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STUDY ROLE OF VARIOUS HEMATOLOGICAL PARAMETERS & ANTITHROPOMETRIC MEASUREMENT IN DIABETIC PATIENTS

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Abstract

Hematological changes impacting platelets are seemed, by all accounts, to be connected with type 2 diabetes mellitus is usually connected with vascular complexities. Lately, there has been reestablished interest and expanding proof that hematological anomalies can be utilized as markers of endothelial brokenness and aggravation in type 2 diabestes mellitus (T2DM). Thus point of this examination was to evaluations of unusual hematological lists and anthropometric boundaries related with type 2 diabetes. Anticoagulated blood tests were gathered from fasting people and hematological Indices examined via computerized platelet counter and fasting glucose via automated laboratory analyzer. Male individuals with T2DM were described by altogether raised degrees of; weight file (BMI), systolic pulse (SBP), diastolic circulatory strain (DBP), mean cell hemoglobin (MCH), red platelet dispersion width (RDW), platelet tally (PLT), mean platelet volume (MPV), platelet appropriation width (PDW), FBS ($P<0.05$) as contrasted and sound individuals without T2DM bunch. Likewise, female individuals with T2DM were portrayed by altogether raised degrees of DBP, HCT, MCHC, RDW, WBC, PLT, MPV, PCT, and FBS ($P<0.05$) as contrasted and non-diabetic female control. This assessment exhibited measurably critical distinction in some hematological boundaries of diabetic patients contrasted and controls. In this way, hematological lists could be valuable markers diabetic difficulty in type 2 DM patients

Keywords: Hematological Parameters, Antithropometric Measurement, Diabetic Patients, C-peptide, Insulin, Parameters of lipid status

Introduction

Diabetes mellitus (DM) is the leading global epidemic of the 21st century with over 422 million diabetics worldwide. The prediction of prevalence of diabetes mellitus patients by 2035 according to the World Health Organization (WHO) is 592 million patients (1). In the Republic of India, 12.4% of the population suffer from DM, and the increase in the number of patients is estimated to be 15.2% by 2035 (2). Blood is a type of tissue, with cellular elements suspended in plasma. Elevated blood glucose level in T2DM contributes to disturbance of blood cells and its indices (3). Good glycemic control is the main recommendation in the prevention of the development of diabetic complications. It has been suggested that early normalization of glycemia may inhibit pathological processes that are closely related and induced by hyperglycemia such as increased oxidative stress and glycation of cellular proteins and lipids (4). Therefore, it is crucial to achieve a gradual optimization of HbA1c levels–between 6.5% and 7%, recommended level, as a long-term form of management in order to reduce the incidence of macro and micro-vascular complications in DM patients (5).

Laboratory tests for monitoring diabetes mellitus patients are plasma glucose (random sample), glucose in urine, glycated proteins, glycated hemoglobin (HbA1c), fructosamine, urinary proteins (microalbuminuria, proteinuria), C-peptide, insulin, parameters of lipid status and kidney function (6). Hemoglobin A1c represents the average glycemic value for the last 2–3 months in patients with diabetes. Based on the HbA1c value, an estimated mean glucose (eAG) value can be determined (7, 8).

Parameters obtained from hematologic counters can provide insight into changes that occur in hematological indices such as white blood cells (WBC), red blood cells (RBC), platelets (PLT), and the other parameters. Analysis of these parameters could contribute in the following-up of the development of degenerative complications in DM (9).

White blood cells are well established biomarker of inflammation in cardiovascular disease as well as in T2DM and its complications. They could be activated by advanced glycation end products, angiotensin II, oxidative stress in T2DM, induced by hyperglycemia (10).

The aim of the study is to determine possible changes in the parameters of the complete blood count depending on glycoregulation, as well as other risk factors in patients with Type 2 Diabetes mellitus.

Materials and Methods

Study area, design, and period

Clinic based, cross-sectional examination was directed on individuals with T2DM in the Specialized Hospital. All grown-up individuals with T2DM out patients in particular medical clinic and solid individuals without T2DM were comprised in the investigation and were arbitrarily chosen from the individuals.

Study populace

This examination incorporated all grown-up individuals with T2DM (>18 years old) going to specific emergency clinic outpatient division in the time frame study period. In any case, T2DM individuals with a background marked by realized hematologic sicknesses like; hemolytic anemia's, post-hemorrhagic sickliness, renal weakness, Hematologic illnesses with WBC check > 15,000/mm3 and platelet tally > 500,000/mm3 that may influence hematological profiles were rejected from the investigation.

Test Size Determination

The necessary example size was resolved utilizing single populace equation for assessing single populace extent. Maintain a strategic distance from mistake in non reaction rate, 10% of the determined example size was added.

Variables

Hematological profiles like; RBC, Hemoglobin, Hematocrit, MCH, MCHC, Red blood cell distribution width (RDW), WBC, PLT, Mean platelet volume (MPV), Platelet distribution width (PDW) and Platelet Crit (PCT) were considered as dependent variables of this study. On the other hand, anthropometric and clinical characteristics like; Age, Sex, Body mass index (BMI), systolic blood pressure (SBP), Diastolic blood pressure (DBP) and duration of diabetes were also taken as independent variables.

Blood sample and data collection procedures

After the investigation members had been requested their agree to be met and to give a blood test, around 2 ml of the blood was removed from the examination members, who had abstained for the time being and gathered in EDTA-covered tubes and hematological profiles were resolved for all examples utilizing hematological analyzer (Minder 6200). The blood test was gathered by qualified medical care experts in the clinic for sure fire research facility examinations. The gathered blood was quickly examined to shield platelets from hemolysis. Furthermore, the survey was loaded up with an up close and personal meeting, and some anthropometric pointers were additionally evaluated and estimated one next to the other too.

Results

Anthropometric and clinical characteristics

The anthropometric and clinical attributes of the patients and controls were outlined in Table 1. The investigation showed genuinely higher estimations of weight file (BMI, P=0.001), systolic pulse (SBP, P=0.002) and diastolic circulatory strain (DBP, P=0.019) with no distinction in the mean age (P>0.05) of male T2D patients. Be that as it may, there was no critical distinction in the mean estimations old enough, BMI and SBP (P>0.05) yet higher estimations of DBP (P=0.008) was seen in female patients.

Platelet records

Investigation of the platelet lists in male patients had genuinely higher estimations of platelet tally (PLT, P=0.024), mean platelet volume (MPV, P=0.000) and platelet conveyance width (PDW, P=0.001) with no adjustment in the mean estimations of platelet crit (PCT, P=0.603). Also, female patients had strikingly raised estimations of platelet lists like PLT tally (P=0.000), MPV (P=0.000) and PCT (P=0.005) with no distinction esteems in PDW (P=0.154). The information were appeared in Table 2.

RBC lists

The mean estimations of the RBC lists demonstrated in Table 3. In the male subjects showed that, the mean estimations of red platelet circulation width (RDW, P=0.001), mean cell volume and mean cell hemoglobin (MCH, P=0.03) were outstandingly raised. Then again, examination of female subjects uncovered that, HCT (P=0.005), RDW (P=0.012) and MCHC (P=0.015) were strikingly raised. Also, mathematically higher estimations of HGB (P=0.057) and MCV (P=0.271) however lower RBC check (P=0.863) was seen in female patients.

White platelet (WBC) records

As demonstrated in Table 4 the aftereffects of the current investigation showed that, there were no huge contrasts seen in the normal estimations of WBC check (P=0.09), Neutrophil (Neu, P=1.532), Lymphocyte (Lymph, P=0.329) and blended cells (MID, P=0.088) in male patients. Female patients had fundamentally higher normal degrees of WBC tally (P=0.000) with no factual distinction in the mean estimations of Neu, Lymph and MID (P>0.05).

Correlation Analysis

As indicated in table below, SBP, DBP, and RBCs were negatively correlated with MPV and this correlation was not statistically significant. However, PDW was positively and significantly (P=0.001) correlated with MPV.

Table 1: Comparison of the Anthropometric and Clinical Characteristics of Male/Female Patients with Male/Female healthy individuals

Variable name	Males (Mean ± SD)		Females (Mean ± SD)	
	Patient (N=47)	Control (N=46)	Patient (N=23)	Control (N=24)
Age(years)	53.33±1.64	53.22±1.44	49.72±2.33	47.81±8.44
BMI(Kg/m^2)	25.11±2.33	23.44±2.11	27.44±3.44	25.37±4.57
SBP(mmHg)	125.11±1.33	119.13±8.33	124.76±1.44	120.33±2.33
DBP(mmHg)	82.33±2.65	78.21±2.43	83.11±2.14	77.22±3.44
FBS(mg/dl)	152.74±6.44	97.57±2.91	165.44±3.55	95.25±2.37
DMD (years)	8.22±2.44		7.30±4.46	

SBP - Systolic Blood Pressure, DBP - Diastolic Blood Pressure, BMI - Body mass Index, DMD - Duration of Diabetes.

Table 2: Comparisons of the Platelet indices in Male/Female Patients with Male/Female Healthy individuals

Variable name	Males (Mean ± SD)		Females (Mean ± SD)	
	Patient (N=47)	Control (N=46)	Patient (N=23)	Control (N=24)
PLT(x10^3/L)	310.11±1.55	251.33±3.44	336.33±4.19	247.04±4.82
MPV(fL)	10.45±1.22	9.44±1.55	10.61±1.66	9.08±1.12
PDW(10(GSD))	16.33±1.44	16.22±2.11	16.22±2.44	16.21±2.81
PCT (%)	0.26±1.25	0.27±2.33	0.33±2.37	0.24±0.02

Volume, PDW - Platelet distribution Width, PCT – Platelet Crit, fL-femtolitre, GSD-Geometric standard deviation.

Table 3: Comparisons of the RBC indices in Male/Female patients with Male/Female Healthy individuals

Variable name	Males (Mean ± SD)		Females (Mean ± SD)	
	Patient (N=47)	Control (N=46)	Patient (N=23)	Control (N=24)
RBC(x10^6/L)	5.55±1.22	5.78±1.41	5.66±1.99	5.33±1.54
HGB(g/dL)	16.33±1.17	16.35±1.94	15.66±1.67	14.53±1.92
HCT (%)	51.57±3.97	50.52±2.81	47.72±2.40	45.22±1.89
MCH(pg)	29.71±2.34	28.78±1.13	28.55±2.85	28.78±1.19
MCHC(g/dL)	32.66±1.967	32.19±1.56	31.33±1.53	32.22±1.77
RDW (%)	14.44±2.82	12.76±1.93	14.14±1.39	13.44±1.66

RBC-red blood cell count, HGB-hemoglobin, HCT- hematocrit, MCH- mean cell hemoglobin, MCHC- mean cell hemoglobin concentration, RDW- red blood cell distribution width, g/dl – gram per deciliter, pg - picogrem

Table 4: Comparisons of the WBC and Platelet indices in Male/Female patients with Male/Female Healthy individuals

Variable name	Males (Mean ± SD)		Females (Mean ± SD)	
	Patient (N=47)	Control (N=46)	Patient (N=23)	Control (N=24)
WBC(x10^3/L)	6.22±1.11	6.22±1.55	7.11±1.33	5.88±1.44
Neu(%)	58.33±1.22	60.66±2.21	60.68±1.25	60.45±2.97
Lymph(%)	33.21±2.28	31.14±1.51	32.22±2.11	31.22±2.16
MID(%)	8.66±1.33	7.33±1.44	7.44±1.54	7.44±1.76

WBC- white blood cell count, Neu- Neutrophil, Lymph- Lymphocyte, MID- Mixed cell

Table 5: Pearson correlations of MPV with various parameters in diabetic individuals

Variable name	Diabetic Patients Correlation (**r**) N=70	P- value
DBP	-0.003	0.997
SBP	-0.001	0.942
RBC	-0.133	0.253
RDW	0.124	0.286
PDW	0.374	**0.001**

Discussion

The current investigation uncovered, measurably higher estimations of BMI in male and just a mathematical contrast in female individuals with T2DM. This is in consonance with Bukhari et al who detailed higher qualities in both male and female individuals with T2DM (11). Additionally, Sarah et al exhibited critical estimations of BMI in T2DM patients (12). Ganz et al recommended that, BMI is firmly and freely connected with the danger of T2D and the greatness of this affiliation is bigger for higher BMI esteems (13).

Our finding of the circulatory strain shows that SBP was altogether higher in guys however not in females with T2DM. In any case, DBP was fundamentally higher in the two guys and females with T2DM contrasted with the relating esteems in their particular solid individuals without T2DM. This outcome is in concurrence with the discoveries of Alao et al; Bukhari et al., who announced fundamentally higher estimations of both SBP and DBP in both genders of individuals with T2DM (11, 14). Hyperglycemia causes microvascular inconveniences in numerous organs including diabetic nephropathy the main source of end-stage renal infection (ESRD) in created nations (15). Furthermore, Gurley and Coffman recommended that diabetes may prompt other vascular intricacies, including fundamental hypertension through enactment of the intrarenal rennin - angiotensin framework (16). As revealed by He et al., the metabolic receptor G-protein coupled receptor 91 (GPR91) is exceptionally communicated in the kidney and actuated by the citrus extract cycle halfway succinate on the grounds that succinate is privately collected in the unblemished diabetic kidney (17). Toma and his associates recommended that, high glucose and succinate-actuated GPR91 initiation trigger paracrine motioning from the (juxta) glomerular endothelium to the nearby rennin creating JG cells to build rennin union and delivery the rate-restricting advance of RAS enactment (18). This may clarify raised estimations of Systolic (SBP) and diastolic (DBP) blood pressures in the current examination. Then again, expanded SBP and DBP in patients of this examination might be clarified as far as cutting edge glycation finished results (AGE). It has been recommended that AGE and its cell surface receptor (RAGE) are the ordinary sub-atomic outcome of diabetes (19). AGEs additionally extinguish NO (nitric oxide) in vitro and may lessen NO-reliant vasodilatation. It additionally incited the creation of the vasoconstrictor endothelin-1 by endothelial cells through atomic factor-kB actuation (20). Consequently, since endothelin-1 is a strong vasoconstrictor, it expands the foundational circulatory strain.

In this investigation, examination of the platelet records showed that mean platelet volume and platelet considers were fundamentally higher as a real part of both genders in individuals with T2DM. Interestingly, Hekimsoy et al., announced the surprisingly low degree of platelet include in individuals with T2DM (21). The MPV and platelet checks are pointers of thrombotic potential and hazard factors for microvascular inconveniences in diabetes (22, 23). As per Chen et al expanded insulin obstruction and glycemic status builds platelet include in hyperglycemia (24). Taniguchi et al, has been shown that expanded platelet tally may autonomously foresee insulin opposition among non-corpulent Japanese sort 2 DM patients (25). Platelet size is another angle that merits consideration since it is by all accounts identified with their capacity. It has been exhibited that, platelets with more noteworthy volume are more youthful, more responsive and aggregatable. Henceforth, they contain denser granules, emit more serotonin and β-thromboglobulin, and produce more thromboxane A2 prompting expanded thrombotic potential when contrasted and more modest and less dynamic platelets (26, 27). Accordingly, huge circling platelets are reflected by an increment in MPV which is the pointer of the normal size, a marker of platelet capacity and action. In diabetic patients, more elevated level of MPV could anticipate an expanded danger factor for apoplexy and persistent intricacies (28, 29). Raised degrees of MPV in individuals with T2DM of the current examination may likewise be clarified regarding oxidative pressure. Expanded ROS in diabetes prompts nonenzymatic glycation of proteins on the outside of the platelet. Such glycation prompts over-collection of cutting edge glycation final results (AGEs). A portion of these AGE cause externalization of platelet film phosphatidylserine that may cause changes in protein structure (adaptation) and modifications of layer lipid elements (30). This may likewise clarify the expanded estimations of MPV in patients of the current examination. Concerning, the current examination showed that there was no critical distinction between female individuals with and without T2DM. In any case, we saw that male with T2DM

had fundamentally raised estimations of PDW. As per Vagdatli et al, enacted platelets go through an underlying change from discoid to a round shape and creates pseudopodia prompting an adjustment in the PDW. Because of this explanation, actuated platelets might be distinctive in size from non-initiated platelets. PDW has likewise been accounted for as essentially raised in individuals with T2DM with confusions when contrasted and individuals with T2DM without inconveniences. Accordingly, various sizes of platelets can be discovered, a result of which was the developed histogram plotting of PDW and expanded degrees of PDW. Plateletcrit (PCT) is the other platelet boundary which has no huge distinction in guys, be that as it may, the huge rise was seen in females with T2DM of the current examination. This is in concurrence with, Alhadas et al., (31). In typical people, when platelet volume is expanded, platelet include will in general diminish to keep up the estimations of PCT inside ordinary reaches. In this manner, platelet mass or PCT should be kept at consistent levels. Notwithstanding, in individuals with T2DM, platelets become bigger and more receptive through various systems prompting the expanded platelet mass along these lines expanding PCT. As indicated by Alhadas et al., this boundary was fundamentally raised when there is a constant complexity. In everyday Platelet records (PLT, PCT, MPV, and PDW) are determinants of platelet usefulness, among which MPV and PDW stand apart because of their association in the improvement of thromboembolic confusions (32).

Our information exhibited that RBC include was brought down in individuals with T2DM of the two sexes yet this distinction was not genuinely huge. Wang et al., recommended that diminished RBC tally is an autonomous indicator of the danger of microvascular inconveniences in individuals with T2DM and this is intervened incompletely through an impact of diminished RBC rely on RBC work (33). Diminished RBC include in this examination might be clarified in wording oxidative pressure which can bring about the mechanical adjustments of RBC film protein. Adjusted film proteins are related with the improvement of microvascular inconveniences in diabetes. The biconcave discoid state of RBC is kept up by the layer cytoskeleton which is known to be the significant determinant of the cells dynamic conduct. Ordinary RBCs will in general situate themselves with stream smoothes out under high shear (misshaping) powers inferring that, these phones are profoundly deformable bodies. They likewise act as flexible bodies on the grounds that the shape change is reversible when twisting powers are eliminated (34). The main part of the RBC layer cytoskeleton (organization of proteins lying underneath the phone film) is a protein called spectrin. Nonetheless, in diabetes constant hyperglycemia causes a non-enzymatical glycosylation of spectrin network for additional oxidation prompting erythrocyte layer irregularities and sped up maturing of RBCs (34). This may be liable for expanded weakness of RBC deformability among individuals with T2DM. Hyperglycemia increment age of superoxide anion that may cause a few primary and practical alterations of the RBCs. One of the significant alterations in this setting is the conglomeration and connection of hemoglobin to within the RBC layer which is a cytoskeletal spectrine protein organization (34). This may bring about the adjustment of the phone shape and mechanical properties of RBCs. hemoglobin connection to spectrin network likewise builds the intracellular or cytosolic thickness of the erythrocytes which is identified with the mean cell hemoglobin focus (MCHC) (34). In this current investigation, MCHC was raised in individuals with T2DM and the thing that matters was genuinely huge in females and inconsequential in guys. Expanded MCHC may bring about the decrease of RBCs layer adaptability (deformability) and increment the film inflexibility (34). Diminished deformability may bring about the total stop of RBCs traveling through slender sections that may prompt expanded thrombogenic state and afterward atherosclerosis.

As to our information uncovered that the boundary was surprisingly raised in individuals with T2DM of the two sexes supporting the aftereffects of Nada, 2015 (35). RDW is a quantitative proportion of the red platelet volume (RBCV) heterogeneity. Subsequently the higher the estimations of RDW are the more prominent heterogeneity in cell size (35). Constant irritation and expanded oxidative pressure in diabetes cause the weakness of erythropoiesis and corruption of RBCs by discontinuity or agglutination identified with anisocytosis (35). This may abbreviate the RBCs life expectancy prompting diminished RBC check (35) which may likewise clarify the aftereffect of the current examination. It has been shown that expanded RDW is a free indicator of the by and large and cardiovascular mortality in everybody and in those with different high dangers (35). Diabetes is hence, a known issue that lessens the life expectancy of RBCs bringing about the expanded fluctuation of the RBC volume (RDW). Expanded RDW causes impedance on RBCs deformability and adversely influences blood course through microcirculation due to the total stop development of RBCs (35). This may bring about the expanded thrombogenic state and atherosclerosis.

Conclusion

The present study demonstrated that the significant elevation of Platelet parameters such as PLT, MPV in both sexes but RDW only in male but not in the female. In contrast PCT elevated in female but not in the male. Total WBC was elevated in female but not in male patients and decreased total RBC may strengthen the notion that the parameters are considered as inflammatory markers. This suggests that hematological parameters might be a useful prognostic marker of cardiovascular complications and thus used in control of T2D disease progression. Therefore, they may contribute to the early detection of complications and may have a role in the potential reduction of morbidity and mortality in diabetic patients. This study in Ethiopian population can be considered as an initial one that

necessitates further studies to define the relation between hematological parameters with its prognostic value and different diabetic complications.

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