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Research Article

Evaluation of Prothrombin Time Activated Partial Thromboplastin Time and Fibrinogen Level in Diabetic Pregnant Women in Shendi Town, Sudan

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Abstract

Background: Pregnancy is a unique physiological event that might have an impact on a woman›s coagulation and fibrinolytic system. Pregnant women and fetuses may be at risk for thrombotic and bleeding problems due to an abnormally hypercoagulable state during diabetic pregnancy. Thus, pregnant women must have regular coagulation tests to keep track of their coagulation and fibrinolytic systems.

Objective: This research was carried out to analyze Prothrombin Time, Activated Partial Thromboplastin Time, and fibrinogen level in diabetic pregnant and normal pregnant women in Shendi town in Almak Nemer hospital during the period from June to November 2021.

Materials and Methods: In tri-sodium citrate, 150 venous blood samples total were taken, 100 from diabetic pregnant women as cases and 50 from healthy pregnant women as controls. A questionnaire was employed to gather certain patient-related data. Coagulometer tests were performed on blood samples.

Results: It was found that pregnant women with diabetes had a significant increase in PT and APTT but a minor increase in fibrinogen when compared to the control result. PT and PTT values were insignificant increase with age, number of pregnancies, and thestage of pregnancy.

Conclusions: In diabetic pregnant women, alterations in the levels of coagulation markers were seen. And the coagulation parameter ranges were reported, which can serve as a point of reference for medical professionals to more precisely monitor the coagulation and fibrinolytic system in pregnant diabetic patients.

Key Words: Partial Thromboplastin, Fibrinogen level, Diabetic pregnant, Prothrombin Time.

1. Introduction

Blood coagulation is a complex process by which blood forms clots. It is an essential part of homeostasis, in which a damaged blood vessel wall is covered by a platelet and fibrin-containing clot to stop bleeding and begin repair of the damaged blood vessel [1]. In addition to keeping blood in a

fluid state while it circulates within the vascular system, homeostasis also stops bleeding at the site of injury or blood loss by forming a hemostatic plug, restricts the process to the area around the damage, and ensures that the plug is eventually removed once healing is complete [2]. Often, thrombosis seems to make the coagulation more difficult and starts nearly right away after a blood artery lesion damages the endothelium. Blood platelet and the plasma protein fibrinogen clotting factor change when exposed to proteins such as tissue factors. Primary hemostasis is the initial formation of a plug at the site of the damage by platelets. Proteins in the blood plasma known as coagulation factors or clotting factors react in a complex cascade to generate fibrin strands, which strengthen the plug, during secondary hemostasis [3]. The blood plasma protein fibrinogen, commonly known as Factor I, is made by the liver and is crucial for blood clotting. Several blood constituents come together to form a clot during the process of blood coagulation. Coagulation is initiated when blood leaks from a blood vessel rupture. Coagulation factors are a group of proteins that work together to create thrombin. Fibrinogen is then transformed into fibrin by the thrombin. The major protein in a blood clot is fibrin, which is formed from fibrinogen [4]. Diabetes mellitus (DM) is a metabolic disorder characterized by chronic hyperglycemia due to interruptions of carbohydrate, fat, and protein metabolism that are related to absolute or relative deficiencies in insulin secretion, insulin action, or both [5]. Type one diabetes mellitus, also known as IDDM (Insulin Dependent Diabetes Mellitus), type two diabetes mellitus, also known as NIDDM (Non-Insulin Dependent Diabetic Mellitus), and gestational diabetes. The progression of retinopathy and neuropathy as well as microvascular and macrovascular disorders are among the long-term effects and complications of diabetes. Atherosclerosis and other macrovascular diseases are linked to the circulation problems that are present in diabetes and are recognized as a primary cause of mortality in the diabetic population. Changes in endothelial metabolism, coagulopathy, fibrinolytic aberration, hemorheological factors, and platelet count and activity modify the circulatory disturbances [6]. Diabetes is a hypercoagulable condition, as numerous investigations have demonstrated. The expression of tissue factor and Von Willebrand factor by vascular endothelial cells is increased, which causes hypercoagulability. Additional causes include decreased fibrinolytic activity, raised procoagulant factor levels, and enhanced platelet adhesion [7]. Pregnancy is a distinctive period in a woman's lifetime. Many physiologic, metabolic, anatomical, and psychological changes occur. Physicians without expertise in the physical impacts of pregnancy on a woman's body may readily mistake these changes. To prevent any diagnostic or management errors, doctors who treat women must be aware of the significance of these physiological changes [8]. Also, Plasma glucose levels may fluctuate as a result of changes in insulin sensitivity that are linked to pregnancy. These alterations could have negative effects on outcomes for pregnant women who already have diabetes or who develop it [9]. Particularly when these disorders are not correctly diagnosed and managed, hypercoagulable states can have immediate repercussions. Individuals with hypercoagulable conditions are more likely to develop thrombi in their veins and arteries, which increases their risk for amputation, heart attack, stroke, and peripheral artery disease. The creation and activation of prothrombotic and fibrinolytic factors must be perfectly balanced to preserve the hemostatic system's stability, and under normal conditions, this process is tightly regulated. Yet, this equilibrium is changed toward a prothrombotic state under specific physiological and pathological conditions, such as during pregnancy and diabetic mellitus (DM) [10]. Prothrombin time (PT) is a laboratory screening test used to detect disturbances affecting the activity of factors I, II, V, VII, and X of the extrinsic and common pathways. The intrinsic and common pathways' factors I, II, V, VIII, IX-XI, and XII activity are measured by the activated partial thromboplastin time (APTT) [11, 12]. These screening test findings are known to take longer than expected and can be associated with bleeding due to several factor deficits. Hence, since PT was shortened, APTT might be an indication of a hypercoagulable condition. An increase of circulating activated coagulation components in plasma brought on by increased coagulation in vivo and an increased risk for thromboembolism may shorten APTT [11, 13].

2. Materials and Methods

2.1. Study design: This analytical prospective case-control study, which was carried out in Almak Nimer Hospital between June and November 2021, sought to assess the levels of PT, APTT, and fibrinogen in pregnant diabetics.

2.2. Study population:

The total number of pregnant women included in this study was 150. In a test group, 100 of them were diabetic pregnant women, while the remaining 50 were normal pregnant women.

2.3. Study period:

The study was started from June to November 2021.

2.4. Inclusion criteria:

All Pregnant women with diabetes and normal pregnant women were selected for this study.

2.5. Exclusion criteria:

The presence of the patient under anticoagulation therapy was excluded.

2.6. Sample size

100 from diabetic pregnant women as a case and 50 samples from normal pregnant women as a control group.

2.7. Data collection:

Data were processed and analyzed using a statistical package for social sciences (SPSS), T-Test, was used to calculate the P. value. Differences were considered statistically significant when the P.value≤0.05.

2.8 Ethical Considerations:

Ethical approval for the study was obtained from the Board of the Faculty of Graduates Studiesat Shendi University. The written informed consent form was obtained from each guardian of the participant as well as from the subject himself before recruitment into the study. All protocols in this study were done according to the Declaration of Helsinki (1964).

3. Results

One hundred fifty Sudanese pregnant women in Shendi city (100) case diabetic pregnant and (50) control normal pregnant women were enrolled randomly in this study. Regarding general characteristics of the study population, the mean age of the study population in a diabetic pregnant and normal pregnant woman is (28.6±6.1 and 29.5±5.5 years) respectively. Also, the frequency of the stage of pregnancy in diabetics pregnant that the 1st trimester represented 23%, 2nd trimester 49%, and 3rd trimester 28%, while in normal pregnant women, the 1st trimester was represent 22%, 2nd trimester 42%, and in 3rd trimester was 36%. The Number of pregnancies in a diabetic pregnant and normal pregnant woman was 3.4±1.2 and 3.5 ±1.1 respectively (Table 1). The results of this study showed that the mean of PT in a diabetic pregnant and normal pregnant woman was (16.6±4.3 and 14.6±2.1) seconds respectively (Table 2). The mean of PT in age groups of (18-30) years and (31-43) years were (17.11+4.3 and 15.9±3.9sec) respectively, while the mean of PTT in age groups of (18-30) years and (31-43) years were (36.6±7.6 and 35.4±7.8sec) respectively, in the other hand the mean of fibrinogen in age groups (18-30) years and (31-43) years were (156.8±20.2 and (163±18.2mg|dl) respectively as shown in (Table 3). The mean of PT, PTT, and fibrinogen levels in the first trimester of pregnancy was (15.6±4.9sec, 34.17±5.1sec and 154.4±20.7mg\dl) respectively, while in the second trimester of pregnancy were (17.1±3.8sec, 35.5±7.7sec and 160.8±20.2mg|dl) respectively, and in the third trimester of pregnancy were (16.1±4.2sec, 38.9±8.4sec and 160.7±17.4mg|dl) respectively (Table 4). The mean of PT and PTT and fibrinogen in women with one pregnancy was (11.2 sec, 37.0 sec and 152.5 mg/dl) respectively, while in those with twice pregnancies was (16.6 sec, 36.3 sec and 162.0 mg/dl), also in those with three pregnancy was (16.6 sec, 36.3 sec and 156.0 mg/dl) respectively, while in those with four pregnancy was (17.0 sec, 35.3 sec and 164.2 mg/dl) respectively, while in those with five pregnancy was (16.5 sec, 38.0 sec and 160.0 mg/dl) respectively, and finally in those with six pregnancy was (16.0 sec, 40.2 sec and 156.8 mg/dl) respectively (Table 5).

Table 1: The meanof age, Number of pregnancies, and the frequency of the stage of the study population in a diabetic pregnant and normal pregnant woman.

Study groups	Age/years Mean±SD	Frequency ofDuration ofpregnancy intrimesters-Mean±SD			No of pregnancy Mean±SD
		15t	2nd	3rd	
Diabetic pregnant	28.7±6.1	23%	49%	28%	3.4+1.2
Normal pregnant	29.5±5.5	22%	42%	36%	3.5±1.1

Table 2: The mean of PT in diabetic pregnant and normal pregnant woman.

Study groups	PT(mean±SD)/sec	P.value
Diabetic pregnant	16.6±4.3	0.002
Normal pregnant	14.6±2.1	

Table 3: The mean of PT and PTT and Fibrinogen level according to the age of pregnant women.

Age		N	Mean	Std. Deviation	P. value
PT	18-30 31-43	60 40	17.1167 15.6500	4.36120 3.93244	0.090
PTT	18-30 31-43	60 40	36.6833 35.4500	7.62799 7.80844	0.435.
FIB	18-30 31-43	60 40	1.5685E2 1.6305E2	20.28594 18.20954	0.122

Table 4: The mean of PT and PTT and Fibrinogen according to stage of pregnancy.

Stage		N	Mean	Std. Deviation	P. value
PT	*First*	23	15.6957	4.94915	0.235
	Second	49	17.1224	3.86023	
	Third	28	16.1776	4.24311	
PTT	*First*	23	34.1739	5.81262	0.636
	Second	49	35.5714	7.71902	
	Third	28	38.9286	8.43682	
FIB	*First*	23	1.54432	20.73606	0.712
	Second	49	1.60802	20.26900	
	Third	28	160792	17.46819	

Table 5:The mean of PT and PTT and Fibrinogen level according to thenumber of pregnancy.

No	Mean of PT	Mean of PTT	Mean ofFibrinogen	P. v	P. v PTT	P. vFibrinogen
1	11.2	37	152.5	0.653	0.093	0.234
2	16.6	36.3	162			
3	16.8	35	156			
4	17	35.3	164.2			
5	16.5	38	160			
6	16	40.2	156.8			

4. Discussion

Pregnancy is a special physiological process, which can affect the coagulation and fibrinolytic system of pregnant women. Many studies have found that normal pregnancy results in enhanced coagulation, which is characterized by elevated levels of coagulation factors and inhibited fibrinolysis. A shift in hemostasis also happens in diabetes mellitus. These modifications affect the coagulation and fibrinolysis systems, as well as the blood platelets. Similar to when a woman is pregnant, coagulation processes rule out fibrinolytic action in diabetes. Because the examination of hemostasis in pregnant women with diabetes has not been thoroughly documented, we compared our study results with those of hemostatic problems in diabetic patients and with alterations seen in normal pregnancy. Measurement of PT, APTT, and Fibrinogen levels have benefit in detecting thrombosis which appears to complicate the diabetes mellitus, especially in a pregnant woman. Our data demonstrate a significant increase in the mean of the APTT in diabetic pregnant women when compared to the means of normal pregnant women with a (P.value 0.009), this findings contradict earlier studies by Elsharif in 2013 [14], and Suheyla in 2016 [15], which reported a decrease in the mean of the APTT in diabetic pregnant women. According to statistical analysis, there was no statistically significant difference between the mean of normal pregnant women and the fibrinogen levels in diabetic pregnant women, with (P.value 0.153). This result was also consistent with earlier studies conducted Elsharif in 2013 [14], Suheyla in 2016 [15], and Agata in 2007 [16]. Numerous publications have noted elevated levels of fibrinogen in type 1 and type 2 diabetic individuals with and without diabetic problems [17–21], this appears to be because pregnancy has more of an impact on fibrinogen than diabetes does. This lack of a "diabetic effect" on the levels of fibrinogen in pregnant diabetic women may be linked to the group's very good diabetes control.Additionally, statistical analysis of the study's findings revealed that the mean of PT and PTT in different ages of pregnant women showed insignificant decreases with P.value (0.090) and (0.435), respectively, while fibrinogen level showed insignificant variation with (P.value 0.122).The mean of the PT, PTT, and FIB at various stages of pregnancy showed insignificant variation. Also, the outcome's statistical analysis With P.value (0.653), (0.093) and (0.234), respectively, the mean of the PT and PTT and the fibrinogen level based on the number of pregnancies showed no statistically significant variance. In general, clinical testing for PT, APTT, and fibrinogen is reasonably priced and easily accessible. According to the findings of this study, pregnant diabetic patients, particularly those who are at high risk for thrombotic problems, may benefit from using enhanced PT,

APTT, and shortened fibrinogen levels as hemostatic measures. Further research into these markers may eventually lead to the development of screening methods for hypo- and hypercoagulable states that are relevant to diabetes and other clinical disorders.

5. Conclusion

In diabetic pregnant women, alterations in the levels of coagulation markers were seen. And the coagulation parameter ranges were reported, which can serve as a point of reference for medical professionals to more precisely monitor the coagulation and fibrinolytic system in pregnant diabetic patients.

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