Original Research Article

Study of anaemia in type 2 diabetes mellitus

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ABSTRACT

Background: Anaemia is increasingly recognized entity in the patients with diabetes mellitus and constitutes an additional burden in patients. The prevalence of anaemia in the patients with diabetes is two or three times higher than in patients with comparable renal impairment and iron stores in the general population. As India is foreseen a diabetic capital of the world, it becomes imperative to recognize co-morbidities such as anaemia at the earliest. Hence this study is being conducted with the aim to determine the prevalence and various causes of anaemia in diabetics.
Methods: After obtaining informed written consent, all diabetics patients were subjected to detailed history, through clinical examination and investigation with CBC, Renal function test including creatinine clearance. The difference of mean between anaemic and non anaemic diabetic patients was evaluated by unpaired student t test. Finally, correlation between the level of haemoglobin and index of renal damage (albumin-creatinine ratio) was accessed by Pearson correlation. Statistical software of SPSS 10 ver. and EXCEL (office 9) was used to analyse the data.
Results: In the present study, nearly two third patients of type 2 diabetes mellitus were anaemic. The maximum number of anaemic patients with type 2 diabetes mellitus had microcytic hypochromic type of anaemia.
Conclusions: It is therefore concluded that anaemia is a prevalent finding in patients with type 2 diabetes mellitus and represents significant unrecognised burden. The anaemia may be attributed to variable contribution of iron deficiency state and chronic inflammation as result of the disease itself.

Keywords: Anaemia, Albuminuria, CKD, Diabetes

INTRODUCTION

The syndrome of diabetes mellitus has followed a long course since the time of Egyptian papyrus in 1500 BC. It was discovered in the tropical India around 600 B.C. just prior to beginning of Buddhist era. The great clinician Charak and Sushruta described the sweetness of urine (Madhumeh-honey urine) in some patients presenting with Polyuria.[1]

Diabetes mellitus comprises a group of common metabolic disorders that share the phenotype of hyperglycaemia. The metabolic dysregulation associated with diabetes mellitus causes secondary pathophysiologic changes in multiple organ system that imposea

tremendous burden on the individual with diabetes and on the health care system. In the United States, diabetes mellitus is the leading cause of end-stage renal disease. With an increasing incidence, worldwide diabetes mellitus will be the leading cause of morbidity and mortality for the foreseeable future. The worldwide prevalence of diabetes has risen dramatically over the past two decades. Although the prevalence of both type1 and type 2 diabetes mellitus is increasing worldwide, the prevalence of type 2 diabetes mellitus is expected to rise more rapidly in the future because of increasing obesity and reduced activity levels.[2] International Diabetes Forum statistics suggest that there are more than 194 million people with diabetes worldwide and project that this will double by 2025.[3]

Anaemia is increasingly recognized entity in the patients with diabetes mellitus and constitutes an additional burden in patients. The prevalence of anaemia in the patients with diabetes is two or three times higher than in patients with comparable renal impairment and iron stores in the general population.[4-6]

Studies show having anaemia along with diabetes may increase the likelihood of developing the diabetic eye disease, developing heart disease or having a stroke. People who have both the diabetes and anaemia are more likely to die early than those who have diabetes but not anaemia. High death rates are even more common in anaemic people with diabetes who also have heart failure and/or kidney diseases.[7]

As India is foreseen a diabetic capital of the world, it becomes imperative to recognize co-morbidities such as anaemia at the earliest. Hence this study is being conducted with the aim to determine the prevalence and various causes of anaemia in diabetics.

METHODS

This study was conducted in the Department of Medicine at ESIC Medical College and Hospital, Faridabad, Haryana with prime objective to determine the prevalence and type of Anaemia in patients with type 2 Diabetes Mellitus.

A 100 patients suffering from type 2 Diabetes Mellitus, attending indoor and outdoor department of General Medicine, were included in the study. After obtaining informed written consent, all patients were subjected to detailed history, through clinical examination and investigation. The following investigations were performed on all the subjects at computerized central laboratory of ESIC Medical College and Hospital, Faridabad

- A complete haemogram including: Haemoglobin-by Sahli's haemoglobinometer, Total leukocyte count-by modified Neubaeur's chamber, Differential leukocyte count, Packed cell volume (haematocit)-by Wintrobe's method, Mean corpuscular volume (MCV), Mean corpuscular haemoglobin(MCH), Mean corpuscular haemoglobin concentration (MCHC)
- ESR
- Blood sugar levels
- Peripheral smear for type of anaemia
- Stool examination: Routine and microscopic, Stool for occult blood.
- Kidney function test
- Urine routine and Microscopic
- ECG
- Reticulocyte count
- Creatinine clearance.

Other investigations (as and when required): UGI-Endoscopy, LGI-Endoscopy, U/S abdomen, Bone marrow, HBA1c.

In all the patients having anaemia with diabetes, creatinine clearance (ml/min) was calculated. It was calculated using the Cockcroft-Gault equation [(140-age) x wt (kg)/serum creatinine (mg/ dl) x 72] x 0.85 (if female).[5]

Statistical analysis

Interpretation and analysis of data obtained were carried out using standard test of significance. The difference of mean between anaemic and non anaemic diabetic patients was evaluated by unpaired student t test. Finally, correlation between the level of haemoglobin and index of renal damage (albumin-creatinine ratio) was accessed by Pearson correlation. Statistical software of SPSS 10 ver. and EXCEL (office 9) was used to analyse the data.

RESULTS

All the cases of Diabetes Mellitus were taken from the outpatient department and various medical wards of the ESIC Medical College and Hospital, Faridabad. The following observations were made.

Table 1: Prevalence of anaemia in type 2 diabetes mellitus.

WHO criteria	Males (%)	Females (%)	Total (%)
Anaemia present	43 (64.17)	20 (60.60)	63 (63.00)
Anaemia absent	24 (35.82)	13 (39.39)	37 (37.00)
Total	67 (67.0)	33 (33.0)	100 (100)

Table 2: Distribution of pattern of anaemia.

Type of Anaemia	Males (%)	Females (%)	Total (%)
Microcytic Hypochromic	22 (51.16)	14 (70)	36 (57.14)
Normocytic hypochromic	21 (48.84)	06 (30)	27 (42.86)
Macrocytic	0	0	0
Total	43 (68.25)	20 (31.75)	63 (100)

Sixty three (63.00%) out of one hundred patients of Type 2 diabetes Mellitus had anaemia, out of which forty three (68.25%) were males and twenty (31.74) were females.

Over all 64.17 % of all male patients and 60.60% of all female patients were anaemic. Only about one third patients were found to be non anaemic (Table 1).

Out of sixty three anaemic patients, twenty seven (42.86) had normocytic hypochromic type of anaemia and thirty six (57.14%) had microcytic hypochromic type of anaemia, whereas none had macrocytic type of anaemia.

Maximum number twenty-two (51.16%) and fourteen (70%) of anaemic males and females respectively had microcytic hypochromic type of anaemia (Table 2).

Maximum number of anaemic patients, that is 32 (50.79%) had a creatinine clearance of 31 to 60 ml/min, whereas maximum number of non anaemic patients, that is 20 (54.05%) also had a creatinine clearance of 61 to 90 ml/min. Prevalence of anaemia was 100% in patients with creatinine clearance less than 30ml/min whereas, prevalence of anaemia was only 18.75% in patients with creatinine clearance more than 90ml /min (Table 3).

Table 3: Creatinine clearance in 100 patients of type 2 diabetes mellitus.

Creatinine clearance (ml/min)	<30	31- 60	61-90	>90
Anaemic (n = 63)	07 (100%)	32 (88.88%)	21(51.21%)	03(18.75%)
Non anaemic (n = 37)	0	04 (11.11%)	20 (48.78%)	13 (81.25%)
Total (n=100)	07 (7%)	36 (36%)	41 (41%)	16 (16%)

Table 4: Relation of haemoglobin level with albuminuria.

Albuminuria (mg/day)(n)	Anaemic (%)	Non anaemic (%)
< 30 (19)	03 (15.78.43%)	16 (84.21%)
30-300(36)	15 (41.66%)	21 (58.33%)
>30(45)	45 (100%)	0

Table 5: Relation of albuminuria with creatinine clearance and haemoglobin level.

Albuminuria (mg)	Creatinine clearance (ml/min)	Haemoglobin level (gm/dl)
< 30 (19)	111.5±11.70	12.8±2.29
30-300 (36)	78.9±10.65	12.1±2.16
>300 (45)	52.5±14.76	9.34±2.03

Maximum number of anaemic patients, that is 60 (89.55%) had albuminuria more than 30 mg/day whereas only 03 anaemic patients had albuminuria less than 30mg /day.

Twenty one patients had albuminuria more that 30 mg/day but they were non anaemic and only 16 non anaemic patients had albuminuria less than 30 mg/day. As the level of albuminuria increased, the prevalence of anaemia also increased (Table 4).

In the patients with normoalbuminuria (urinary albumin < 30 mg/day) the mean creatinine clearance was 111.5±11.70 and mean Hb level was 12.8±2.29.

In the patient with microalbuminuria (urinary albumin 30-300 mg/day) and macroalbuminuria (urinary albumin >300mg/day) the mean creatinine clearance was 78.9±10.65 and 52.5±14.76 ml/min. The mean Hb level in patients with microalbuminuria and macroalbuminuria was 12.1±2.16 and 9.34±2.03 gm/dl respectively (Table 5).

DISCUSSION

Prevalence of anaemia

In this study, out of one hundred patients, 63 (63%) were anaemic and 37 (37%) were non anaemic. In contrast, study conducted by Ezenwaka CE et al, out of 155 patients of type 2 diabetes mellitus, 72 (46.45%) were anaemic and 83 (53.54%) were non anaemic.[8] In another study, conducted by Cawood TJ et al, out of 270 patients only 34 (12.29%) were anaemic.[9] The higher prevalence of anaemia in our study was probably due to lack of knowledge about balanced diet, increased incidence and prevalence of infection and chronic diseases, malnutrition due to poverty and poor access to medical care. In our study, out of 63 anaemic patients, 43 (68.25%) were males and 20 (31.74%) were females. Similarly, the study conducted by Cawood TJ et al, out of 34 anaemic patients, 19 (55.88%) were males and 15 (44.11%) were females.[9]

Type of anaemia

In this study, out of 63 anaemic patients, 27 (42.86%) had normocytic normochromic type of anaemia, 36 (57.14%) had microcytic hypochromic type of anaemia. Maximum number of anaemic patients that is 22 (34.92%) males and 14 (22.22%) females had microcytic hypochromic type of anaemia, whereas study conducted by Cawood TJ et al, 85% of anaemic patients had normocytic anaemia.[9]

In another study, conducted by Yun YS et al, 87.5% patients had normocytic and 14.3% had microcytic type of anaemia.[10] The higher prevalence of microcytic hypochromic anaemia in our study was probably due to malnutrition, poverty and increased frequency of pregnancy in females. The maximum number of patients with any type of anaemia belonged to the age group of 51 to 60 years.

There were 32 (50.79%) patients in the age group of 51 to 60 years, out of which 14 (43.75%) had microcytic hypochromic type of anaemia, 18 (56.25%) had normocytic hypochromic type of anaemia and none had macrocytic type of anaemia. In our study, there was no significant relation between the type of anaemia and duration of type 2 diabetes mellitus.

Microcytic hypochromic anaemia and normocytic hypochromic anaemia were maximum in patients with duration of type 2 diabetes mellitus from 16 to 20 years. There was no significant correlation between the signs and symptoms of anaemia with the pattern of anaemia. The symptoms like, Weakness, giddiness, anorexia was more prevalent in all types of anemia as compare to the symptoms like breathlessness, Palpitation, Tinnitus. Similarly, sign like pallor was present in all patients of anaemia, irrespective of its type.

Creatinine clearance

In this study, prevalence of anaemia decreased as creatinine clearance increased. Out of 100 patients with type 2 diabetes Mellitus the prevalence of anaemia in patients with creatinine clearance <30ml /min was 100% whereas prevalence of anaemia in cases with creatinine clearance >90ml/min was only 18.75% male and female diabetic patients also follow the same pattern. These finding were supported by Thomas MC et al, which showed that patients of type 2 diabetes mellitus with creatinine clearance 60-90nml/min were twice likely to have anaemia as compared to the patients with creatinine clearance >90ml/min and diabetes with creatinine clearance <60ml/min were twice likely to have anaemia as compared to patients with creatinine clearance 60-90ml/min.[5]

In present study, the prevalence of anaemia in the diabetic patients with creatinine clearance more than 60 ml/ min was 51.21%, whereas study conducted by Cawood TJ et al, 72% of diabetic patients with creatinine clearance more than 60 ml /min are anaemic.[9] Both of this result, signified that there are many factors that cause anaemia in type 2 diabetes mellitus other than diabetes nephropathy. Another study done by Ezenwaka CE et al, reported that anaemic patients of diabetic group had significantly lower creatinine clearance (67.1±3.0ml/min) than non diabetic (57.9±5.4ml/min) and it was significant (p<0.001).[8]

Albuminuria

In our study, in patients with normoalbuminuria (albuminuria < 30mg/day) the mean creatinine clearance was 111.5±11.70 and mean Hb level was 12.8±2.29, in patients with microalbuminuria (albuminuria 30-300mg/day) the mean creatinine clearance was 78.9±10.65ml/min and mean Hb level was 12.1±2.16 and in patients with macroalbuminuria (albuminuria>300mg/day) the mean creatinine clearance

was 52.5±14.76 ml /min and mean Hb level was 9.34±2.03gm/dl.

In our study, as the level of albuminuria increased, prevalence of anaemia increased. In patients with normal buminuria, out of 19 only 3 (15.78%) were anaemic, whereas in patients with micro buminuria, the prevalence of anaemia was 41.66% and in patients with macro albuminuria the prevalence of anaemia was 100%. The study conducted by Thomas MC et al, reported similar results.[5]

Albumin-creatinine ratio

In this study, albumin creatinine ratio showed negative correlation with haemoglobin level. Thus, as the albumin creatinine ratio increased, Hb level decreased, similar finding was reported by the study of Cawood TJ et al.[9]

CONCLUSION

It is therefore concluded that anaemia is a prevalent finding in patients with type 2 diabetes mellitus and represents significant unrecognized burden. The anaemia may be attributed to variable contribution of iron deficiency state and chronic inflammation as result of the disease itself. The differentiation being extremely difficult in the country like India with iron deficiency being common. Also, anaemia of other etiologies may also coexist and contribute to the ambiguity in the interpretation. Patients at greater risk can be identified by the presence of renal disease either in the form of renal impairment and or albuminuria.

In the present study, nearly two third patients of type 2 diabetes mellitus were anaemic. The maximum number of anaemic patients with type 2 diabetes mellitus had microcytic hypochromic type of anaemia. Also, it is seen that as incidence of albuminuria and chronic kidney disease in diabetes mellitus type 2 increases, severity of anaemia increases.

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