Original research article

Prevalence of Anemia among Type 2 Diabetes Mellitus Patients-A Cross-Sectional Study

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Abstract

Background: Type 2 diabetes mellitus has become a serious public health problem due to its rising prevalence. The number of diabetes patients has been rising due to population and urbanization expansion, rising obesity, sedentary lifestyle and patients with DM living longer. Complications of diabetes are blindness, amputations, renal disease, anemia, cardiovascular disease, brain issues, and lowered quality of life. We in the current study tried to assess the prevalence of anemia in people suffering from diabetes mellitus among OPD patients of PHC Kinaye.

Methods: A cross-sectional study was conducted from October 01st, 2021 to November 30th, 2021 among people visiting the OPD of PHC Kinaye, Belagavi, Karnataka under the administrative control of JNMC. The estimated sample size was n=215. A semi-structured questionnaire was used to collect data. The existence of diabetes-related complications such as retinopathy, neuropathy, nephropathy, and other problem, as well as the history of hypertension and current diabetic medicines, were obtained by evaluating the patient's medical records.

Results: Hemoglobin levels were normal in n=125(58.1%) of cases. The existence of anemia was found in n=90(41.86%) cases out of which n=65(72.22%) cases were mild anemia, n=25(27.78%) cases were moderate anemia, and there were no cases of severe anemia in our study group. The range of hemoglobin levels was 8.1 to 14.9 mean hemoglobin levels in the study were 13.9 ± 3.56 gm%

Conclusions and Recommendations: Prevalence of anemia was found in approximately 40% of the cases in the study. Most people were suffering from DM for 2-3.9 years. Dietary advice regarding iron-rich diets and dietary practices inhibiting iron absorption were explained to patients. All the participants were educated regarding the various risks associated with type 2 diabetes mellitus, awareness regarding risk factors, and co-morbidities like hypertension, diabetic retinopathy, diabetic neuropathy, and diabetic nephropathy.

Keywords: Anemia, Diabetes Mellitus Type 2, Prevalence, PHC Kinaye

Introduction

Diabetes mellitus (DM) is a metabolic disorder defined by persistent high blood glucose levels as a result of impaired carbohydrate, lipid, and protein metabolism. [1] Epidemiological data showed that Over 400 million individuals worldwide suffer from diabetes, which claimed the lives of 1.6 million people in 2015 and it is estimated that in the year 2030 we will have about 440 million diabetics and by the year 2035 one among ten of the world's population could be diabetics. [2, 3] Its worldwide prevalence is increasing rapidly among developing countries. The existence of chronic hyperglycemia in poorly controlled diabetics leads to long-term damage, and dysfunction of several organs of the body, including the eyes, kidneys, nerves, blood, and blood arteries. [4] Anemia is the commonest blood-related disorder found in diabetic patients. [5] The incidence of anemia is particularly very in patients with associated kidney dysfunction where the production of erythropoietin is typically affected. [6, 7] Several studies in this field have found, that diabetic individual with renal insufficiency are more likely than normal diabetics to develop anemia when their kidneys' ability to manufacture erythropoietin declines. Diabetic neuropathy also affects the hormone responsible for RBC synthesis, which leads to anemia. [8, 9] Diabetes patients have cyanocobalamin, folate, and iron deficits, which can lead to anemia in various forms. Metformin may cause vitamin B12 deficient anemia by interfering with cyanocobalamin absorption. [10]

Hemoglobin levels of less than 13 g/dl in men and 12 g/dl in women are considered anemia. [11] Furthermore, anemia is defined as a reduction in the oxygen-carrying capacity of blood produced by a decreased erythrocyte mass or a decrease in the hemoglobin concentration of the blood. [12] It occurs when the amount of red blood cells (and hence their oxygen-carrying capacity) is insufficient to satisfy the body's physiologic requirements. Age, gender, residence elevation above sea level (altitude), smoking habits, and different phases of pregnancy all influence physiologic demands. [13] Anemia in the diabetic population, whether type I or type II, is now thought to be a powerful and independent predictor of the increased risk of macrovascular and microvascular complications of diabetes. [14] Several studies have found in diabetic care hospitals that the prevalence of unrecognized anemia is twice or thrice more common as compared to the general population. Furthermore, DM patients acquire anemia at a younger age and with greater severity than the general population, placing them at higher risk of problems, and this added load adds significantly to the patient's concomitant vascular disease and unfavorable outcomes. [15, 16] Since there is a paucity of data on the prevalence of anemia in rural populations, we in the current study tried to assess the prevalence of anemia in people suffering from diabetes mellitus among OPD patients of PHC Kinaye of Belagavi District, Karnataka State, India.

Material and Methods

A cross-sectional study was conducted from October 01st, 2021 to November 30th, 2021 among people visiting the OPD of PHC Kinaye, Belagavi, Karnataka under the administrative control of JNMC. Institutional Ethical committee permission was obtained for the study. Written consent was obtained from all the participants of the study.

Inclusion criteria
1. All Diabetic patients attending OPD of PHC rural area.
2. Diabetic patients who have given consent.
3. Age above 30 years.
4. Males and females

Exclusion criteria
1. Patients with Type 1 DM
2. Age less than 18 years
3. Patients with Gestational Diabetes Mellitus
4. Patients with known hematologic diseases
5. Patients attending OPD of PHC Kinaye but who have not given consent.

Sampling technique used: Universal sampling

Sample size:
Sample size calculation
n=4pq/d2
Where n = sample size, p = prevalence taken as
p=47.5
q= 52.5
d= 6.811 = absolute error
n= 4*47.5*52.5/46.4 = 215
So, the estimated sample size is 215

A semi-structured questionnaire was used to collect data. Sociodemographic factors, clinical features, anthropometric measures, and laboratory analysis are among the data gathered. The existence of diabetes-related complications such as retinopathy, neuropathy, nephropathy, and other problem, as well as the history of hypertension and current diabetic medicines, were obtained by evaluating the patient's medical records. After 10 minutes of rest in a sitting position, blood pressure was taken with an aneroid sphygmomanometer. Hypertension was defined as having a systolic blood pressure (SBP) of 130 mmHg or diastolic blood pressure (DBP) of 80 mmHg or using antihypertensive medication.

Data were collected by using a semi-structured questionnaire. The collected information includes socio-demographic characteristics, clinical characteristics, anthropometric measurements, and laboratory analysis. Socio-demographic data and clinical characteristics like duration of DM were collected using questionnaire; whereas the presence of diabetes-related complications like; retinopathy, neuropathy, nephropathy, and other complication; history of hypertension, and current diabetic medications were collected from reviewing of patient's medical records. Blood pressure (BP) was measured using an aneroid sphygmomanometer after 10 mins of rest in a sitting position. Hypertension was defined as Systolic Blood Pressure (SBP) ≥130 mmHg and/or Diastolic Blood Pressure (DBP) ≥80 mmHg or current use of antihypertensive medication. 5 ml of blood sample was obtained in a vacutainer under aseptic conditions and hematological analysis was done for Hemoglobin (Hgb) values in Hematology Analyzer. Anemia was defined by the World Health Organization (WHO) as Hb concentrations of less than 13 g/dl in males and less than 12 g/dl in females. [43 of jbm] Mild anemia (female: 11–11.9 g/dl; male: 11–12.9 g/dl), moderate anemia (8–10.9 g/dl), and severe anemia (less than 8 g/dl) were the three categories. [17]

Statistical analysis:

The data was collected and uploaded on an MS Excel spreadsheet and analyzed by SPSS version 22 (Chicago, IL, USA). Quantitative variables were expressed on mean, standard deviations, proportions and percentages. Fisher's exact test is used to find the difference between two proportions.

Results

A total of n=215 cases were studied based on the sample size estimation. Out of n=215 cases, n=90(41.8%) were males and n=125(58.2%) were females. Out of these the age group between 51 – 55 years were with n=45(20.93%) of the cases followed by the age group 46 – 50 with n=40(18.6%) of all the cases. The age-wise distribution of the cases has been depicted in table 1. The mean age of the cases in the study was 48.59 ± 7.5 years the youngest case was 38.5 years old female and the oldest case was a 69-year-old female.

Table 1: Demographic profile of the patients included in the study

Age group (yrs)	Frequency	Percentage
35-40	15	06.97
41-45	35	16.27
46-50	40	18.60
51-55	45	20.93
56-60	35	16.27
61-65	30	13.95
66-70	15	06.97
Total	215	100.0

The duration of diabetes mellitus was recorded in the cases of the study as depicted in table 2. A critical analysis of table 2 reveals the most common duration of diabetes mellitus in the cohort was 2.0 – 3.9 years with n=70(32.5%) of cases followed by a duration of 4.0 – 5.9 years with n=45(20.9%) of the cases. The duration of diabetes mellitus of greater than 10 years was found in n=15(6.9%) cases. The mean duration of diabetes mellitus in all the groups was 3.75 ± 1.8 years. our study found of n=215 people, n=170(79.07%) were suffering from hypertension also along with type 2 diabetes mellitus. Out of which n=108 were females and n=62 were males. The mean level of Fasting blood glucose recorded in the current study was 153.66 ± 23.65 mg/dl.

Table 2: Duration of Diabetes in the cases of study

Duration of Diabetes	No. of cases	Percentage
6 months-1.9 years	20	09.3
2.0 - 3.9 years	70	32.5
4.0 - 5.9 years	45	20.9
6.0 - 7.9 years	35	16.2
8.0 - 9.9 years	30	13.9
>10 years	15	06.9

In the current study, hemoglobin level were normal in n=125(58.1%) of cases. The prevalence of anemia was found in n=90(41.86%) cases out of which n=65(72.22%) cases were mild anemia, n=25(27.78%) cases were moderate anemia, and there were no cases of severe anemia our study group. The range of hemoglobin levels was 8.1 to 14.9 mean hemoglobin levels in the study were 13.9 ± 3.56 gm% the distribution of cases based on their hemoglobin levels has been given in table 3. The mean fasting blood glucose levels in anemia cases (n=90) was 165.25 ± 23.65 mg/dl slightly higher than the mean values of non-anemic cases n=125 cases was 141.25 ± 20.89 mg/dl.

Table 3: Hemoglobin levels in the cases of study

Haemoglobin Levels (gm %)	No. of cases	Percentage
8.0 - 8.9	15	06.9
9.0 - 9.9	10	04.6
10.0 - 10.9	25	11.6
11.0 - 11.9	40	18.6
12.0 - 12.9	75	34.8
13.0 - 13.9	35	16.2
14.0 - 14.9	15	06.9

Out of the total n=215 cases studied in this study n=50(23.2%) had pallor, n=25(11.6%) experience fatigue, n=10(4.6%) experienced dyspnea, n=5(2.3%) experienced dizziness, and n=125(58.1%) had none of the features suggestive of anemia. The distribution of the signs and symptoms recorded in this study has been depicted in Figure 1.
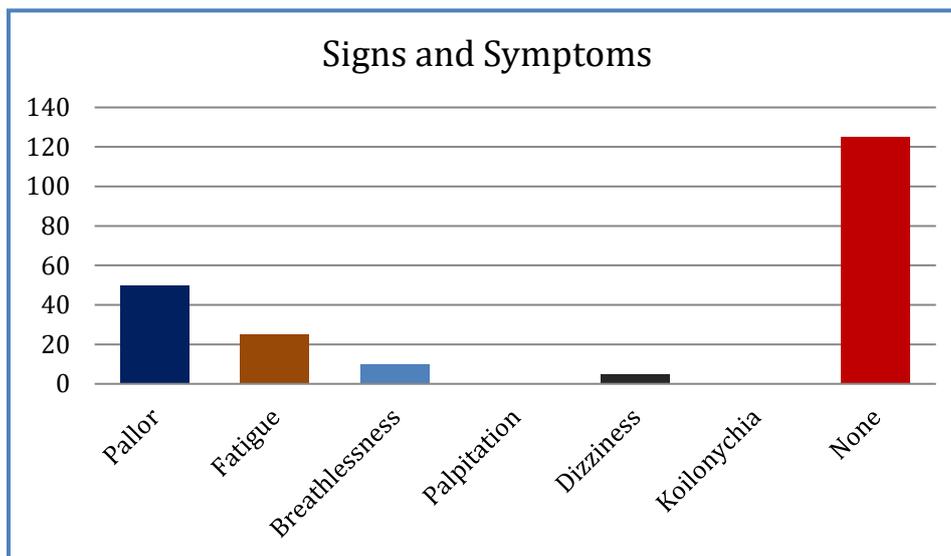

Figure 1: Distribution of common signs and symptoms of anemia recorded in the study

Discussion

Patients with type 2 diabetes are twice as likely to suffer from anemia as those without the disease. Anemia has been recognized as a risk factor for cardiovascular and end-stage renal disease in diabetes individuals by Bosman et al., [18] and Keane et al., [19] In a similar study we found that diabetics with low Hb levels are more likely to be hospitalized or die prematurely. Anemia in diabetics is said to increase the risk of developing eye diseases, heart diseases, or stroke. [20] Despite these data, anemia remains undiagnosed in 25% of diabetes patients. [21] It has been found that diabetic patients with anemia have increased levels of proinflammatory cytokines as compared to those without anemia. In anemia, the IL-6 activity production, as well as B cell activity, increases this shows the association of IL-6 with anti-erythropoietic actions. [22] Furthermore, there diabetic and anemic cases have higher levels of C-reactive protein and ferritin. Lower iron contents in these patients show that ferritin increase is associated with chronic inflammatory processes found in diabetics. [23] The prevalence of anemia was found in n=90(41.86%) cases. The prevalence is higher than a study conducted by Rani et al, found (12.3%). [24] A similar cross-sectional study in Brazil [25] found the prevalence at 34.24% and Australia at 23.3%. [26] The two important factors which could have been the reason for the higher prevalence found in the current study in the Indian scenario are firstly the overall prevalence of iron deficiency anemia is very common in India as compared to the rest of the world. Secondly, the rural population in India has a greater deficiency as compared to the urban

population due to the lack of access to nutritious foods. Countries such as Pakistan have shown a prevalence of 63% [28] and Caribbean studies have shown a prevalence of 46.5%. [29] The overall existence of differences in different countries is related to geographical locations, ethnicity, age of the study participants, duration of diabetes mellitus, and quality of health care system in the country. [3, 5, 28] The Majority of cases out of a total of n=90 detected with anemia n=65(72.22%) cases were of mild anemia, and n=25(27.78%) cases were of moderate anemia. No case of severe anemia was detected in this study. These findings were similar to the other studies done in this field. [30] The mean age of anemic patients in the current study was 55.36 ± 3.6 years whereas the mean age of non-anemic patients in this study was 43.66 ± 5.21 years. This shows that older age diabetics are more susceptible to developing anemia as compared to the lower aged patients. These results are in concordance with observations done in other countries, which showed that old age is associated with a higher prevalence of anemia and the mean age of anemia patients is higher than non-anemic patients. [31] This also shows that related deficiencies of vitamins such as folate, and B12 and a greater number of comorbidities are common in elderly patients. [31] The strength of the study is that this is one of the studies of its kind done in this PHC where there is no data available on the prevalence of anemia in diabetes mellitus. The limitations of the current study were the absence of age and sex-matched controls and glycemic status was assessed by Fasting blood glucose, not by HbA1c. Another important area of limitation is the cut-off value for the diagnosis of anemia is not validated as per the Indian population.

Conclusions:
Prevalence of anemia was found in approximately 40% of the cases in the study. The common duration of DM for 2.0-3.9 years. Most people were suffering from hypertension along with type 2 diabetes mellitus. The mean FBS levels in anemia cases were higher than those without anemia. Accordingly, patients who were found to be anemic were treated with iron supplements. Ferrous sulfate tablets and vitamin B12 with folic acid were given to men and women who were diagnosed to be anemic.

Recommendations:
Dietary advice regarding iron-rich diets and dietary practices inhibiting iron absorption were explained to patients. All the participants were educated regarding the various risks associated with type 2 diabetes mellitus, awareness regarding risk factors, and co-morbidities like hypertension, diabetic retinopathy, diabetic neuropathy, and diabetic nephropathy. Participants were also motivated to have regular exercise, control their sugar intake, regular sugar monitoring, and be advised foot care for diabetic neuropathy. Participants were educated regarding prevention, treatment, and control of DM through role-plays and house-to-house talk.

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