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Coagulation Abnormalities in Diabetic Patients with Retinopathy among Sudanese Patients in Cairo City –eygpt-2025

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Abstract: Background: *Diabetes considered as one of the common diseases and one of the causes of death and disability worldwide Diabetes a heterogeneous group of diseases, characterized by a state of chronic hyperglycemia, caused by a variety of etiologies and genetic and environmental factors acting in concert.* ***Methodology:*** *This was prospective case-control study. Performed in 78 blood samples, of which 38 were collected from diabetic patients with retinopathy and 40 from healthy individual's to evaluate prothrombin time, activated partial thromboplastin time, Platelet count and platelet indices in diabetic patient with retinopathy. The statistical analysis was conducted using SPSS 26 computer program Data were analyzed using a T-test to compare variables, with P < 0.05 considered statistically significant.* ***Results:*** *the results showed that 42% males and 58% females. The participants' ages ranged from 17 to 72 years, with a mean of 33.28 ± 13.97 years. Hemostatic parameters measured included prothrombin time (PT) with a mean of 14.12 ± 2.15 seconds, activated partial thromboplastin time (APTT) with a mean of 38.47 ± 5.58 seconds, platelet count (PLT) averaging 276.54 ± 73.62 x10^3/µL, platelet distribution width (PDW) at 13.16 ± 3.28, mean platelet volume (MPV) at 9.58 ± 1.10 fL, and plateletcrit (PCT) averaging 0.26 ± 0.06. The study sample was divided into case (n=38) and control (n=40) groups, revealing significant differences between groups in PT, APTT, and PLT (p < 0.05), while MPV showed no significant difference (p = 0.447). Gender-based analysis within the case group showed no significant differences in PT, APTT, PLT, or MPV (p > 0.05). Moreover, no significant correlations were found between duration or age and the clinical parameters in the case group (p > 0.05).*

Conclusion: This study conclude that Sudanese diabetic patients with retinopathy exhibit significant coagulation abnormalities, such as higher PT, APTT, and lower platelet count, compared to healthy controls.

Keywords: Hemostatic Abnormalities - Diabetic Patients and Retinopathy –Sudan.

1.INTRODUCTION

Diabetes considered as one of the common diseases and one of the causes of death and disability worldwide.(1).Diabetes a heterogeneous group of diseases, characterized by a state of chronic hyperglycemia, caused by a variety of etiologies and genetic and environmental factors acting in concert. The primary cause of diabetes is impaired production or action of insulin, a hormone that controls the metabolism of glucose, lipids, and amino acids. Diabetes-related metabolic dysregulation causes secondary pathophysiological changes in multiple organ systems that impose an enormous burden on the individual with diabetes and on the healthcare system. Two broad categories of diabetes have been classified as type1 and type 2 diabetes mellitus (DM). Type 2 DM is more common than type1. Most long-term total vascular complications are more common in patients with diabetes(2).The origin and etiology of DM can vary greatly but always include defects in either insulin secretion or response or in both at some point in the course of disease.(3) The abnormality of coagulation is highly involved in the development of diabetic retinopathy which is one of the microvascular complications that mostly occur in diabetic patients. The persistent hyperglycemic condition causes endothelial dysfunction and Oxidative stress which subsequently initiates a state of pro-inflammatory and prothrombotic state(4). In diabetic patients having retinopathy, there is usually an increased concentration of clotting factors that include fibrinogen, von Willebrand factor and plasminogen activator inhibitor-1 (PAI-1). These alterations lead to a rise in blood thickness, reduced fibrinolysis as well as amplified platelet aggregation which culminate in microvascular stasis and ischemia of the retinal vasculature(5). This changed coagulation profile in diabetic retinopathy does not only contribute to the faster capillary destruction but also to neovascularization in proliferative forms of the disease that put the vision at risk because of developing vision-threatening complications such as vitreous hemorrhage and retinal detachment(6).

2. MATERIALS AND METHODS

This study was prospective case-control study .and undertaken in Khartoum state during the period from January 2025 to May 2025. A total of seventy eight diabetic with retinopathy patients were included in this study. Patients who had diabetic without retinopathy were excluded. Under hygienic conditions, using 70% alcohol and pre-analytical phase preparation of patients and equipment, 3 ml

of blood was collected in ethylene diamine tetra acetic acid (EDTA) blood container2.5 ml in tri sodium citrate ((3,2%; 109 mmol/L))under hygienic conditions; plasma was separated then transferred to the lab zone from all participants.
PLTs count and indices) Measurement by used Sysmex KX-21N hematological analyzer and Coagulation profiles byMeasurement by used Biobas 10.
Data were analyzed by statistical package for social science (SPSS), version 16. Qualitative
data were presented as mean and SD

3 Results

Data were collected from a sample of 78 individuals who served as the analytical study sample. Demographic variables such as gender (male-female) were described in this study. Males constituted 32(42%) and females constituted 44(58%)

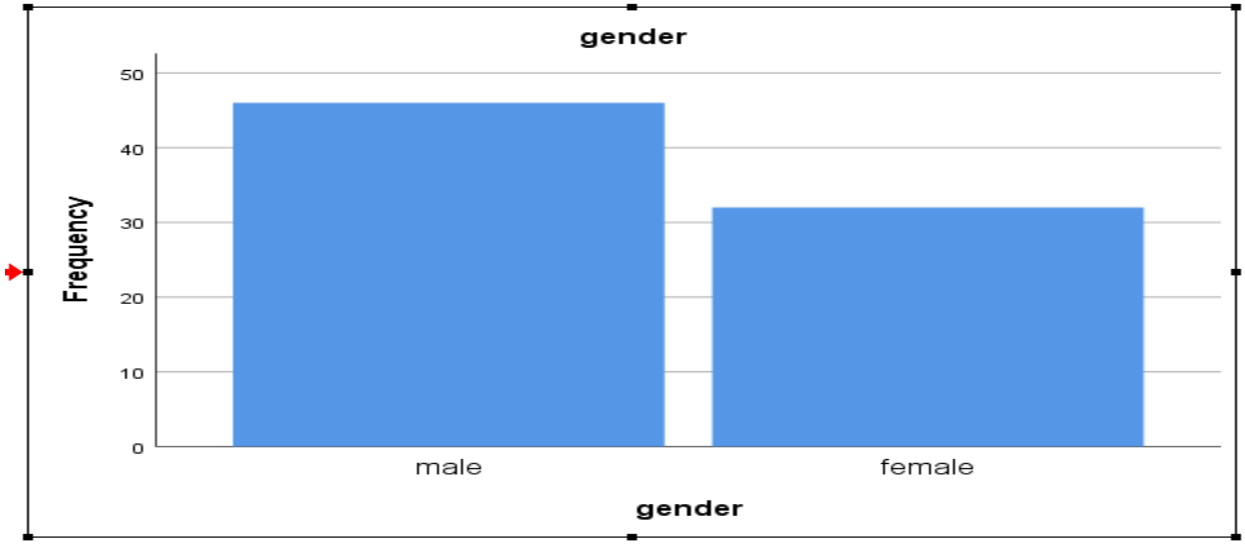

Figure 4.1: Frequency of gender among study population

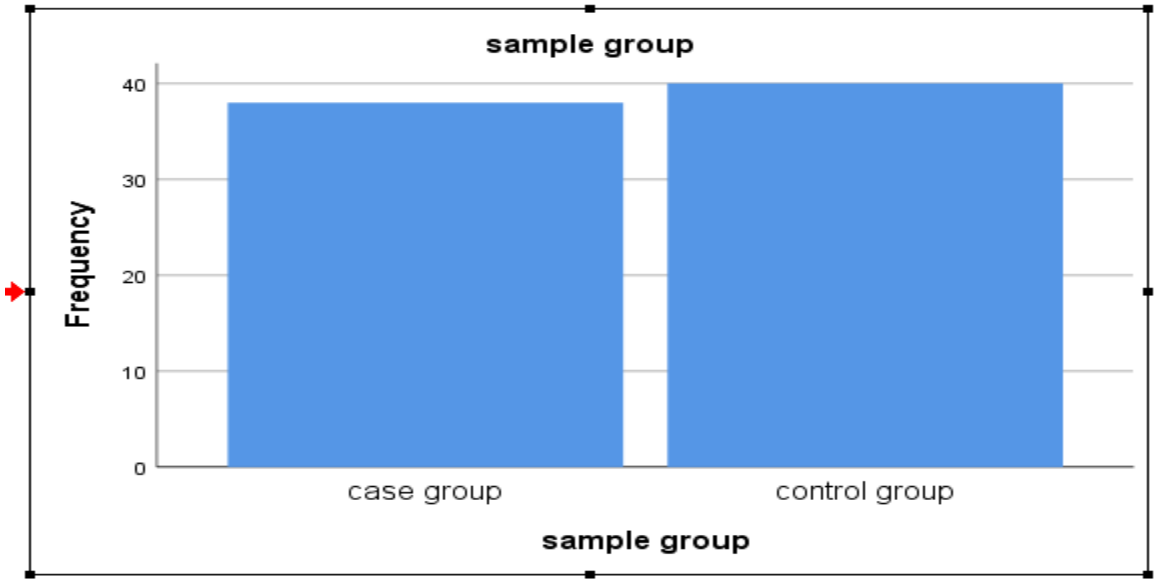

Figure 4.2: Frequency of Group sample among study population

The data were separated for comparison using the variable (Group sample) into two groups (control group-case group).

Table 4.1: Descriptive statistic of the study population (Mean, SD-Frequency) all groups.

Variable		case Group (n=38)	Control group (n=40)
Age (years)	Mean	44. 26	22.85
	SD	12.755	1. 272
Gender (M\F)	male	22	24
	Female	16	16
PT	Mean	14.832	13.448
	SD	2.6204	1. 2794
APTT	Mean	36.834	40.015
	SD	6. 2104	4.4598
PC	Mean	253.61	298.33
	SD	65.591	74.970
PDW	Mean	15.134	11. 275
	SD	3.4988	1.4806
MPV	Mean	9.676	9.485
	SD	1.3945	0.7277
PCT	Mean	0. 24087	0. 27968
	SD	0.050309	0.061267

Table 4.2: comparison between case and control groups (comparative analysis)

Statistical test (independent samples T-test)					
Parameter		**Case group**	**Control group**	**p-value**	**Decision**
PT	mean	14.832	13.448	0.004	Reject the null hypothesis
	SD	2.6204	1. 2794		
APTT	Mean	36.834	40.015	0.011	Reject the null hypothesis
	SD	6. 2104	4.4598		
PLT	Mean	253.61	298.33	0.007	Reject the null hypothesis
	SD	65.591	74.970		

MPV	Mean	9.676	9.485	0.447	Accept the null hypothesis
	SD	1.3945	0.7277		

The table showed there is different in the mean of PT, APTT, PLT , and MPV between case group and Control group at significant 5%.

Table 4.3: Correlation of parameter with gender in case group

T-test (male vs female)						
parameter	Gender				p-value	Decision
	males		Females			
	Mean	SD	Mean	SD		
PT	14.398	2.3482	13.725	1.7831	0.175	Accept the null hypothesis
APTT	38.646	4.9463	38. 206	6.4641	0.735	Accept the null hypothesis
PLT	266.54	66. 262	290.91	82.025	0.152	Accept the null hypothesis
MPV	9.565	1. 2483	9.597	0.8645	0.902	Accept the null hypothesis

The table showed that There is no effect from gender to PT , APTT , PLT , and MPV at significant 5%.

Table 4.4: correlation Between Duration and (PT-APTT-PLT-MPV) in case group

Pearson correlation coefficient			
Parameter	**Correlation coefficient (r)**	**p-value**	**Decision**
PT	0.125	0.456	Accept the null hypothesis
APTT	-0. 233	0.160	Accept the null hypothesis
PLT	-0.181	0. 276	Accept the null hypothesis
MPV	0.068	0.683	Accept the null hypothesis

The table showed there is no relationship between duration and PT , APTT , PLT , and MPV at significant 5%.

Table 4.5: correlation Between AGE and (PT-APTT-PLT-MPV) in case group

Pearson correlation coefficient			
Parameter	**Correlation coefficient (r)**	**p-value**	**Decision**
PT	0.060	0.721	Accept the null hypothesis
APTT	-0. 211	0. 203	Accept the null hypothesis
PLT	-0. 236	0.153	Accept the null hypothesis
MPV	0.055	0.743	Accept the null hypothesis

The results showed there is no relationship between AGE and PT , APTT , PLT ,and MPV at significant 5%.

4.DISCUSSION

This study aimed to assess coagulation abnormalities in Sudanese diabetic patients with retinopathy residing in Cairo City. Our data analysis involved 78 participants, with 32 males (42%) and 44 females (58%). The age of the participants ranged from 17 to 72 years, with a mean age of 33.28 years. This demographic is relatively young, which is important when comparing findings from other studies conducted on older populations, as the pathophysiology of diabetes and coagulation may differ based on age. Our study found significant differences in coagulation parameters between the case group (diabetic patients with retinopathy) and the control group (healthy individuals). The case group had significantly higher prothrombin time (PT) and activated partial thromboplastin time (APTT), and lower platelet count (PLT) compared to the control group, which suggests a disturbed coagulation profile in diabetic patients with retinopathy.

When comparing present findings with previous studies, the results align with the study by Hussein Abker Hussein et al. (2021) (7), who observed a reduction in platelet indices in diabetic patients treated with Metformin and Glimepiride. Hussein et al. found that Glimepiride, in particular, had an effect on platelet distribution width (PDW), which was somewhat consistent with our observation that diabetic patients in the case group had an altered PDW. However, unlike their study, we did not observe a significant effect on platelet count. This discrepancy could be due to the type of diabetes medications used by the participants, the duration of treatment, or the presence of retinopathy, which may contribute to the development of specific coagulation abnormalities.

Additionally, this findings are in contrast to those reported by Salima Omran BOSHABOR (2022) (8), who did not find significant differences in PT, APTT, or platelet count between diabetic patients and healthy controls. While we observed statistically significant changes in PT, APTT, and PLT between the case and control groups, BOSHABOR's study emphasized the importance of regular monitoring of coagulation markers despite no significant changes being observed. This contrast underscores the variability in coagulation abnormalities observed across different populations and suggests that coagulation disturbances may be more pronounced

in diabetic patients with complications like retinopathy. Our study adds to the body of evidence that diabetic complications, such as retinopathy, may influence coagulation markers more significantly than diabetes alone.

Similarly, the findings in the study by Omer Ibrahim Abdallah Mohammed (2020) (9) also support our results in that diabetic patients exhibited a higher platelet count compared to healthy controls. However, this study found no significant differences in PT, INR, or APTT, which contrasts with our findings, where we observed significant differences in both PT and APTT between the case and control groups. These differences may reflect variations in the sample population, such as the presence of retinopathy in our case group, which could exacerbate coagulation abnormalities. The study by Mohammed (59) points to a potential hypercoagulable state in diabetic patients, a concept that is consistent with our observation of altered PT and APTT, which are markers of coagulation impairment.

Our study also aligns with the work of Mohammed Ali Awed Elgeid et al. (2019) (10), who found that diabetic patients had significantly shorter PT and APTT compared to controls. In contrast to Elgeid et al.'s study, where fibrinogen levels were elevated in diabetic patients, we did not find significant changes in MPV between the case and control groups, suggesting that the mechanisms behind coagulation changes in our cohort may differ from those observed in Elgeid's study. The variation in PT and APTT between the studies could be attributed to differences in the presence of diabetic complications like retinopathy, which may alter coagulation pathways, and the different methods of data collection or patient selection criteria used in each study.

Moreover, in a study by Anik Ika Winarni et al. (2019) (11), the effects of hypertension on APTT in diabetic patients were explored. They found no significant difference in APTT between hypertensive and non-hypertensive patients receiving bevacizumab intravitreal injections. This study's results highlight that while APTT might shorten in response to certain treatments, hypertension and the use of antihypertensive drugs did not significantly affect APTT. In contrast, our study found a significant difference in APTT between the case and control groups, but we did not focus on the role of hypertension or medication treatments. This discrepancy suggests that factors like retinopathy, which was a focal point in our study, could contribute more directly to coagulation abnormalities in diabetic patients than hypertension alone.

Our study also found no significant correlations between coagulation parameters (PT, APTT, PLT, and MPV) and variables such as age or the duration of diabetes, which contrasts with some previous studies that have reported associations between longer disease duration and coagulation changes. In our case group, the mean age of participants was 44.26 years, and although previous studies have suggested that older age could exacerbate coagulation abnormalities, our younger cohort may not have shown the same trends due to the relative homogeneity of age and the potential for early-stage retinopathy in the studied population.

5. CONCLUSION

The present study conclude that Sudanese diabetic patients with retinopathy exhibit significant coagulation abnormalities, such as higher PT, APTT, and lower platelets count, compared to healthy controls

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this work

ETHICAL APPROVAL AND CONSENT

The study was approved by the research committee at the faculty of medical laboratory science – al mashriqe university. Ethical approval was achieved from the university, Informed consents

were taken from each subject before enrollment in the study.

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. COMPETING INTERESTS

Authors have declared that no competing interests exist.

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