



Clinical Significance of Screening for Anaemia in Diabetic Patients

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Received: 28-12-2017; Revised: 19-01-2018; Accepted: 05-02-2018.

ABSTRACT

Anemia is more common in diabetic patients particularly with decreased renal function. The symptoms of anemia are not well recognized because some of them can also be linked to diabetes mellitus. Glycated haemoglobin (HbA1c) value is used by the health care professionals for the diagnosis, monitoring and management of diabetes mellitus. Unfortunately anemia is more common in diabetes mellitus and the HbA1c value measured may be highly influenced by the severity of anemia. The measurement of capillary blood glucose level by the blood glucose monitor is highly influenced by the hematocrit value. Some medications prescribed for diabetic patients may increase the risk for anemia. Diabetic patients with anemia are more prone for microvascular and macrovascular complications. The aim of the current research study is to correlate the haematological indices values like RBC, HB, MCV, MCH and MCHC between diabetic nephropathy and diabetic patients. The study included 49 diabetic nephropathy patients as cases with 49 diabetic patients as controls. The values are expressed in Mean \pm Standard Deviation. Student t test (two tailed) has been used to find the significance. The HB, MCV and MCHC among patients with diabetic nephropathy were significantly lower than Diabetic controls with significance at the level of 0.05. We conclude our study by saying that anemia is more common in diabetes particularly in patients with decreased renal function and is a frequent complication of diabetic nephropathy. Routine screening and proper treatment for anemia in diabetic patients will improve the quality of the patient, because the accurate measurement of blood glucose monitor, Glycated haemoglobin and progression of the complications of diabetes mellitus are highly influenced by the severity of anemia.

Keywords: Anemia, haematological indices, Diabetes mellitus, diabetic nephropathy.

INTRODUCTION

Anemia is more common in diabetic patients particularly with decreased renal function. Diabetes is the single most common cause of endstage renal disease. In addition, anemia may be more common in diabetes and develop earlier than in patients with renal impairment from other causes. Yet anemia is less recognized and not well treated in diabetic patients.^{1,2}

When diabetes affects the kidneys (diabetic nephropathy), they may not be able to produce enough erythropoietin, a hormone that controls the production of red blood cells.³⁻⁵ This leads to anaemia which is responsible for tiredness, weakness, dizziness, paleness, lightheadedness, rapid heart rate, shortness of breath, and most of these symptoms can also be associated with diabetes, they are not recognized as evidence of anemia.

The main causes of anemia in diabetic patients are diabetic nephropathy which reduces production of erythropoietin, diabetic neuropathy which affects the nervous system's anemia response, nutritional deficiencies and some medications given for other related conditions.²⁻⁸ Diabetic patients with anemia are more prone for complications like diabetic nephropathy, diabetic retinopathy, diabetic neuropathy, Ischemic heart disease and non-healing diabetic ulcers.⁷⁻⁸

Diabetic nephropathy is a progressive kidney disease caused by angiopathy of capillaries in the kidney glomeruli, classified as a microvascular complication of diabetes.² Renal failure usually takes more than 10 year after the onset of nephropathy to develop; however, because type 2 diabetes is often present for several years before being recognized, nephropathy often develops less than 10 years after diabetes is diagnosed.^{2,13}

The study was taken up in our population of middle aged and older individuals to investigate the correlation of haematological indices like RBC,HB, MCV,MCH and MCHC in patients with diabetic nephropathy with diabetic patients as control. The study is concluded by saying that anemia is more common in diabetes particularly in patients with decreased renal function and is a frequent complication of diabetic nephropathy.

MATERIALS AND METHODS

The study was conducted in a sample of 49 diabetic nephropathy patients and 49 diabetic control patients attending diabetic and nephrology department for check-up at Shri Sathya Sai Medical College and Research Institute in Ammapettai, kancheepuram district. Blood samples were collected for haematological indices.

Study individuals were divided into group 1 and group 2.

Group 1: comprises of 49 known diabetic patients belonging to the age group between 40 and 80



Group 2: comprises of 49 known diabetic nephropathy patients belonging to the age group between 40 and 80

Exclusion criteria: Smokers, Hypertension, Alcoholics and Chronic illness

The study was taken up in our population of middle aged and older individuals (both male and female patients are included) to investigate the correlation of haematological indices like RBC, HB, MCV, MCH and MCHC in patients with diabetic nephropathy with diabetic patients as control.

DETERMINATION OF HAEMATOLOGICAL INDICES

Red blood cell indices are blood tests that provide information about the hemoglobin content and size of red blood cells. The reported values are directly obtained in standard automated complete blood counts.

The reported values are:

1. RBC number:

The normal red blood cell count ranges from 4.2-5.4 million RBCs per micro-litre of blood for men and 3.6-5.0 million for women.

2. Hemoglobin (Hb):

Hemoglobin values range from 14-18 grams per decilitre of blood for men and 12-16 grams for women.

3. Hematocrit (HCT or PCV):

The normal hematocrit is 42-54% for men and 36-48% for women.

4. Mean Corpuscular Volume (MCV):

Mean corpuscular volume (MCV) is the average size of a red blood cell and is calculated by dividing the hematocrit (Hct) by the red blood cell count Normal range: 80-100 fl.

5. Mean corpuscular haemoglobin (MCH):

Mean corpuscular hemoglobin (MCH) is the average amount of hemoglobin (Hb) per red blood cell and is calculated by dividing the hemoglobin by the red blood cell count. Normal range: 27-31 pg/cell

6. Mean corpuscular hemoglobin concentration (MCHC):

Mean corpuscular hemoglobin concentration (MCHC) is the average concentration of hemoglobin per unit volume of red blood cells and is calculated by dividing the hemoglobin by the hematocrit. Normal range: 32-36 g/dl

RESULTS

Table 1: Group Statistics

Parameter	Cases Diabetic Nephropathy	Controls Diabetes Mellitus
	Mean ± Standard Deviation	
RBC	4.0069 ± 0.69646	4.0516 ± 0.67102
Hb	9.035 ± 1.2025	10.847 ± 1.6989
PCV	30.269 ± 3.8854	33.735 ± 5.2890
MCV	76.655 ± 9.2892	83.724 ± 7.4925
MCH	23.037 ± 3.8769	26.969 ± 3.0303
MCHC	29.986 ± 2.2789	32.159 ± 1.1299

Table 2: Student t test

Student t test (two tailed) has been used to find the significance at the level of 0.05.

Student t test (two tailed)	
Hb	The HB among patients with diabetic nephropathy were significantly lower than controls with level of significance (t value =6.092) (p=0.032)
MCH	The MCH among patients with diabetic nephropathy were significantly lower than controls with level of significance (t value = 5.594) (p=0.013)
MCHC	The MCHC among patients with diabetic nephropathy were significantly lower than controls with level of significance (t value =5.981) (p=0.000)



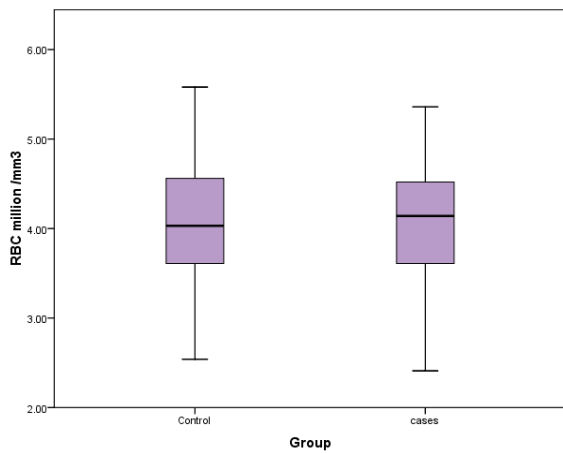


Figure 1:

Both group 1 (control) and group 2 (cases) were compared with **RBC values** on the bar diagram. There is **no significant correlation** and is clearly seen in the graph.

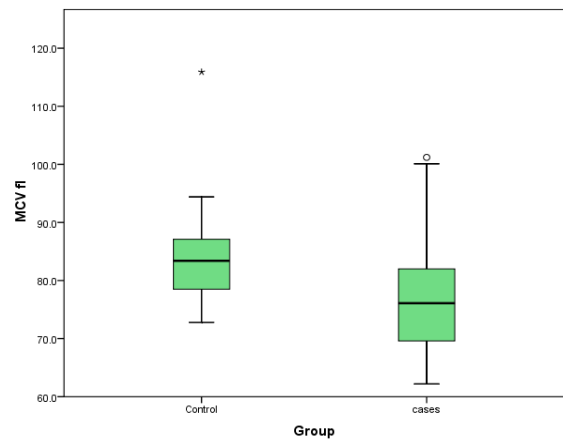


Figure 4:

Both group 1 (control) and group 2 (cases) were compared with **MCV values** on the bar diagram. Their significance and correlation is clearly visible in the graph.

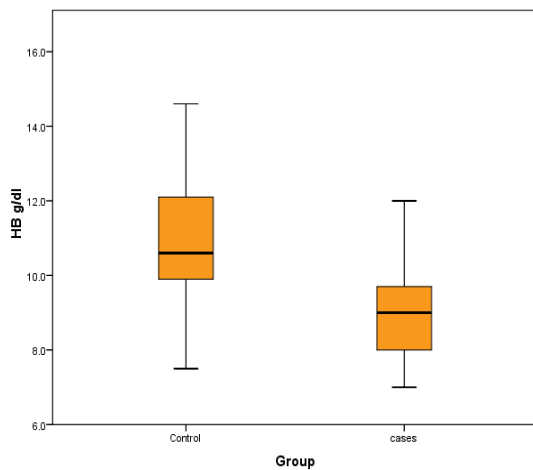


Figure 2:

Both group 1 (control) and group 2 (cases) were compared with **HB values** on the bar diagram. Their significance and correlation is clearly visible in the graph.

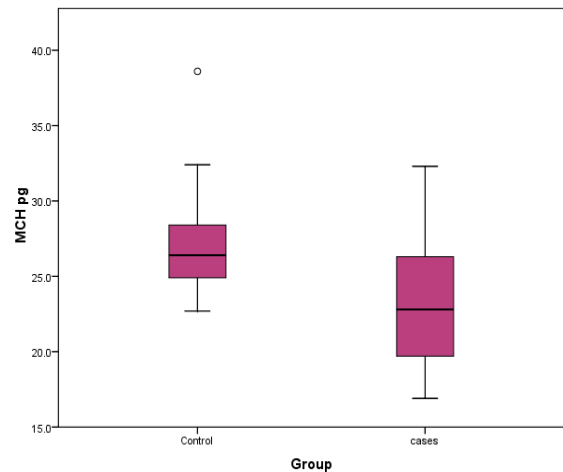


Figure 5:

Both group 1 (control) and group 2 (cases) were compared with **MCH values** on the bar diagram. Their significance and correlation is clearly visible in the graph.

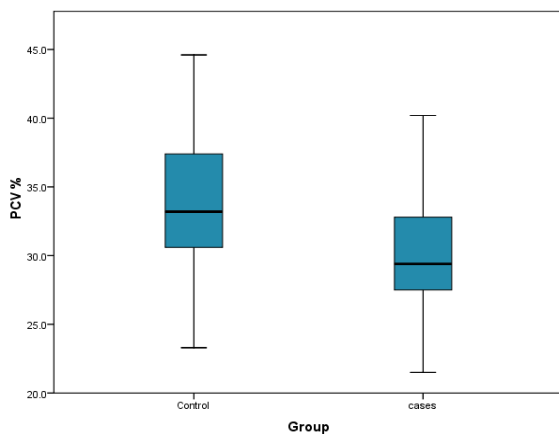


Figure 3:

Both group 1 (control) and group 2 (cases) were compared with **PCV values** on the bar diagram. Their significance and correlation is clearly visible in the graph.

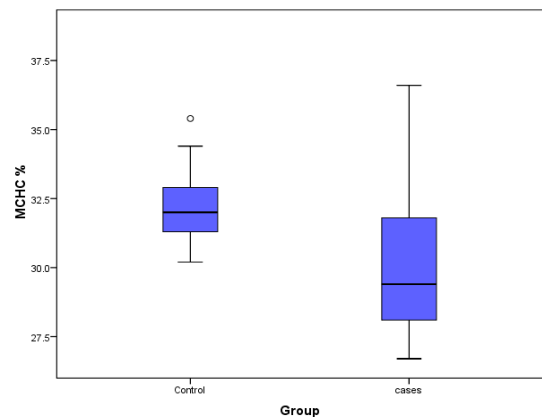


Figure 6:

Both group 1 (control) and group 2 (cases) were compared with **MCHC values** on the bar diagram. Their significance and correlation is clearly visible in the graph.

DISCUSSION

Anemia is common in diabetes mellitus particularly with albuminuria. The predominance of damage to renal interstitium, systemic inflammation and autonomic neuropathy have all been suggested as contributors to anemia in diabetic nephropathy (DN).^{2,3} Most patients with DN have little overt renal impairment and the majority are treated by the physician and not by a nephrologist. However, significant damage may be present in these patients before meeting criteria for referral to a nephrologist (GFR ~30 ml/min). So, renal anemia may go unrecognized or untreated in these patients.^{1, 13, 14} Nutritional deficiencies are common in diabetic patients which may or may not be caused by diabetes but it can also result in anemia. Some medication like ACE inhibitors, Fibrates, metformin and thiazolidinedione given for diabetic patients may also increase the risk of anemia.^{7,8}

The blood glucose monitor is frequently used by the health care team and the diabetic patients for rapid blood glucose measurement and prompt management. The blood glucose monitor uses most likely fixed hematocrit value for calculating the glucose concentration. If the patient's sample hematocrit value differs from the manufacturer's hematocrit value, accuracy is affected. If the difference is larger, the calculated glucose concentration value may not reflect the true glycemic status of the patient.^{9, 10} Glycated haemoglobin (HbA1c) reflects the patients glycemic status over the previous 3 months. Glycated haemoglobin is formed by the non-enzymatic addition of glucose on haemoglobin. HbA1c value is used by the health care professionals for the diagnosis, monitoring and to control the elevated blood glucose levels. Unfortunately anemia is more common in diabetes mellitus and the HbA1c value measured may be highly influenced by the severity of anemia.^{11, 12}

Anaemia is a frequent complication of diabetic nephropathy. It has only recently been recognised that in diabetic patients anaemia is seen not only in preterminal renal failure, but also frequently in patients with only minor derangement of renal function. Anaemia is more frequent and severe in diabetic patients at any level of glomerular filtration rate (GFR) compared to non-diabetic patients. Diabetic patients with anemia are having shorter lifespan than those who have diabetes but not anemia. So, the treatment of anemia will benefit the diabetic patients by not only improving their quality of life but also to a reduction in morbidity and mortality.^{13, 14, 15}

In our study the statistical analysis was done for the 49 diabetic nephropathy cases and the 49 diabetic control patients. Mean \pm Standard Deviation were calculated for RBC, HB, MCV, MCH and MCHC values and shown in the table1. The correlation of haematological indices between diabetic nephropathy cases and diabetic control patients were clearly shown in the bar graph figures 1-6. There is no significant correlation for RBC, Hb, PCV and MCH values are below normal range in both cases and controls.

Student t test (two tailed) has been used to find the significance at the level of 0.05, the HB, MCH and MCHC among patients with diabetic nephropathy were significantly lower than controls which is shown in table 2.

SUMMARY AND CONCLUSION

We conclude our study by saying that anemia is more common in diabetes mellitus particularly in patients with decreased renal function and is a frequent complication of diabetic nephropathy. Early diagnosis, regular monitoring and proper management is very essential for diabetic patients to prevent the microvascular and macrovascular complications. The accurate measurement of blood glucose monitor, Glycated haemoglobin and progression of the complications of diabetes mellitus are highly influenced by the severity of anemia, therefore routine screening and proper treatment for anemia in diabetic patients will improve their quality of life.

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Source of Support: Nil, **Conflict of Interest:** None.

