD UREA , SERUM CREATININE , LFT , USG WHOLE ABDOMEN .
- Inclusion Criteria – All diabetic patients between the age group of 18-65 years.
- Exclusion criteria – hemoglobinopathies , hemolytic anemia , hypothyroidism , pregnant patients and the patient having abnormal renal function test.

RESULT

ALCOHOL

	Diabetic-NonAlcoholic	Diabetic-Alcoholic
1	7.9	7.8
2	7.8	7.6
3	7.8	7.7
4	7.9	7.7
5	8.2	7.5
6	7.9	7.6
7	7.7	7.7
8	7.8	7.5
9	7.9	7.5
10	8.0	7.7
Mean	7.89	7.63

- Total 20 patients were taken.
- Out of which the 10 patients were diabetic- alcoholic with

history of alcohol intake for last 10 year and 10 patients were diabetic non-alcoholic.
- The reference fasting and post- prandial blood sugar levels in both groups were in the range of 120-150mg/dl and 190-220mg/dl respectively.[7]

CHRONIC LIVER DISEASE
- Total 20 patients were taken.
- Out of which 10 were diabetic with Chronic Liver Disease (proven) and 10 were diabetic with no liver disease.
- The reference fasting and post- prandial blood sugar range in both groups being 120-150mg/dl and 180-220mg/dl respectively [8]

	DiabeticswithCLD	DiabeticswithNoCLD
1	6.9	6.8
2	6.7	6.8
3	6.7	7.2
4	6.8	7.4
5	6.9	7.0
6	6.8	6.9
7	6.9	7.2
8	7.0	7.1
9	6.8	7.0
10	6.9	6.9
Mean	6.84	7.03

Chronic Kidney Disease

Chronic kidney disease , prospective study of 20 patients with Type 2 DM and CKD out of which 10 patients receiving only I/V iron therapy (Group A) and 10 patients receiving i/v iron plus erythropoeitin stimulating agent (ESA) (Group B) were done.[9]

	BeforeIron	Afteriron	P(pairedttest)
HbA1C(%)	7.35	6.86	<0.001
Hb(g/dl)	9.27	10.87	0.001
	Before ESA	**After ESA**	**P (paired t test)**
HbA1C(%)	7.22	6.45	0.013
Hb(g/dl)	8.2	10.3	<0.001

DISCUSSION
- Patients who were chronic alcoholic have a lower HbA1c levels due to reaction of aldehyde with amino acid of globin chains resulting from the formation of acetaldehyde from alcohol metabolism.
- In patients of CLD, there can be anemia due to various reasons which causes red blood cells to have a shortened life- span which consequently lowers the HbA1c levels.
- Both iron and ESA cause a significant fall in HbA1c due to formation of new erythrocyte without a change in glycemic control in patient with diabetes and chronic kidney disease.

CONCLUSION
- The level of HbA1c level remains the gold standard to monitor the glycaemic control in the patients with diabetes mellitus and is also a diagnostic criterion but still its value misleading in many clinical scenarios.
- The value of HbA1C depends on many factors, such as iron parameters, erythrocyte survival time, renal function impairment and other comorbidities.
- When a patient has a condition in which the HbA1C results are misleading, the glycaemic
- control should be evaluated based on appropriate blood glucose self-monitoring performed with adequate frequency.
- The alternative measures of glycaemic control are fructosamine , glycated albumin and continuous glucose monitoring .

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