Comparative Study of Hemostatic Parameters in Type 2 Diabetes Mellitus and Healthy Individuals

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ABSTRACT

Diabetes mellitus patients with persistent hyperglycemia develop coagulopathies because prothrombin, fibrinogen, and other proteins essential to the clotting process are affected. Reduced prothrombin time (PT) and activated partial thromboplastin time (APTT) show a hypercoagulable condition, which is linked to an elevated thrombotic risk and detrimental cardiovascular outcomes. The coagulation profile of type 2 diabetes mellitus was evaluated in this study. The aim of this study was to determine the blood clotting profiles and risk factors for blood clotting abnormalities in diabetic people.

Methods: A total of 50 participants comprising 40 patients with diabetes mellitus type 2, including (15 females and 25 males, aged 30–65 years) and 10 non-Diabetics attending. To perform platelet count, coagulation assays, and glucose analysis, a blood sample of 10 ml was collected in EDTA (5 ml), citrate (2.5 ml), and chemistry (2.5 ml) tubes.

Results:- Hemostatic parameter comparisons between T2DM patients and healthy controls In comparison to controls, patients with type 2 diabetes showed substantially shorter activated partial thromboplastin time (aPTT), lower platelet count (PLT), increased fibrinogen, and elevated D-dimer (D-D) levels

Keywords: Diabetes mellitus, Hemostatic parameter comparisons

1.Introduction:

Diabetes mellitus (DM), a metabolic disease, is characterized by chronic hyperglycemia brought on by abnormalities in the metabolism of carbohydrates, lipids, and proteins that are connected to absolute or relative impairments in insulin production, insulin action, or both. (1)

Diabetes mellitus is categorized depending on its origin and clinical manifestation. Type 1 diabetes, type 2 diabetes, gestational diabetes, and other specialized forms are the four subtypes or classes of diabetes mellitus. Although type 1 diabetes is the most common kind among younger age groups in the majority of highly developed countries, it is believed to only make up a small portion of the overall burden of diabetes in a population. (2). T2DM development is a long-term process with a latent stage that lasts for around ten years before the disease manifests clinically (**3**).

Diabetes poses a severe threat to human health as the third greatest cause of death, and it has a number of serious side effects, including microvascular problems (**4**). Blood clotting, however, is a common physiological response that enables an organism to maintain blood in a fluid state, close up damaged blood arteries when they occur, and eliminate blood clots after vascular integrity has been restored. (5). There is evidence that diabetes mellitus can disrupt healthy blood clotting. (6,7). Many coagulation mechanisms are

impacted by hyperglycemia, including thrombus development and inhibition, fibrinolysis, platelet function, and endothelial function (8). Numerous studies have linked diabetes mellitus to increased platelet activity or activation, as well as their underlying mechanisms. Global coagulation tests, such as the prothrombin time (PT), were performed on ten milliliters of venous blood obtained after 12 hours of fasting. Among the contributing factors are the effects of insulin, hyperglycemia, hyperlipidemia, endothelial dysfunction, oxidative stress, and an inflammatory state (9 ,10). In addition to increased fibrinogen binding, diabetic individuals have greater amounts of Glycoprotein Ib expression for agonists and glucoproteins on platelet surfaces (11).

Patients with metabolic syndrome and Type 2 diabetes have higher levels of Factor VII (FVII), indicating that dyslipidemia is common in both conditions(12). Along with increased endothelial (13). According to a study from India, Hyperfibrinogenemia is common in Type 2 diabetes patients, and fibrinogen levels are independently linked with hemoglobin A1C values (14). The hypercoagulable hemostasis wing, which contributes to atherosclerosis and thrombosis, is stimulated by diabetes-related hemostatic disorders. According to study, diabetics who die from cardiovascular difficulties have a higher risk of myocardial infarction and stroke (75% of their deaths are caused by cardiovascular problems). (15,16). Patients with diabetes mellitus are additionally observed for D-dimer and other coagulating markers. Even though several studies have shown that T2DM and defective hemostatic and coagulation processes are related(17). Vitamin E has various therapeutic actions that might delay hepatic fibrosis and perhaps prevent cirrhosis by regulating inflammatory response, cell damage, cellular signaling, and cellular proliferation in addition to its antioxidative properties(18). Adiponectin is a crucial molecule that functions by inhibiting hepatic fatty acid production and decreasing inflammation in patients. Studies have shown a correlation between vitamin E administration and increased adiponectin mRNA and protein levels(18).

2.Materials and Methods

Population of Patients

A total of 50 individuals, including 10 non-diabetics and 25 males and 15 females with T2DM, aged 37 to 65, attended.

Administration of Questionnaire

Information on demographic factors, including age, sex, employment, and gender, as well as each participant's clinical history, were gathered using a well-constructed constructed questionnaire.

Collection Of Blood Samples

After 12 hours of fasting, ten milliliters of venous blood were obtained and split among three tubes: an EDTA tube (4 milliliters), a 3.2% citrated tube (3 milliliters), and a plain tube (3ml). to determine the prothrombin time (PT), activated partial thromboplastin time (aPTT), HbA1c, fibrinogen (FIB), D-dimer (D-D), and platelet count, among other routine hemostatic measurements (PLT).

Using a Chemistry analyzer, the lipid profile and glucose level of a serum made from a plain tube were evaluated (HeCoS, Italy). To create platelet-poor plasma for PT, PTT, TT, FIB, and D-D coagulation analyzer testing, the sample in the citrated tube was centrifuged at 1400 g for 10 minutes (Ares, chaina). The platelet count was calculated in a cell using an EDTA tube sample.

3. Results

Patients with T2DM and healthy controls' hemostatic parameters were compared, and the results showed that, when compared to controls, patients with type 2 diabetes had significantly shorter activated partial thromboplastin times (aPTT), lower platelet counts, higher levels of fibrinogen, and higher levels of D-dimer (D-D) (P 0 01).

Table : Hemostatic parameters of T2DM patients and healthy controls are compared.

Variable	Control	T2DM
Age (years)	10 (33–60)	40 (35–65)
PT (s)	13.3(4.8938)	10.8 (0.8110)
APTT (s)	30.64 ± 4.20	25.49 ± 3.13

Fibrinogen (g/L)	2.65 ± 0.40	3.51 ± 1.33
HbA1c	3.77 ± 0.57	8.36 ± 3.84
D-dimer (mg/dL)	0.14 (0.03–0.54)	0.48(0.06–10.31)
PLT (109 /L)	211 (89–323)	183 (43–447)

The information was reported as median or mean and standard deviation (SD) (range). activated partial thromboplastin time, Prothrombin time, D-dimer, platelet count, and fibrinogen are all abbreviations for type 2 diabetes mellitus.

4. Discussion

According to the results of the current study, which were undoubtedly connected to metabolic issues and consistent with those described by other authors, patients with T2DM may experience changes in hemostatic parameters(19). Numerous indicators, including those related to hematology, biochemistry, immunology, and hemostasis, have been shown to impact the onset of diabetes mellitus (DM). As a result, several metrics may be useful to assess how DM is developing. Recent research has suggested that increased activation of the clotting cascade plays a significant role in the development of vascular problems in diabetes, and that these difficulties are linked to changes in hemostasis(20).

Compared to controls, T2DM patients had higher D-D levels and lower PT, aPTT, and PLT counts, according to the results of this study on T2DM risk and prediction. Diabetics also had lower PLT counts and shorter PT, aPTT, and D-D levels. And additional reports appear to support the current findings in part(21). In this study, the group with diabetes had significantly higher fibrinogen levels, which was a significant difference. Another study conducted in India came to a similar conclusion, finding that all diabetes patients had greater blood fibrinogen levels than non-diabetic controls. (22). According to a different study, the plasma fibrinogen levels in the diabetes fraction were significantly higher than those in the non-diabetic group. (14).

The abnormal predisposition of diabetic platelets for increased activity and aggregation results in thrombus development, microcapillary embolization, and local vascular lesions. (23). Between diabetics and non-diabetics, there was a statistically significant difference in the median platelet (PLT) count. the mean platelet counts in those with diabetes were significantly lower than those of healthy, non-diabetic controls (24).

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