

## Evaluation of incidence of anemia in type 2 diabetic patients with normal renal function

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### Abstract

**Aim:** The study was carried out over a period of 6 months to evaluate the incidence of anemia in Type 2 diabetic patients with normal renal functions.

**Methods:** The study group comprised of 100 patients with TYPE 2 diabetes mellitus and normal renal functions. Haemoglobin concentration, fasting blood sugar and HbA1c (glycated haemoglobin) of the subjects was measured. Renal function test (Serum urea, serum creatinine, serum uric acid, serum sodium and serum potassium) of all the patients were done and were within the normal range. The subjects with abnormal renal functions were excluded from the study. The presence of anemia was defined by haemoglobin level of less than 13 g/dl in men and <12 g/dl in women.

**Results:** In the present study, the patients had high incidence of anemia i.e., 79%. The incidence was more in patients with uncontrolled diabetes and HBA1c level more than 7.5%.

**Conclusion:** This study indicated that poor glycemic control and old age are associated with high incidence of anemia in Type 2 diabetics with normal renal functions.

**Keywords:** Anemia, Type 2 Diabetes Mellitus, HbA1c (glycated haemoglobin).

### Introduction

Diabetes mellitus is a metabolic disorder of great impact worldwide.<sup>(1)</sup> Epidemiological data show that, in 2010 there were 258 million people affected in the world and it is estimated that in the year of 2030, we will have about 440 million diabetes worldwide.<sup>(2)</sup>

Anemia is the most common blood disorder in patients with diabetes.<sup>(3)</sup> It is also a key indicator of chronic kidney disease and an important cardiovascular risk factor.<sup>(4,5)</sup> Previous studies have shown the relationship between anemia in diabetic patients and presence of kidney disease. It could be due to autonomic neuropathy causing efferent sympathetic denervation of the kidney and loss of appropriate erythropoietin, release of pro-inflammatory cytokines and inhibition of erythropoietin release.<sup>(6,7)</sup>

There are a number of studies on the presence of anemia in diabetic patients with renal insufficiency but limited studies exist on the incidence of anemia in diabetics with normal renal functions. Therefore, the need for studies on incidence of anemia in diabetic patients prior to renal impairment has become important to increase the level of awareness and understanding of anemia amongst diabetic patients to improve the quality of life and for their better outcomes. Our study was therefore undertaken with the aim to evaluate the incidence of anemia in Type 2 diabetic patients with normal renal functions.

### Materials and Methods

The study was carried out at Dr. Vivek's Diagnostic Center, Jammu over a period of 6 months i.e., from 1<sup>st</sup> January 2016 to 30<sup>th</sup> June 2016. The study

group comprised of 100 patients already diagnosed with Type 2 diabetes mellitus with normal renal functions. Blood sample were collected from the patients under aseptic conditions using fresh disposable needles and syringes and sterile containers. Blood samples were collected into fluoride oxalate bottles for fasting blood glucose (F.B.G), EDTA bottles for haemoglobin percentage and HBA1c levels.<sup>(8)</sup> Plain serum was used for renal function tests (RFT), blood glucose and renal function tests (Serum urea, serum creatinine, serum uric acid, serum sodium and serum potassium) were estimated using semi-automated biochemical analyser (chem. 7). Haemoglobin concentration was done using cell counter and HBA1c levels were estimated using NACO Card reader. The presence of anemia was defined by a haemoglobin level less than 13 g/dL in men and less than 12 g/dL in women based on the definition of World Health Organization.<sup>(9)</sup>

The renal function tests of all subjects were within normal limits.

### Results

The study group comprised of 100 patients, out of which 53 (53 %) were females and 47 (47 %) were males (Table 1). The diabetic patients were divided into groups:

1. Age group- less than 60 years & more than 60 years (Table 2)
2. Blood glucose levels (Table 5)  
110-130 mg/dL  
130-150 mg/dL  
>150 mg/dL

3. HbA1c levels (Table 6) - less than 7.5% (Good control)

More than 7.5 % (poor control).<sup>(10)</sup>

61 patients were less than 60 years of age and 39 patients were more than 60 years of age. Out of 61 patients (less than 60 years), 36 (59.1%) were males and 25 patients (40.9%) were females. Out of 39 patients (more than 60 years), 11 patients (28.2%) were males and 28 patients (71.8 %) were females (Table 2).

Haemoglobin levels were studied in 100 patients, out of which 21 patients (21%) patients had adequate haemoglobin levels and 79 patients (79%) had haemoglobin levels below cut off of 12 g/dL for females and 13 g/dL for males (Table 3).

Out of 79 patients (79%) 48 (60.7%) were females and 31 (39.3%) were males. Out of 48 females (60.7%) 23 females (47.9%) were less than 60 years and 25 females (52.1%) were more than 60 years. Out of 31 males (39.3%) who were anemic, 20 (64.5%) were less than 60 years and 11 (35.5%) were more than 60 years (Table 4). Out of 21 patients who had adequate haemoglobin levels, 5 (23.8%) were females and 16 (76.2%) were males. These 21 patients had been recently diagnosed as diabetics. The patients were also grouped into three categories according to fasting blood glucose levels. Out of 47 male patients, 12 patients (25.5%) had F.B.G levels between 110-130 mg/dL, 16 patients (34.5%) had F.B.G levels between 130-150 mg/dl and 19 patients (40.5%) had F.B.G levels more than 150 mg/dl. Out of 53 females, 10(19%) had F.B.G between 130-150 mg/dL, 20 (38%) had F.B.G between 130-150 mg/dL and 23 (43%) had F.B.G levels more than 150 mg/dL (Table 5).

HbA1c levels of all the patients were done. 22 patients (22 %) had good control of diabetes with HbA1c less than 7.5%. Out of these 22 patients, 12 (54.5%) were males and 10 (45.5%) were females. 78 patients (78%) had HbA1c levels greater than 7.5% and were grouped under poor control. Out of these 78 patients, 35 (44.8%) were males and 43 (55.2%) were females (Table 6). The renal functions of all the patients were within normal limits.

**Table 1**

Gender	n = 100 patients
Females	53 (53%)
Males	47 (47%)

**Table 2**

Age Group n = 100		
< 60 yrs	61 Patients (61%)	M – 36 (59%)
		F – 25 (41 %)
>60 yrs	39 Patients (39%)	M - 11 (28.2 %)
		F – 28 (71.8%)

**Table 3**

Hemoglobin levels Cut off for anemia <12 mg/dL – Females and <13 mg/dL - Males	
Normal Hb levels	21 Patients (21%)
Anemic	79 Patients (79%)

**Table 4**

Gender	Anemic n = 79 patients	<60 Yrs	>60 yrs
Females	48 (60.7%)	23 (47.9%)	25 (52.1%)
Males	31 (39.3%)	20 (64.5%)	11 (35.5%)

**Table 5**

Fasting Blood Glucose Level (mg/dL)	Male patients n = 47	Female patients n= 53
110 - 130	12 (25.5%)	10 (19%)
130 - 150	16 (34%)	20 (38%)
>150	19 (40.35%)	23 (43%)

> 130 = 35 males, 43 females

**Table 6**

HbA1c level %	n = 100
Good control < 7.5	n = 22 M – 12 (54.5%)
	F – 10 (45.5%)
Poor control > 7.5	n = 78 M – 35 (44.8%)
	F – 43 (55.7%)

## Discussion

In present study, the patients had high incidence of anemia (79%). In the previous studies done by B.I Adejumo et. al. and J. Barbieri<sup>(10,11)</sup> the reported incidence was 15.3% and 34.2% respectively. The higher incidence in our study could be attributed to poorly controlled diabetes in our patients as a result of impaired erythropoietin production and release due to diabetic neuropathy.<sup>(11)</sup> The incidence of anemia was more in females i.e. 48 patients (60.7%) as compared to males i.e. 31 patients (39.3%). Out of 48 females, 23(47.9%) were less than 60 years and 25 (52.1%) were more than 60 years (Table 4). The higher incidence in elderly females could be due to old age and poor nutritional status. In males however, the incidence was more in age group less than 60 years i.e. 20 patients (64.5%) and less in age group greater than 60 years 11 patients (35.5%). In the study done by B.I Adejumo et.al, the incidence of anemia was more in elderly patients. Similar findings have also been found in previous studies conducted by E.L Achkar, Gold Haber A and Ahmed A.T (12, 13, 14 respectively).

These findings indicate the need for proper diabetic care and management for senior citizens who have limited food choices and are vulnerable to anemia. However, in the study conducted by the B.I Adejumo et al,<sup>(10)</sup> there was no significant difference in the risk of anemia between males and females. This discrepancy could be attributed to nutritional associated gender bias

in our society. In the present study, a higher incidence of anemia was seen in patients with high blood glucose levels and poorly controlled HbA1c levels. Out of 47 male patients, 35 (74.5%) had blood glucose levels more than 130 mg/dL. This correlates with number of anemic males i.e. - 31 patients (39.3%). 35 males (44.8%) had poorly controlled HbA1c levels. Out of 53 females, 43 (81%) had blood glucose levels >130 mg/dL and anemia was seen in 48 females (60.7%). 43 females (55.2%) had poorly controlled HbA1c levels. The study conducted by Kojima. K<sup>(7)</sup> also showed that long standing poorly controlled diabetes was associated with anemia. It has been established that diabetic autonomic neuropathy is a complication of poor glycemic control.<sup>(15)</sup> It is thought that since erythropoietin production and release is regulated in part by Autonomic Nervous system, erythropoietin production could be prematurely impaired in patients with poor glycemic control. Other associated factors associated with anemia could be systemic inflammation,<sup>(16,17)</sup> damage to renal architecture produced by chronic hyperglycemia and formation of advanced glycosylation end products.

### Conclusion

The high incidence of anemia in Type 2 diabetic patients suggest the need to include hematological tests as a part of routine testing in all diabetics. Proper diabetic care, management of anemia and nutrition in elderly diabetics should be taken care of to prevent diabetic complications and ensure healthy life style for them.

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