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INFLUENCE OF IRON DEFICIENCY ANAEMIA ON HBA1C IN TYPE 2 DIABETIC AND NON DIABETIC PATIENT A RETROSPECTIVE STUDY IN CENTRAL INDIA

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ABSTRACT **Introduction:** Haemoglobin Alc (HbA1) has been adopted by physicians as a surrogate for monitoning glycemic control. The exists other factor beyond serum glucose concentration may affect glycationrate\.**Aim:**This study aimed to analyse the effect of Iron deficiency anemia on HbA1 c levels in type 2 diabetic patients having both controlled and uncontrolled fasting blood sugar level compared with non-diabetic .**Method:** The study group comprised 600 patients with type 2 diabetes. Out of this, 360 uncontrolled diabetic with IDA patients (FBS>125mg %) and 240 controlled diabetic without IDA patients (FBS <115mg%) compared with 460 non-diabetics, out of this 200 with IDA and 260 without IDA.**Result :** In controlled diabetes whitout IDA the HbA1c was 6.9=0.8%, while uncontrolled diabetes with IDA , subject who had FBS>125 mg% had significant.**Conclusion:** The study emphasize the need to exercise caution when applying HbA1 c references ranges to anaemic populations

KEYWORDS : HbAIc,type 2 dm. of Iron deficiency anemia on HbA1 c

Introduction

The American Diabetic Association (ADA) suggests HbA1c levels as analytic models for diabetes mellitus. Doctors have embraced HbA1c levels as an advantageous method to evaluate for diabetes, just as to screen treatment. There exists worry that on the grounds that HbA1c is framed from the glycation of the terminal Valine unit of the β-chain of hemoglobin, it may not be a precise substitute to find out glycaemic control in specific conditions that influence the fixation, construction and capacity of hemoglobin.

Kim et al (2010) expressed that iron deficiency is related with shifts in HbA1c conveyance from < 5.0 to ≥ 5.5 % and significant increments was seen in the patients outright HbA1c levels 2 months after treatment of weakness [1]. HbA1c is likewise influenced by pregnancy [2,3], uraemia [4], haemolytic pallor [5], haemoglobinopathies [6], intense and constant blood misfortune, Vitamin B12 and folate deficiencies [7]. There is a deficiency of writing onHbA1c levels in the pallor populace and a reference range for this special populace doesn't as of now exist.

Iron deficiency paleness is quite possibly the most pervasive kinds of lack of healthy sustenance and normal in India. Ferritin is the structure wherein iron is put away, and testing measure of ferritin reflects the iron status. All around the world, half of paleness is ascribed to press deficiency [8]. Studies have shown that decreased iron levels are connected with expanded degrees of HbA1c prompting bogus undeniable degrees of HbA1c in non-diabetic people [9, 10]. The soonest study to examine the impacts of iron deficiency weakness on HbA1c levels was directed by Brooks et al[9] who evaluated HbA1c levels in 35 non-diabetic patients having iron deficiency paleness both previously, then after the fact treatment with iron. They saw that HbA1c levels were significantly higher in iron deficiency pallor patients and diminished get-togethers with iron.

Paleness with type 2 diabetes remains unidentified in light of the fact that the two of them share comparative manifestations like laziness, fair skin, chest torment, crabbiness, deadness/frigidity in the hands and feet, tachycardia, windedness and migraine [11]. A high occurrence of pallor was seen in diabetics without renal insufficiency, and furthermore proposed that poor glycemic control and advanced age are related with the frequency of frailty in diabetic patients with typical renal capacity [12].

In the light of the vulnerability in the influence of iron deficiency on HbA1c, it is basic that clinicians know about the admonitions with HbA1c esteems when they settle on administration choices in the pale populaces. The investigation endeavors to perceive clinical contrasts in HbA1c levels in patients with iron deficiency contrasted with non-pale populace of both kind 2 diabetes and non-diabetics, and furthermore to measure and show the heading of such distinction in the event that they in fact exist

Materials and Methods Subjects:

The study is a retrospective chart review of patients with and without anaemia of both type 2 diabetes and non-diabetics. 1060 patients of L.N medical college hospital and research centre, Bhopal., who consulted during April 2016 to December 2016 were selected. The study participants were residents of in and around Bhopal,central India.

Incusion criteria The investigation explored electronic clinical records of chosen patients, separating information on fasting blood glucose, HbA1c, serum ferritin, fringe smear and hemoglobin and red cell lists. Other data acquired electronically were socio segment factors (Gender, age, nationality, smoking status and span of T2DM) and clinical findings on first visit [blood pressure (BP), meds, eGFR and diabetic complications]. To be remembered for the examination, all patients were 30 – 70 years old

Exclusion criteria included those who had history of unstable cardiovascular and peripheral diseases; those with chronic illnesses; those with recent blood loss or donated blood recently; those who have haemolytic anaemia or genetic differences in the haemoglobin molecule (haemoglobinopathy) such as sickle-cell disease and other systemic disorders that could result in anaemia and pregnancy, overt thyroid dysfunction, chronic kidney disease, chronic liver disease, on corticosteroid therapy.

The presence of anaemia was defined by a haemoglobin level < 13.0 g/dL in men and < 12.0 g/dL in women, Hct < 40% in males and < 36% in females, mean corpuscular volume (MCV) < 80 fl, MCH < 26 pg/cell, MCHC < 32 g/dl and peripheral smear showing microcytic hypochromic picture were considered to have IDA and confirmed by their serum ferritin levels (<15µg/L) [13]. Fasting blood glucose and HbA1C were estimated using Mindray BS-420 chemistry analyser. Hb, Hct, MCV, MCH, MCHC were measured by using Mindray BC-5300 Auto Haematology analyser. Serum ferritin by Biorad lab.

Absolute HbA1c levels were calculated from the measured HbA1c levels by using the formula [13].

Statistical Analysis

Descriptive data are presented as means and standard deviations (SD). Data analysis between two groups was compared using two-tailed independent sample t-test. Two-tailed Pearson's partial correlation coefficient was used to determine age-adjusted correlations between variables. Logistic regression analysis was used for the analysis of associations between anaemia and independent variables. Data were analysed using IBM SPSS statistics 20. P value < 0.05 was considered as significant.

mographic and clinical characteristics of patients are as shown in Table 1. For this current study, out of total 1060 subjects of both gender (Male = 560, Female = 500) were selected (Table-1). As our aim was to examine prevalence of iron deficiency anaemia in diabetic patient, 600 diabetic patients were divided into two groups according to their FBS levels. 360 were uncontrolled diabetics (FBS > 125 mg %) with IDA (A) and 240 were controlled diabetics (FBS < 115 mg %) without IDA (B). Table 1 revealed that the incidence of anaemia was higher in

patients with poorly controlled diabetes than controlled diabetes (P < 0.05) and the odds of anaemia were higher in diabetic females than diabetic males (P < 0.05).

FBS and HbA1c levels: (Fig: 1, Table 3): The well-controlled diabetes with normal FBS < 115 mg % had HbA1c of 6.9 ± 0.8%, while subjects who had FBS > 125 mg % had significantly higher HbA1c of 8.1 ± 0.5% value. Odds ratio for HbA1c > 5.0 % for non-diabetic patients with IDA and without IDA were 5.5 ± 0.8 and 5.1 ± 0.01 and it was non-significant.

Haemoglobin, ferritin and HbA1c: The data in Table 3 provided evidence that haemoglobin was indeed lower in anaemic patients than in healthy control and the observed difference was statically significant (< 0.05).

The Serum ferritin level of IDA with uncontrolled diabetes was significantly lower compared to controlled diabetes without IDA and non-diabetes (with and without IDA). Additionally the Absolute HbA1c levels were low in anaemia compared to controlled diabetic and control group.

Table 1: Prevalence of Anaemia Vs. Gender with FBS in Diabetic and NonDiabetic

N = 1060					
Diabetic (n = 600)***			Non-Diabetic (n = 460)		
	Female (n = 300)	Male (n = 300)		Female (n = 200)	Male (n = 260)
IDA (A) (n = 360) FBS > 125 mg %	200*** (55.6%)	160 (44.4%)	IDA (C) (n = 200)	60 (30 %)	140 (70 %)
No IDA (B) (n = 240) FBS < 115 mg %	100 (41.7%)	140 (58.3%)	No IDA (D) (n = 260)	140 (53.9%)	120 (46.1 %)

A: Diabetic (FBS > 125 mg %) with Iron deficiency anaemiay
B: Diabetic (FBS < 115 mg %) without Iron deficiency
C: Non-Diabetic with Iron deficiency anaemia
D: Non-Diabetic without Iron deficiency anaemia

Table 2 comparison red cell indices

	Diabetic with IDA	Diabetic without IDA	Non Diabetic with IDA	Non Diabetic without IDA
Hb (g/dL)	10.4 ± 0.08	14.3 ± ***0.16	11.46 ± 0.08	14.4 ± ***0.2
Haematocrit (%)	32.1 ± 0.3	39.6 ± *** 0.4	37.07 ± 0.3	42.2 ± ***0.8
MCV (fl)	75.4 ± 0.2	85.1 ±*** 0.4	78.56 ± 0.22	86.2 ± **0.2
MCH (pg/cell)	26.3 ± 0.3	29.7 ± ** 0.15	25.9 ± 0.2	29.9 ± **0.3
MCH-Conc (%)	30.6 ± 0.2	33.51 ± ** 0.15	31.1 ± 0.24	34.1 ± **0.2

Table 3: Comparison of haemoglobin and HbA1c, Absolute HbA1c and Serum ferritin levels in diabetics and non-diabetics (with and without IDA)

	A	B	C	D
Hb (g/dl)	9.4 ± 0.08***	13.3 ± 0.16	10.46 ± 0.08	14.4 ± 0.2
HbA1C (%)	8.1 ± 0.5***	6.9 ± 0.8	5.5 ± 0.8	5.1 ± 0.04
Absolute HbA1C (g/dl)	0.762	0.98	0.58	0.74
Sr. Ferritin (ng/ml)	16.9 ± 6.1***	196.9 ± 65.0	140.6 ± 59.4	210.0 ± 40.6

DISCUSSION

In the present cross-sectional study, diabetic patients with IDA had high incidence of anaemia (60%). Anaemia along with diabetes is an alarming condition because of increased risk of developing eye disease, heart disease or a stroke therefore the life span of patients who have anaemia along with diabetes is less as compare to people who have diabetes without anaemia [15]

Our study shows that Diabetic with Iron deficiency anaemia is more common among women than men. This was observed in a similar study by Nitin Sinha et al [8], who reported females to be more affected with IDA than males. HbA1c levels in IDA with FBS >125mg% compared to diabetes with controlled FBS < 115mg% without IDA. Our results show that there is a positive correlation between haemoglobin and HbA1c concentrations. HbA1c levels tend to be higher in cases of iron deficiency. On treatment with iron supplements, the HbA1c levels decrease [8, 9, 14]. On improvement of Hb, a significant decrease HbA1c was observed in type 2 diabetes, however no such significant difference caused in non-diabetic cases. Corroborating our study, studies by Cogan et al, and el Agouza et al showed that the HbA1c levels were higher in patients with IDA and decreased significantly on treatment with iron supplements. According to them, elevated HbA1c levels in iron deficiency anaemia could be explained by the assumption that if serum glucose remains constant, a decrease in the haemoglobin concentration might lead to an Thus our findings suggest that a reduction of blood glucose levels and the targeting of acceptable glycated haemoglobin levels would help reduce the risk of anaemia in the diabetic population. There is an urgent need for proper diabetic care and management for diabetic senior citizens, who have limited food choices and are more vulnerable to iron deficiency anaemia. Therefore, physicians should recommend them to take iron and vitamin supplement and take nutritious iron-rich diet.

As high incidence of anaemia was observed in diabetes mellitus we recommend that routine haematological tests along with blood glucose level should be mandatory in diabetic outpatient clinics in order to make optimal therapeutic decisions for treatment of anaemia in type 2 diabetes mellitus.

Conclusion

The study emphasizes the need to exercise caution when applying HbA1C reference ranges to anaemic populations. It makes the case for defining HbA1c reference ranges and thus therapeutic goals for IDA. Redefining such reference ranges may increase the sensitivity of HbA1c in diagnosing type 2 diabetes in anaemic population. We recommended that absent of risk factors and symptoms reliable to type 2 diabetes, marginal elevation in HbA1c levels in anaemic patients should warrant confirmation of diagnosis using FBS and PPBS

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