Section A-Research paper

HEAMATOLOGICAL INDICES AND THEIR CORRELATION WITH GLYCEMIC CONTROL AND ANTHROPOMETRIC MEASUREMENTS IN PATIENTS OF TYPE 2 DIABETES MELLITUS

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Abstract

Aim and objectives: To know the relation between haematological indices and fasting blood glucose level and anthropometric measurements in type 2 diabetes mellitus patients. **Material and methods:** This study was conducted in Out patient and Inpatient facilities of the department of Internal Medicine, MMIMSR, Mullana. Either in patients or out patients of type 2 diabetes mellitus coming to MMIMSR , Mullana. This study was Hospital based, prospective observational study conducted during 18 month. By using simple random method, 50 patients having type 2 diabetes mellitus were selected in MMIMSR mullana. 50 age and sex matched non diabetic individuals were taken as control group. **Result**: In diabetes group, the mean age was 53 years and in non-diabetes group, the mean age was 52 years. There is an insignificant association between groups according to abnormal abdominal diameter with p-value>0.05. There is an insignificant association between groups according to MCV, MCH, MCHC, PLR and RDW with p-value>0.05. There is a significant association between groups according to MPV with p-value<0.001. The mean (10.26) is higher in diabetic group than the mean (7.98) of non-diabetic group. On applying regression analysis there is very mild association of MCV with HBA1C. On applying regression analysis, there is no significant association of RDW, PLR, MCHC, and MCH with HbA1c. **Conclusions:** Poor glycaemic control along with a longer duration of diabetes were all linked to a higher MPV.

Key words: MPV, FBS, PPBS, HBA1C

Introduction

A significant issue for world health is diabetes mellitus (DM). Diabetes mellitus is a complicated metabolic syndrome that affects almost all bodily organs and is defined by persistent hyperglycemia. It is a condition that is affecting more and more people throughout

the world. Diabetes is divided into two types: Type 1 DM, which is defined by significantly lower insulin levels and mostly affects young people, and Type 2 DM, which is characterized by insulin resistance and more common in adults. 80% of cases of diabetes mellitus (DM) are type 2 diabetes.[1- 3]

The long-term consequences of DM have a variety of severe impacts on people's quality of life as well as their prospective life lengths, harming both individuals and civilizations. Nephropathy, neuropathy, and retinopathy are examples of microvascular consequences of diabetes; macrovascular problems include (cardiovascular and cerebrovascular disease). Erectile dysfunction (64%), visual disturbance (33.8%), and cardiovascular problems (30.1%) were the most prevalent chronic sequelae, followed by neuropathy (29.5%), nephropathy (15.7%), and hypertension alone (68%). Similar to acute consequences, hyperosmolar hyperglycemia was negligible, with a range of 30.5%, of which diabetic ketoacidosis was 71%, followed by hypoglycemia (19.4%). The majority of early deaths and disabilities worldwide are caused by complications associated to diabetes, which are 2-4 times more common in people with diabetes mellitus than in the general population.[4]

It is known that diabetes mellitus causes morphological and functional abnormalities in platelets and other hematological indicators. Mean Platelet Volume (MPV) measurements, which are a component of a complete blood count, are a simple way to quantify platelet activity and aggregation potential, which are crucial in atherogenesis and thrombogenesis (CBC). It is possible to predict angiopathy in type 2 DM using the simple, reliable, and affordable assays platelet count (PC) and mean platelet volume (MPV).[5- 7] The value of glycated hemoglobin (HbA1c), as a measure of long-term gluco-regulation, should be maintained below 7% in type 2 diabetes mellitus patients in order to lower the risk of micro-vascular and macrovascular problems.[1]

Materials & methods

The present study was conducted to asses the relation between haematological indices and fasting blood glucose level and anthropometric measurements in type 2 diabetes mellitus patients. By using simple random method, 50 patients having type 2 diabetes mellitus were selected in MMIMSR mullana. 50 age and sex matched non diabetic individuals were taken as control group.

Inclusion criteria:-

a) Age group>18 years
b) Diabetes mellitus type 2 confirmed by clinical features, random blood sugar, fasting blood sugar, 2 hour post prandial glucose and past history of diabetes mellitus on oral hypoglycemics or on injectable insulin, either newly detected or detected within past 2 years.

Exclusion criteria:-

a) Age group≤18 years
b) Patients with type 2 diabetes mellitus diagnosed more than past 2 years
c) Patients having type 1 diabetes mellitus and MODY

d) T2DM patients who were severely ill, pregnant women, smokers, alcoholics, on antihypertensive treatment, on statins for abnormal lipid treatment, on anticoagulant therapy, and who had other chronic diseases.
e) Patients with anemia, COPD and chronic liver disease.

An HbA1c of 48mmol/mol (6.5%) as the cut off point for diagnosing diabetes. A value of less than 48mmol/mol (6.5%) does not exclude diabetes diagnosed using glucose tests. Venous plasma glucose measured by glucose oxidase method. Measurement of height and weight and calculating BMI from it as per WHO recommendations. The data regarding anthropometric variables such as height (to the nearest centimeter without shoes), weight (to the nearest 0.1 kg), and waist circumference (WC) (taken midway between the lowest rib and the iliac crest). Body mass index (BMI) calculated as weight in kilograms divided by height in meter squared. Blood pressure (BP) taken by qualified personnel using an analog sphygmomanometer and stethoscope. Measurements were taken from the upper arm with the hand at the heart level after the patient had been sitting for more than 5 minutes. Five milliliters of fasting blood sample was collected by laboratory technologist for fasting blood glucose (FBG) determination after 10–12 hours of fasting with the exception of water and medication. FBG was estimated by following glucose oxidase method Other parameters such as hemoglobin, hematocrit (Hct), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), MPV, platelet distribution width (PDW), red cell distribution width (RDW), and the count of RBCs, WBCs, platelets, absolute lymphocytes, mixed cells (monocyte, basophil, and eosinophil [MID]), and neutrophils were recorded. All the results were analysed using SPSS software.

Results

In diabetes group, the mean age was 53 years and in non-diabetes group, the mean age was 52 years. There is an insignificant association between groups according to abnormal abdominal diameter with p-value>0.05. There is an insignificant association between groups according to MCV, MCH, MCHC, PLR and RDW with p-value>0.05. There is a significant association between groups according to MPV with p-value<0.001. The mean (10.26) is higher in diabetic group than the mean (7.98) of non-diabetic group. On applying regression analysis there is very mild association of MCV with HBA1C. On applying regression analysis, there is no significant association of RDW, PLR, MCHC, and MCH with HbA1c.

Table 1: Comparison of abnormal abdominal diameter among diabetic and non-diabetic subjects

ABNORMAL ABDOMINAL DIAMETER	DIABETIC	NON-DIABETIC	TOTAL
YES	15 (30%)	20 (40%)	35 (35%)
NO	35 (70%)	30 (60%)	65 (65%)
TOTAL	50 (100%)	50 (100%)	100 (100%)
CHI-SQUARE VALUE=1.09;P-VALUE=0.29; NOT SIGNIFICANT			

Table 2: Comparison of MCV Between Diabetes And Non-Diabetes Group

GROUP	MCV			95% CI	
	N	MEAN	STD. DEV	LOWER	UPPER
DIABETIC	50	86.14	10.66	(-3.57, 4.77)	
NON-DIABETIC	50	85.54	10.37		
T-VALUE=0.28; P-VALUE=0.77; NOT SIGNIFICANT					

Table-3: Comparison Of MCH Between Diabetes And Non-Diabetes Group

GROUP	MCH			95% CI	
	N	MEAN	STD. DEV	LOWER	UPPER
DIABETIC	50	28.18	3.46	(-1.04, 1.41)	
NON-DIABETIC	50	28.00	2.68		
T-VALUE=0.29; P-VALUE=0.77; NOT SIGNIFICANT					

Table-4: Comparison Of MCHC Between Diabetes And Non-Diabetes Group

GROUP	MCHC			95% CI	
	N	MEAN	STD. DEV	LOWER	UPPER
DIABETIC	50	32.69	1.12	(-0.61, 0.36)	
NON-DIABETIC	50	32.81	1.32		
T-VALUE=-0.50; P-VALUE=0.6; NOT SIGNIFICANT					

Table-5: Comparison of MPV Between Diabetes And Non-Diabetes Group

GROUP	MPV			95% CI	
	N	MEAN	STD. DEV	LOWER	UPPER
DIABETIC	50	10.26	0.88	(1.80, 2.75)	
NON-DIABETIC	50	7.98	1.45		
T-VALUE=0.76; P-VALUE<0.001; SIGNIFICANT					

Discussion

Due to surveillance and care, the common hematological count has been shown to be a reliable marker in patients with diabetes. According to the research, people with T2DM have changed hematological indices. Persistent hyperglycemia in DM patients exposes RBCs to high glucose levels, leading to the glycation of hemoglobin, prothrombin, fibrinogen, and other proteins involved in the clotting process.[7- 10]

In the present study, the bulk of the 18 patients in the current research (36%) were found to be between the ages of 51 and 60. The mean age in the diabetes group was 53 years with a standard deviation of 10.31, whereas the mean age in the non-diabetic group was 52 years with a standard deviation of 10.28. It was noted that the comparison between the two groups was statistically insignificant. According to a research by Arkew M. et al[11], the mean age (mean SD) for T2DM patients was 43.089.30 years, compared to 42.718.60 years for

controls. According to a study by Biadgo B et al.[12] the mean ages (mean + SD) of T2DM patients and controls were 49.09 + 8.1 and 47.8 + 6.7 years, respectively.

In the current study, diabetic retinopathy was evident in 19 (38%) individuals while it was present in only 8 (16%) patients in the non-diabetic group. This difference was statistically significant. PDW was increased in diabetic retinopathy and nephropathy, according to the Buch et al[13] study. It was also higher in complications including CAD and diabetic foot, although not statistically significant. P LCR revealed no alteration in diabetic complications.

In the current study, the majority of 33 (66%) patients in the diabetic group developed diabetic nephropropathy, whereas there were no patients in the non-diabetic group. This difference was statistically significant. The study by Buch et al. indicates no statistically significant difference between the study groups. According to Manvar et al's study,[14] incidence of nephropathy (microalbuminuria) was found to be 26.3% in the group of people with good glycemic control and 18.9% in the group of people with poor glycemic control.

According to MCV, there was a negligible correlation between the groups in the current investigation. According to a research by Kaviya et al, diabetes patients had a higher MCV count than non-diabetic participants in our study, and this difference was statistically significant. The compared data's P value was [P=0.583 (>0.05)].[5] According to the current investigation, there was a negligible correlation between the groups. The study by Biadgo B. et al demonstrates a negligible correlation between groups.[12] According to MCHC, there was no significant relationship between the groups in the current study. The study by Biadgo B. et al demonstrates a negligible correlation between groups.[12] According to PLR, there was no significant association between the groups in the current study. The study by Biadgo B. et al[12]demonstrates a negligible correlation between groups.

In the present study, there was an insignificant association between groups according to RDW. Yaqi Yin et al.[15] Study shows the lowest RDW quartile, subjects in the highest RDW quartile had an OR (95% CI) and a P-value of 0.2 (0.07–0.59) and 0.004, respectively, for being in poor glycemic control. In subgroups of tertile 1 and tertile 2 for TC, compared with subjects in the lowest RDW quartile, OR (95% CI) and P-value for being in poor glycemic control for subjects in the highest RDW quartile were 0.20 (0.05–0.71) and 0.013 vs 0.10 (0.02–0.52) and 0.006, respectively. Pujani et al[6] study shows, there was a statistically significant difference in between the groups. Biadgo B et al[12] study revealed that RDW values were significantly higher in T2DM patients than control groups. This is due to the fact that high RDW indicates impairment of erythropoiesis, reflecting chronic inflammation and increased levels of oxidative stress, both of which are significant signs of T2DM that result in the RBC size variation.

According to MPV, there was a significant correlation between the groups in the current study, and the diabetes group's mean (10.26) is greater than the non-diabetic group's mean (7.98). According to a research by Biadgo B et al[12] T2DM patients had statistically significant increases in MPV (P=0.001) for platelet indices when compared to the control group D.

FBS and MPV levels shown a favourable connection in the current investigation. The statistically significant Pearson's R Correlation value of 0.11 with a p-value of 0.01 shows that this is the case. The research by Manvar et al[14] demonstrates that there is no association between FBS and MPV levels.

FBS and MPV levels in the current research had a negative connection. This was demonstrated by the Pearson's R Correlation value of 0.11 with a statistically insignificant p-value of 0.5. There is no relationship between FBS and MPV levels, according to a study by Milind Jivanlal Manvar et al[14].The Pearson's R Correlation score of 0.087 with P=0.221 suggests this.

HBAIC and MPV levels shown a favourable connection in the current investigation. This was demonstrated by the correlation study conducted by Findikl A H et al[16], which revealed a positive linear association between HbA1c levels and MPV, with a Pearson's R Correlation value of 0.29 and a statistically significant p-value of 0.01 (statistically significant). According to a research by Manvar et al[14], there is a significant relationship between MPV levels and Hba1c levels. The Pearson's R Correlation value of 0.228 with P=0.001 indicates this. So it is clear that persistent hyperglycemia causes platelets to become overloaded with glucose, causing them to synthesize glycogen and glycolyze certain proteins. A little percentage of the mean platelet volume's size is raised as a result of the increased glycogen content. Another explanation is that elevated amounts of particular glucose metabolites cause the platelets to expand osmotically, and persistent hyperglycemia may cause a high platelet turnover rate.

Conclusion

Poor glycaemic control along with a longer duration of diabetes were all linked to a higher MPV.

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