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Original Research Article

Coagulation Profile and D Dimer in Diabetes Patients

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Abstract: ***Background:*** Diabetes mellitus causes coagulopathies by glycating haemoglobin, prothrombin, fibrinogen, and other proteins involved in the clotting process. Shortened PTTK and PT reflect a hypercoagulable state associated with an increased thrombotic risk and a negative cardiovascular effect, both of which can lead to the beginning and progression of microvascular and macrovascular disorders. ***Objective:*** To examine the coagulation profile and D dimer in diabetic patients and controls. ***Materials and Methods:*** This hospital-based case-control research was conducted in the department of Laboratory Medicine, BIRDEM General hospital from August 2024 to February 2025. Patients with type-2 diabetes were included in the study. Healthy individuals of the same age group were matched for the study analysis having no type-2 diabetes or other comorbid conditions. Individuals with a history of hypercoagulability, such as thrombocytosis, known inherited coagulation disorders, venous thromboembolism, pregnancy, cancer, recent surgery, and hyperthyroidism were excluded. ***Results:*** The mean age was 49.71 (±17.62) years. Regarding coagulation profile mean PT (sec), PTTK (Sec), Fibrinogen (mg/dl), D-dimer (µgm/ml), Platelets count (cell/L). FBS (mg/dl) and HbA1c were significant relation with diabetic in comparison to non-diabetic ($p<0.02$). Also significant relation with diabetic with complication and without complicated patients. ***Conclusion:*** The coagulation profile alters, with non-diabetics having significantly increased PT(Sec), PTTK(Sec), and platelet count(cell/L) levels than diabetics. Diabetes mellitus patients exhibited significantly higher levels of fibrinogen (mg/dl), D-dimer (µg/ml), FBS (mg/dl), and HbA1c than controls.

Keywords: Coagulation profile, D-dimer, Diabetes mellitus.

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Introduction

Diabetes mellitus is a condition with high blood glycemic states, either due to a lack of insulin or insensitivity to insulin in the body.[1] Type-2 diabetes is the most common type of diabetes, which presents micro and macrovascular complications.[1] Diabetes mellitus induces coagulopathies by glycating haemoglobin, prothrombin, fibrinogen, and other proteins involved in the clotting mechanism. A shortened activated partial thromboplastin time (APTT) and prothrombin time (PT) can be indicators of a hypercoagulable state, related to an elevated thrombotic risk and a negative cardiovascular effect, both of which can lead to the onset and progression of microvascular and macrovascular problems.[2] D-dimer is a fibrin degradation product present in the blood after a blood clot dissolves, and it is commonly used as a biomarker for thrombotic activity. D-dimer is associated with microalbuminuria in patients with diabetes and this suggests that glomerular dysfunction is in part mediated by hypercoagulability.[3] High level of D-dimer is observed in patients with DN especially in T2DM than it in type 1 diabetes mellitus.[4] In addition to reflecting long-term blood sugar content, hemoglobin A1c

(HbAlc) level is also thought to be closely linked to complications of diabetes such as microangiopathy and macroangiopathy.[5, 6] There are studies suggesting that monitoring coagulation function and HbA1c in patients with DM plays a role in assessing the progression of complications of the disease, especially microangiopathy.[7, 8] In diabetic patients, antiplatelet and anticoagulation treatments may need to be administered to manage this prothrombotic state. Antithrombotic treatment can be given to these patients by monitoring D-dimer and fibrinogen levels.[9] These tests are frequently and easily studied in laboratories.[9] So this study aimed to evaluate Ddimer and fibrinogen levels in patients with DM, by examining the relationship between Coagulation profile and D dimer levels with HbA1c, which indicates different blood glucose levels in diabetic patients.

Materials And Methods

This hospital-based case-control research was conducted in the department of Laboratory Medicine, BIRDEM General hospital from August 2024 to February 2025. Patients with type-2 diabetes were included in the study. Healthy individuals of the same age group were matched for the study analysis having no type-2 diabetes or other comorbid conditions. Individuals with a history of hypercoagulability, such as thrombocytosis, known inherited coagulation disorders, venous thromboembolism, pregnancy, cancer, recent surgery, and hyperthyroidism were excluded. Plasma fibrinogen, D-dimer levels, fasting blood sugar (FBS), HbA1c levels were evaluated in all groups, and other biochemical parameters were also examined. D-dimer and fibrinogen determinations were made by Coagulation analyzer. The data were analyzed using SPSS-25.0. Quantitative variables were summarized as mean±SD and qualitative variables were summarized as frequency and percentages. The mean values were compared between cases and controls with the help of independent samples t-test, while categorical comparisons were made using the Chi-square test. The *p*-value of ≤0.05 was considered statistically significant.

Results

Table 1: Demographic profile of DM patients (n=130)

Age in years	Number	Percentage
≤20 years	9	6.92
21-30 years	21	16.15
31-40 years	14	10.77
41-50 years	26	20.00
51-60 years	29	22.31
>60 years	31	23.85
Mean ±SD	49.71 (±17.62)	Range 16-72 years
Gender		
Male	57	43.85
Female	73	56.15

The mean age was 49.71 (±17.62) years, minimum age was 16 and maximum age were 72 years. Majority 73 (56.15%) were female.

Table 2: Comparison of coagulation profile between diabetic and non-diabetic

Coagulation Profile	**Study group**		**p value**
	Diabetes Mellitus n=65	Non-Diabetes Mellitus n=65	
PT(Sec)	12.74±1.36	14.67±1.23	0.02
PTTK(Sec)	25.73±1.34	29.68±1.32	<0.001
Fibrinogen(mg/dl)	587.4±156.7	213.2±112.6	0.001
D-dimer(µgm/ml)	2.18±1.03	0.19±0.08	0.02
Platelets count(cell/L)	179.41±2.67	196.18±3.47	0.001
FBS (mg/dl)	193.64±4.18	98.64±2.27	0.001
HbA1c	6.6±4.4	4.8±1.1	0.02

Regarding coagulation profile mean PT (sec) 12.74±1.36 were in diabetic and 14.67±1.23 were in non-diabetic (p 0.02), PTTK (Sec) 25.73±1.34 were in diabetic and 14.67±1.23 were in non-diabetic (p<0.001). Fibrinogen (mg/dl) 587.4±156.7 were in diabetic and 213.2±112.6 were in non-diabetic (p<0.001). D-dimer (µgm/ml) 2.18±1.03 were in diabetic and 0.19±0.08 were in non-diabetic (p<0.02). Platelets count (cell/L) 179.41±2.67 were in diabetic and 196.18±3.47 were in non-diabetic (p<0.001). FBS (mg/dl) 193.64±4.18 were in diabetic and 98.64±2.27 were in non-diabetic (p<0.001). HbA1c 6.6±4.4 were in diabetic and 4.8±1.1 were in non-diabetic (p<0.02).

Table 3: Coagulation Profile among Diabetes with or without complication (n=65)

Coagulation Profile	**Study group**		**p value**
	Diabetes with Complication n=33	Diabetes without Complication n=32	
PT(Sec)	12.09±0.48	13.68±0.97	<0.001
PTTK(Sec)	23.90±0.40	27.42±0.91	<0.001
Fibrinogen(mg/dl)	770.1±122.5	584.4±130.7	<0.001
D-dimer(µgm/ml)	9.13±2.02	2.18±1.91	<0.001
Platelets count(cell/L)	155.67±2.67	188.76±2.57	<0.001
FBS(mg/dl)	193.93±3.63	187.19±2.56	<0.001
HbA1c	8.6±2.4	6.6±1.8	0.003

Regarding coagulation profile mean PT (sec) 12.09±0.48 were in diabetes with complication and 13.68±0.97 were in diabetes without complication (p <0.001), PTTK (Sec) 23.90±0.40 were in diabetes with complication and 27.42±0.91 were in diabetes without complication (p<0.001). Fibrinogen (mg/dl) 770.1±122.5 were in diabetes with complication and 584.4±130.7 were in non-diabetic (p<0.001). D-dimer (µgm/ml) 9.13±2.02 were in diabetes with complication and 2.18±1.91were in diabetes without complication (p<0.001). Platelets count (cell/L) 155.67±2.67 were in diabetes with complication and 188.76±2.57 were in diabetes without complication (p<0.001). FBS (mg/dl) 193.93±3.63 were in diabetes with complication and 187.19±2.56 were in diabetes without complication (p<0.001). HbA1c 8.6±2.4 were in diabetes with complication and 6.6±1.8 were in diabetes without complication (p<0.03).

Discussion

In this study showed that the mean age was 49.71 (±17.62) years, minimum age was 16 and maximum age were 72 years. Majority 73 (56.15%) were female. Abdelrhman and Abdelgadir study.[10] reported the mean of age among study group was (53 ± 14.2 years), they taken same number of male female. Kha *et al*. reported the mean age was 59.9±6.2 years and male was predominant.[1] In this study, It was observed coagulation profile mean PT (sec) 12.74±1.36 were in diabetic and 14.67±1.23 were in non-diabetic (p 0.02), PTTK (Sec) 25.73±1.34 were in diabetic and 14.67±1.23 were in non-diabetic (p<0.001). Fibrinogen (mg/dl) 587.4±156.7 were in diabetic and 213.2±112.6 were in non-diabetic (p<0.001). D-dimer (µgm/ml) 2.18±1.03 were in diabetic and 0.19±0.08 were in non-diabetic (p<0.02). Platelets count (cell/L) 179.41±2.67 were in diabetic and 196.18±3.47 were in non-diabetic (p<0.001). FBS (mg/dl) 193.64±4.18 were in diabetic and 98.64±2.27 were in non-diabetic (p<0.001). HbA1c 6.6±4.4 were in diabetic and 4.8±1.1 were in non-diabetic (p<0.02). Adejumo *et al*. discovered that prothrombin time (PT) and partial thromboplastin time with kaolin (PTTK) were shorter in diabetes participants compared to non-diabetes (p<0.05).[2] The Abdelrhman and Abdelgadir study was disagreement with studies that found plasma fibrinogen levels were higher among type 2 diabetes mellitus patients (656 mg/dl) as compared to controls (324 ± 139 mg/dl) which were statistically significant different p-value <0.01.[10] Adejumo *et al*. reported that the coagulation profiles of patients with and without diabetes mellitus are displayed Prothrombin time and partial thromboplastin time with kaolin, fibrinogen, D-dimer, and platelet levels were shown to be statistically significant (p< 0.05) when compared to the control.[2] Khan *et al*. the platelet count was in the normal range for both cases and controls, it was lower in cases than in controls (177.5±18.3 vs 231.2±18.1, p<0.001).[1] Similarly, the mean fibrinogen level was significantly higher among cases compared to controls (298.2±11.4 vs 256.6±6.5, p<0.001). It has been mentioned in literature by FU et al.[11] that shortened APTT is considerable for the risk of hypercoagulability states. The possible reason is the glycation of red blood cells, prothrombin, and fibrinogen, which lead to coagulation abnormalities in patients with diabetes. Further presence of shorter APTT was significantly found to be associated with the patients with diabetes as compared to controls (*p*<0.001).[11] Arpaci, concluded that no significant changes in PT, PTTK, and fibrinogen levels were seen in diabetic individuals belonging to the controlled diabetic group (HbA1c< 7.0%) and the uncontrolled diabetes group (HbA1c >7.0%).[12] Which is consistent with the findings of Arpaci, who found no significant increase in fibrinogen levels between people in the regulated diabetic group (323.42 mg/dL) and people in the dysregulated diabetic group (342.36 mg/dL).[12]

Regarding coagulation profile mean PT (sec) 12.09±0.48 were in diabetes with complication and 13.68±0.97 were in diabetes without complication (p <0.001), PTTK (Sec) 23.90±0.40 were in diabetes with complication and 27.42±0.91 were in diabetes without complication (p<0.001). Fibrinogen (mg/dl) 770.1±122.5 were in diabetes with complication and 584.4±130.7 were in non-diabetic (p<0.001). D-dimer (µgm/ml) 9.13±2.02 were in diabetes with complication and 2.18±1.91were in diabetes without complication (p<0.001). Platelets count (cell/L) 155.67±2.67 were in diabetes with complication and 188.76±2.57 were in diabetes without complication (p<0.001). FBS (mg/dl) 193.93±3.63 were in diabetes with complication and 187.19±2.56 were in diabetes without complication (p<0.001). HbA1c 8.6±2.4 were in diabetes with complication and 6.6±1.8 were in diabetes without complication (p<0.03). Adejumo *et al*. reported that together with diabetes without complications.[2] It was shown that the PTTK duration was shorter, and the platelet count was lower (p< 0.05). When compared, the levels of fibrinogen and D-dimer were not statistically different (p>0.05). Multiple comparisons of the impact of anti-diabetes medications on the coagulation profile. Khan *et al*. observed that the coagulation profile differed among the healthy and diseased groups.[1] Activated partial thromboplastin time and prothrombin time were lower, contrary to our results, where we did not find any difference in the APTT levels in the two groups. Fibrinogen levels were found to be raised in the study, which was similar to our study results (*p*=<0.001). An association between the HBA1c levels was also noticed in the study, where higher HBA1c was found to be associated with deranged PT, APTT and fibrinogen levels. In addition, similar data were reported for patients with more retinal complications compared to the non-complication group.[13, 14]

Conclusion

The coagulation profile changes, with an increase in PT(Sec), PTTK(Sec), and platelet count(cell/L) being considerably higher in non-diabetes individuals than in diabetics. Diabetes mellitus cases had significantly higher levels of fibrinogen (mg/dl), D-dimer (µg/ml), FBS (mg/dl), and HbA1c compared to controls. Diabetes patients with complications had a considerably greater coagulation profile than those without complication.

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