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Study of hemoglobin and MCV in type 2 diabetes mellitus patients and its correlation with complications of diabetes

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Abstract

Introduction: Several hematological changes affecting the red blood cells (RBCs), white blood cells (WBCs), and the coagulation factors are shown to be directly associated with DM.Altered hematological indices are closely associated with HbA1c levels in individuals with and without diabetes and some of these parameters are associated with diabetic complications.**Objective:**To study the HEMOGLOBIN and MCV in type 2 diabetes mellitus patients and to study the correlation between HEMOGLOBIN and MCVand complications in type 2 diabetes mellitus patients.**Materials and methods:** This cross sectional observational study was carried out in our institution for duration of 1 year.Total of 500 subjects was enrolled in the study.Detailed clinical and hematological profile including presence of diabetic complications was noted.The data was analysed using software Graph Pad Instat.**Result:**Mean Hb is lower side in poor glycemic control group [p=<0.013] and with microvascular[p<0.0001} complications. and mean mcv was found slightly higher side in poor glycemic control group and with diabetic complications group.**Conclusion:**Our studyshow that haemoglobin is significantly associated with diabetic complications.
Keyword: Haematological, Microvascular, Macrovascular, Diabetes mellitus.

Introduction

Diabetes mellitus (DM) is not a single disease entity but rather a group of metabolic disorders sharing the common underlying features of hyperglycemia.The chronic hyperglycemia and attendant metabolic deregulation of diabetes mellitus may be associated with secondary damage in multiple organ systems especially kidneys, eyes, peripheral nerves and blood vessels[1]. Altered hematological indices are closely associated with HbA1c levels in individuals with and without diabetes and some of these parameters are associated with diabetic microvas- cular complications.

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These associations may be explained by connection between these easy accessible and inexpensive hematological indices and inflammation, tendency to coagulation and thrombosis in patients with diabetes. India have largest number of diabetics in any given country in the world. In the 1970s, the prevalence of diabetes among urban Indians was reported to be 2.1 percent and this has now risen to 12.1 per cent[2,3]. Several hematological changes affecting the red blood cells (RBCs), white blood cells (WBCs), and the coagulation factors are shown to be directly associated with DM[4].   Other hematological abnormalities reported in the DM patients include RBCs, WBCs, and platelet dysfunction[5].   The mean corpuscular hemoglobin concentration (MCHC) was higher in diabetics. However, mean corpuscular volume (MCV) of diabetics was lower. The quantitative and qualitative

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analysis of red cell parameters as measured by the red blood cell count, Hematocrit, Mean Corpuscular Volume (MCV), Mean Corpuscular Hemoglobin (MCH) and Mean Corpuscular Hemoglobin Concentration (MCHC) gives the indication of red cell deformability and the hemorheological state. Hemoglobin concentration is closely associated with diabetic profiles. It is widely accepted that patients with diabetes are more vulnerable to the effects of anemia.Many hematologic abnormalities have been defined in diabetic patients but there are no classical hematological findings. The Reduced hemoglobin levels independently identify diabetic patients with an increased risk of microvascular complications, cardiovascular disease and mortality[6].Anemia is associated with increased risk of diabetic complications including nephropathy and micro vascular disease. Watala et al. attributed an increase in erythrocyte internal viscocity to glycation derived structural alterations in hemoglobin molecules[7]. Hematological profile in Diabetes patients is deranged and diabetics are more prone for anemia, leukocytosis and lymphocytosis. Hence routine and regular screening for hematological profile is recommended in diabetic patients to initiate early prevention strategies and to reduce the morbidity related to it

Materials and methods

This cross sectional observational study was carried out in our institution for duration of 1 year.Total of 500 subjects were enrolled in the study.Patients presented with history of diabetes were included in the study. Patients were interviewed regarding history, and clinical examination was done Informed Patient Consent was obtained before clinical examination. Patient's proforma was maintained which included all demographic particulars, past medical, surgical, drug, personal, family history ,clinical examination, haematological profile and necessary investigations .After baseline evaluation, the patients were divided into 2 groups based on HbA1C levels. Diabetics with good glycemic control (patients with HbA1c<7%) and those with poor glycemic control (patients with HbA1c >7%). Hb and MCV were compared between both the groups. These groups were further sub grouped based on the presence or absence of complications.

Selection criteria
Inclusion criteria
1. All Type 2 Diabetes Mellitus patients
Exclusion Criteria
1. Type 1 diabetes mellitus patients
2. Patients who are not giving consent for study.
3. Pregnancy
4. Bone marrow or hematological disorders,
5. Malignancy
6. Autoimmune disorders
7. Chronic Smoking and alcoholism
8. Patients on Hematotoxic drugs[7-9].

Statistical analysis

Descriptive statistics was done for all data and suitable statistical tests of comparison were done. Continuous variables were analysed with the Unpaired t test and categorical variables were analysed with chi squared test. The data was analysed using software GRAPH PAD INSTAT. Microsoft word and Excel have been used to generate graphs tables etc. Descriptive analysis was used to compute percentage, to calculate Mean and Standard deviation. P value <0.05 has been considered as significant.

Results

Table 1:Demographic characteristic of patients

SN	Demographic characteristic	Mean and SD	Good glycemic control group	Poor glycemic control group	P value
1	Age	Mean	57.68	58.21	0.323
		SD	15.26	13.66	
2.	Gender	Male	126	139	0.0258
		Female	104	131	
3.	Diabetes and Hb	Mean	10.89	10.58	<0.013
		SD	2.13	2.51	
6.	MCV	Mean	82.99	83.82	0.2534
		SD	13.66	11.42	

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Table 2:Clinical characteristics of patients

SN	Clinical characteristic	Mean and SD	Diabetic microvascular complications absent group	Diabetic microvascular complications present group	P value
1	Diabetes and Hb	Mean	10.93	9.96	<0.0001
		sd	2.25	2.43	
2.	MCV	Mean	83.08	84.36	0.1745
		Sd	13.46	9.66	

Table 3:Other clinical characteristics of patients

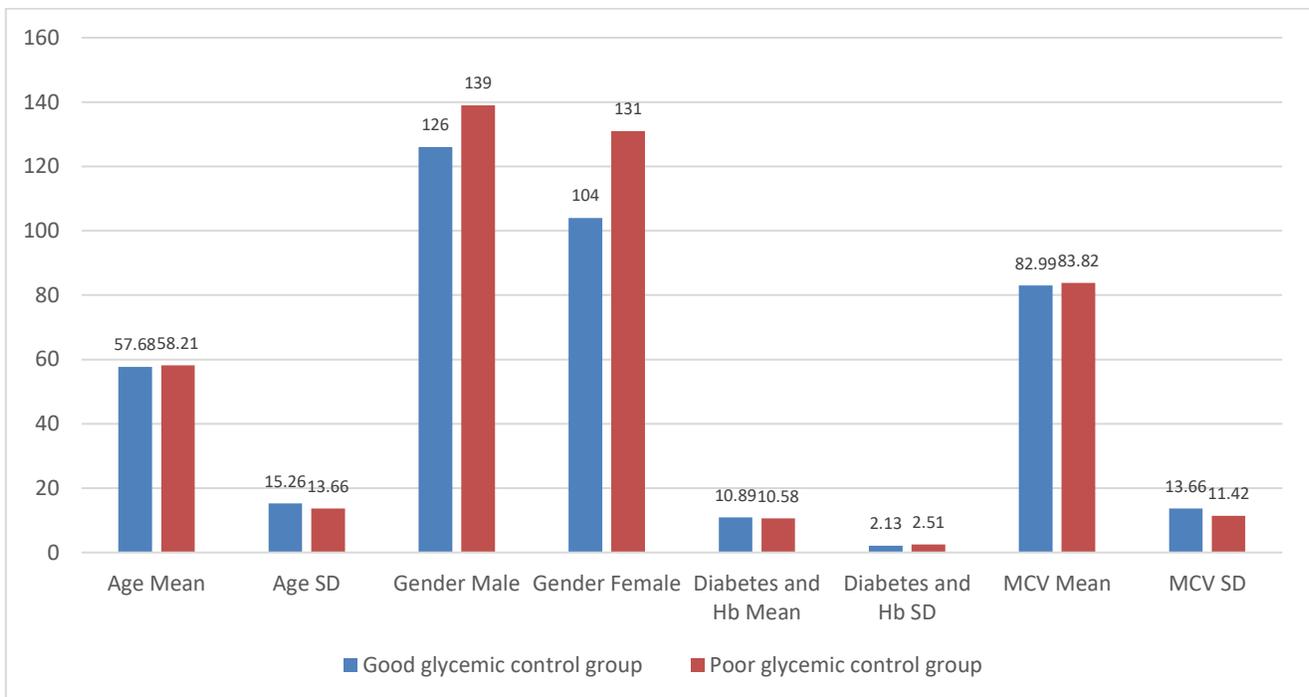| SN	Clinical characteristic	Mean and SD	Diabetic macrovascular complications absent group	Diabetic macro-vascular complications present group	P value
1.	Diabetes and Hb	Mean	10.59	11.02	.49
		sd	2.34	2.35	
2.	MCV	Mean	82.79	84.47	0.093
		Sd	11.66	13.58	

Fig 1:Demographic characteristic of patients
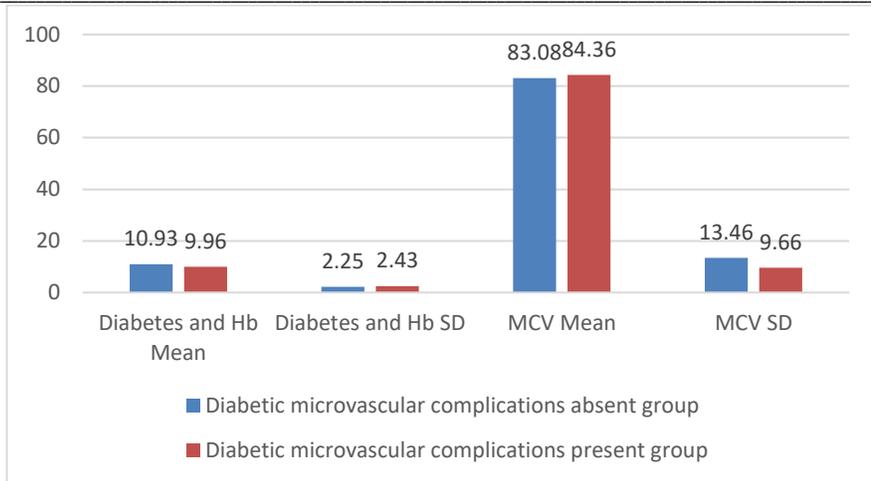
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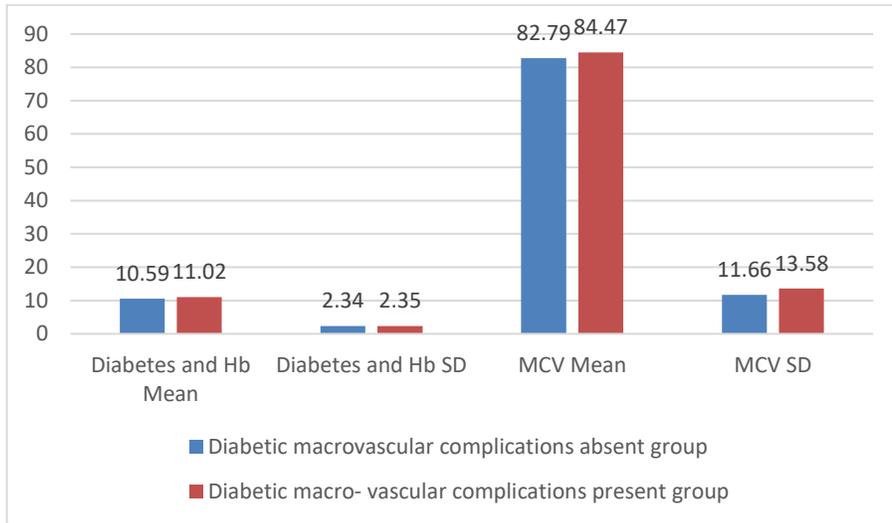**Fig 2:Haemotologic characteristics of patients**

Fig 3:Other haemotological characteristics of patients

Table 1show that:

1.In present study mean age in good glycemic control group was 57.68+-15.26 and mean age in poor glycemic control was 58.21+-13.66.[p value= 0.323].

- In good glycemic control group 126 patients were male and 104 patients were female and in poor glycemic control group 139 patients were male and 131 patients were female [p value= 0.258]

- Patient with good glycemic control group belonged to a mean Hb of 10.89 and in poor glycemic control group belonged to a mean Hb of 10.58 (p= < 0.013)

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- Diabetic patient with good glycemic control group belonged to a mean MCV of 82.99 and poor glycemic control group also belonged to a mean MCV of 83.82 (p=0.2534)

Table 2 show that:

- Diabetic patient with diabetic microvascular complications absent group belonged to a mean - Hb of 10.93   and diabetic microvascular complications present group belonged to a mean Hb of 9.96 (p= < 0.0001)
- Diabetic patient with diabetic microvascular complications absent group belonged to a mean MCV of 83.08 and diabetic microvascular complications present group also belonged to a mean MCV of 84.36(p= 0.1745)

Table 3 show that:

- Diabetic patient with diabetic macrovascular complications absent group belonged to a mean Hb of 10.59 and diabetic macrovascular complications present group belonged to a mean Hb of 11.02 (p= .49)
- Diabetic patient with diabetic macrovascular complications absent group belonged to a mean mcv of 82.79 and diabetic macrovascular complications present group also belonged to a mean MCV of 84.47 (p= 0.093).

Discussion

In our study 500 type 2 diabetic patients were enrolled, and then these patients were divided in two groups based on their HbA1c values. One was good glycemic control group (HbA1c ≤7) in which 230 patients were present and the other was poor glycemic control group(HbA1c >7) in which 270 patients were present.After that Hematological parameters such as haemoglobin and mcv were compared between diabetic population with good glycemic control(HbA1c <7) and poor glycemic control(HbA1c >7) and relation of these haematological parameters with diabetic complications were assessed.Most common type of anemia is moderate anemia[as per WHO criteria] in my study and mean Hb is lower side in poor glycemic control group [p=<0.013] and with microvascular [p<0.0001} and macrovascular complication[p =0.49].This was similar to studies done by Bharathi K et al[10]and Farooqui R et al[11] In my study Out of total 500 patients, 403 patients were found anemic which were further subdivided into morphological types of anemia based on MCV.In my study most common morphological type of anemia is normocytic [10]and is not statistically significant with respect to HbA1C and diabetic complications and mean mcv was found

slightly higher side in poor glycemic control group and with diabetic complications group .This is opposite to the study done by Farooqui R et al[11] and similar to the study done by Marcinkowska-Gapinska A et al[12].In my study anemia is significantly associated with microvascular complications which is similar to the studies done by Rani PK et al[13] and Baisakhiya S et al[14].

Conclusion

Majority of patients having moderate anemia and its correlation is statistically significant with poor glycemic control and microvascular complications. most common morphological type of anemia is normocytic and is not statistically significant with respect to HbA1C and diabetic complications and mean mcv was found slightly higher side in poor glycemic control group and with diabetic complications group.

Limitation of the study

- The study was conducted in small population that may not represent the entire population.
- We have not included all other type of diabetic patients
- The follow up of the cases was not possible to determine the prognostic significance of our findings. This would have enabled us to compare its association with the progress of the Diabetic complications.
- My Study includes only diabetic patients and not includes control group

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