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Prevalance of Iron Deficiency Anemia Among Type 2 Diabetes Mellitus Patients in Guwahati, Assam

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ABSTRACT:

BACKGROUND: Iron deficiency anemia is a global public health problem affecting both developing and developed countries with major consequences for human health as well a social and economic development and it is reportedly common in type 2 diabetes mellitus (T2DM). There are many conflicting opinion regarding the association between iron deficiency anemia and diabetes mellitus. Moreover, there are studies showing that iron deficiency treatment has positive effects on diabetes biomarkers in diabetic individuals. The aim of this study was to evaluate the iron deficiency anemia (IDA) among the patients with T2DM in Guwahati, Assam.

MATERIALS AND METHOD: Over a period of six months, 100 type 2 diabetic patients, attending Dispur Hospitals Pvt. Ltd, Guwahati studied. Venous blood samples were collected, haemoglobin estimation, PCV, RBC count, IRON, FERRITIN, TIBC, FBS, PPBS and HbA1c tests were performed.

RESULT: According to the data, it was noted that out of 100 patients, 38 cases were recorded with less than 5 years of duration of T2DM followed by 62 patients having more than 5 years duration. A total of 32 patients were iron deficient among which 12 were male, i.e 37.5 % and 20 female, i.e. 62.5%. The average fasting glucose level of patients without IDA is 168.76±3.51. The average fasting glucose level of patients with IDA is 169.25±3.08. The average PP glucose level of patients with IDA is 221.56±3.87. The average PP glucose level of patients without IDA is 215.06±3.94. The average PP glucose level of patients with IDA is 221.56±3.87.

CONCLUSION: Diabetes mellitus is one of the fastest-growing and the most common chronic endocrine and metabolic disorders that affect many people globally. Our findings also emphasized the analysis of duration of T2DM in the patients. On the basis of the study, it can be concluded that female gender elderly persons are more prone to T2DM and thus they are expected to further suffer from complications of T2DM like iron deficiency anemia. Early diagnosis and treatment of IDA in diabetic patients can improve their glycemic control and may prevent or delay complications. However, its complications can be reduced through proper awareness and timely treatment.

Keywords: Iron Deficiency Anemia, Type 2 Diabetes Mellitus, Prevalence, HbA1c, Chronic endocrine disorder, Glycemic control.

1. INTRODUCTION

Anemia is a condition characterized by a decreased number of red blood cells and has serious implications for the health, cognitive development and productivity of adults and children worldwide. Despite recent economic growth and prevention efforts, anemia remains particularly pervasive in India and is the largest cause of countrywide disability.[1] Anemia can have a variety causes, including nutrient deficiencies, acute and chronic infection and genetic haemoglobin disorder.[2] Iron deficiency (ID) and iron deficiency anemia (IDA) are prevalent forms of nutritional deficiency. Globally, 50% of anemia is attributed to iron deficiency. Reduced iron stores have been linked to increased glycation of haemoglobin A1C (HbA1c) The prevalence of iron deficiency anemia (IDA) is considerably significant in patients with type 2 diabetes mellitus especially those with nephropathy.[3-5]

Diabetes mellitus is a metabolic disorder characterized by chronic hyperglycemia, metabolic abnormalities resulting in long-term macro vascular and micro vascular complication. Diabetes mellitus is a major health problem all over the world (pandemic) with high morbidity and mortality rate.[6] Majority of diabetic patients suffer from complications mainly due to hyperglycemia which can lead to increased morbidity and mortality owing to poor glycometabolic control. Glycometabolic control can be monitored by Fasting Blood Glucose (FBG) and Hemoglobin A1C (HBA1C). HBA1C is a useful marker to determine mean blood glucose levels over the period of three months.[7]

According to the WHO report, India has 31.7 million diabetic patients and the number is expected to increase to a staggering 79.4 million by 2030.[8] Reportedly the prevalence of anemia in diabetes ranges from 11% to 65%.[9,10]. The clinical relevance of the effect of iron deficiency on glucose metabolisms is still not clear. Reduced iron stores have been linked to increased glycation of HbA1C. The links between glucose, anemia and HbA1C are complex and not yet fully elucidated. Diabetes may cause anemia through reducing absorption of iron, gastrointestinal bleeding and through diabetic complications that cause anemia.[3-5] In chronic iron deficiency anemia, erythrocytes survival is prolonged, there is a chronic hypoxia and haemoglobin cannot be synthesized sufficiently due to iron deficiency. The decrease in HbA1C level after iron treatment given to patients with anemia can be explained by the increase of erythrocytes production in the circulation which further increases the erythropoiesis in the bone marrow.[11] Various previous studies have proved that, depleted iron status, tend to have a link with the deranged (increased) glycation of hemoglobin (HbA1c) levels.[12] Certain haematological factors like the haemolytic anemias,[13] hemoglobinopathies and acute and chronic blood loss also have a significant impact on the HbA1c levels besides pregnancy and uraemia. HbA1c levels in the body may also be influenced/altered by various other minor factors like vitamin B12 & folate levels in addition to iron deficiency anaemia status. [14] Anemia is a frequent condition is patients with type 2 diabetes.[15,16] This reflects the pivotal role of the kidney in the control of hemopoiesis, the failure of the kidney to increase erythropoietin release in response to a decreasing hemoglobin (Hb).[17,18]. The purpose of the study was to evaluate the iron deficiency anemia (IDA) among the patients with type 2 diabetes mellitus in Guwahati, Assam to determine CBC, iron, TIBC, ferritin, FBS, PPBS

2. Materials and Methodology

Samples were collected from Dispur Hospitals, Ganeshguri, Guwahati, Assam from August,2022 - January,2023 for a six months duration. A total of 100 patients were taken for the study.

2.1. Sample Preparation and Sample processing for Haemoglobin, RBC count and PCV using SYSMEX 550 analyzer**.**

2.2 VITROS Fe slide method was performed with the sample using VITROS Fe slide and VITROS Chemistry products calibrator kit 4 on VITROS 250/350/950/5, 1 FS and the VITROS5600 integrated system for determining Iron (Fe) Concentration, Total Iron Binding Capacity (TIBC).
2.3 The VITROS Ferritin test is performed using the VITROS Ferritin Reagent Pack and the VITROS Ferritin calibrators on the VITROS ECi/ECiQ immunodiagnostic systems, the VITROS 3600 Immunodiagnostic System and the VITROS 5600 integrated System using Intellicheck technology
2.4 VITROS 5600 Integrated system for determining fasting blood sugar (FBS) and Post Prandial (PP) sugar levels
2.5 BIO-RAD D-10 for determining HbA1c

3. Results:

3.1 DATA COLLECTION

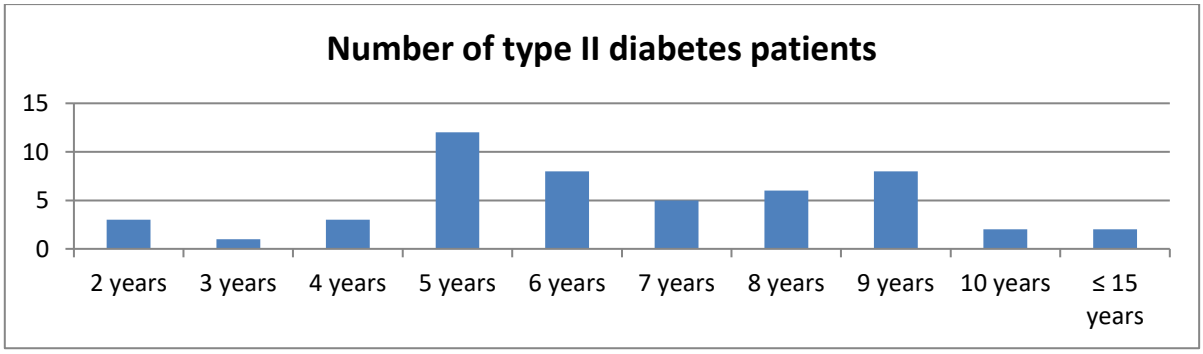

Figure 1: Bar graph showing duration of type II diabetic patients (in Years)

According to the gender based distribution of patients with type II diabetes mellitus, it was found that number of cases was mostly seen in male rather than female. i,e 54% male population was diabetic compared to 46% female were effected in the total 100 patients of this study.

Table 1: Findings of different parameters among patients with and without IDA

Parameters	Patients (IDA) (N=32)	Patients(Without IDA) (N=68)
Age	30-60	30-60
<5 years duration of diabetes mellitus	38	
>5 years duration of diabetes mellitus	62	
Hb	7.98±1.18	13.97±1.39
HbA1C	10.09±1.70	9.85±1.68
Total RBC Count	3.10±0.53	5.04±0.61
PCV	29.94±3.92	42.50±4.11
TIBC	39.73±4.59	66.69±5.23
Ferritin	12.00±4.86	84.44±4.67
Iron	5.77±1.00	17.88±5.54
Fasting Sugar Level	169.25±3.08	168.76±3.51

Post Prandial Sugar Level	221.56±3.87	215.06±3.94

According to the data, it was found that Iron deficiency anemia in Type 2 diabetes mellitus was mostly observed in case of female as compared to male patients. It was noted that a total of 32 patients were iron deficient among which 12 were male, i.e 37.5 % and 20 female, i.e. 62.5%. From the study, it is clear that maximum number of patients' i.e.38 cases were recorded with less than 5 years of duration of Type 2 diabetes mellitus followed by 62 patients having more than 5 years duration.

DISCUSSION

This is a typical case control study organized and conducted in the premises of Dispur Hospitals pvt.ltd. Guwahati, Assam. In this study, it was found that the out of a total of 100 patients, number of diabetic cases was mostly seen in male (54%) rather than female (46%). Although the HbA1c levels are generally higher in the diabetic patients, both in male and female, patients with controlled plasma glucose levels for 3 months are generally expected to have HbA1c level below 6.5%. [13] IDA was most prevalent (61.7%) in the individual with duration of diabetes <5 years whereas ACD was most prevalent (50.5%) in individual with long standing diabetes (>10 years). The paper mentioned that independent risk factors for IDA were female gender [19].

Glycosylated hemoglobin (HbA1c) have attended 50 years of existence and also considered as one of the best achievements in the history of diabetes mellitus (DM). HbA1c has been in use since 1980s as the "gold standard" for monitoring glycemic control and as a predictor of diabetic complications. Recently, HbA1c has also been recommended as a diagnostic test for DM by the American Diabetes Association. Even though several conditions such as hemolytic anemia (lowers HbA1c) and aplastic anemia (raises HbA1c) tend to confound and interfere with HbA1c measurement, in most circumstances, HbA1c is a valid and reliable index of glycemic status [20].

Iron is necessary for various metabolic processes, including oxygen transport and storage, redox reactions, cell signaling and microbial defense. Absorption, transport and storage of iron are carefully regulated, presumably to avert potential toxic effects of free iron. **[21,22]** Both iron overload and iron deficiency can be detrimental to health, so iron homeostasis is essential. Although many factors that take part in iron homeostasis are known, mechanisms by which the body regulates iron stores are still being elucidated.**[21-23]** Also, iron absorption and homeostasis are intimately linked to the inflammatory response.**[24]** Iron deficiency (ID) and iron deficiency anemia (IDA) are prevalent forms of nutritional deficiency. Globally, 50% of anemia is attributed to iron deficiency.**[3,4]** Type 2 Diabetes Mellitus (T2DM) is the most common type of diabetes, the prevalence of which increases more rapidly than expected and affects millions of people worldwide.**[25]** Since the early stages of the disease are usually asymptomatic, it causes late diagnosis. In this asymptomatic process, major cardiovascular complications may occur which adversely affect the quality of life and life expectancy of the patients. The risk of these complications increases significantly in individuals with late diagnosis of T2DM.**[26]** According to the data, it is found that Iron deficiency anemia in T2DM was mostly observed in case of female as compared to male patients. It was noted at total 32 patients were iron deficient among which 12 male, i.e. 37.5 % and 20 female, i.e. 62.5% females were observed from this study.

From the study it is clear that maximum number of patients' i.e.38 cases were recorded with less than 5 years of duration of T2DM followed by 62 patients having more than 5years duration. According to a study knowledge of diabetic complications among patients with T2DM in the public hospitals of Addis

Ababa was 54.9. Duration of DM since diagnosis, current profession, family history, and participation in diabetic counseling were identified having good knowledge about DM complications and mentioned about the correlation between the iron deficiency and type II diabetes. [27]

CONCLUSION

Iron deficiency anemia and DM are common public health problems. It should be remembered that iron deficiency is an important point to be considered in the diagnosis and treatment of diabetes. In this study, it shows that there is a strong association between T2DM and iron deficiency Anemia. This study suggested that among all the T2DM, iron deficiency anemia was mostly found in females rather than the male patients. The iron status should be considered during the interpretation of the HbA1c concentrations in diabetes mellitus. Iron supplementation is important in diabetic patients with IDA, as it would also increase the reliability of the HbA1c results. Early diagnosis and treatment of IDA in diabetic patients can improve their glycemic control and may prevent or delay complications. Thus, on the basis of the study, it may be concluded that female gender elderly persons are more prone to T2DM and thus they are expected to be more prone to complications due to T2DM like iron deficiency anemia. Diabetes mellitus is one of the fastest-growing and the most common chronic endocrine and metabolic disorders that affect many people around the world. So our findings were also regarding analysis of duration of T2DM. And it was found that duration of the disease was more than 5 years from the collected data. The duration of diabetes is expected to influence the results and thus required inclusion in the further study design. Hence, Diabetes is a slow killer with no known curable treatments. However, its complications can be reduced through proper awareness and timely treatment. It is important to keep the blood glucose levels of patients under strict control for avoiding the complications.

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