

Coagulation Dynamics in Type 2 Diabetes Mellitus: Insights from PT and APTT Assessment

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Received: 26 Aug 2023 / Revised: 23 Oct 2023 / Accepted: 03 Dec 2023

ABSTRACT

Background: Diabetes mellitus is a global health concern associated with significant cardiovascular complications, particularly coronary artery disease. The hyperglycemic environment in diabetes contributes to increased thrombotic risks, affecting platelet reactivity, fibrinogen levels, thrombin formation, and fibrinolysis. Coagulation parameter assessments, such as prothrombin time (PT) and activated partial thromboplastin time (APTT), offer insights into potential coagulation impairments, aiding in preventing thromboembolic cardiovascular events.

Methods: A cross-sectional study involved 400 Type 2 diabetes mellitus patients above 35 with HbA1c levels >7 at SLN Medical College and Hospital, Koraput, Odisha. Exclusion criteria encompassed patients on anticoagulants, hepatic failure, coagulation disorders, malignancy, coronary artery disease, or cerebrovascular accidents. Collected data included fasting and postprandial blood sugars, HbA1c levels, PT, and APTT.

Results: Patients with diabetes for over 5 years exhibited a distinct coagulation profile, indicating a significant correlation between diabetes duration and coagulation dynamics. Poor glycemic control (HbA1c >9) was associated with shortened PT and APTT values, highlighting a link between hyperglycemia and altered coagulation parameters.

Conclusion: This study underscores the association between diabetes mellitus and altered coagulation profiles, emphasizing the importance of routine PT and APTT assessments. Effective glycemic control is not only pivotal in managing diabetes but also plays a crucial role in mitigating hypercoagulable states, preventing both micro and macrovascular complications.

Key-words: Type 2 diabetes, mellitus, Coagulation impairment, Prothrombin, Thromboplastin, Glycated Haemoglobin

INTRODUCTION

Diabetes mellitus is one frequent endocrine disorder that seriously jeopardises public health throughout the world. One of the main macrovascular effects of diabetes is cardiovascular disease, particularly coronary artery disease, for which people with diabetes have a two- to four-fold increased risk.^[1]

People with diabetes are more prone to thrombotic issues due to factors such reduced fibrinolysis, hyperfibrinogenemia, increased thrombin generation, and platelet hyperreactivity brought on by hyperglycemia. Persistent hyperglycemia caused by diabetes glycosylates essential clotting proteins such haemoglobin, fibrinogen, and prothrombin, leading to coagulopathies.^[2-5] APTT and prothrombin time (PT) can be used to identify the extrinsic and intrinsic coagulation pathways. An observable hypercoagulable state, indicated by shorter PT and APTT in diabetes mellitus, may contribute to the formation of occlusive thrombi in coronary arteries.^[6,7] This study aims to ascertain the significance of routinely measuring PT and APTT to

How to cite this article

Pati S, Mohapatra M, Das S, Sabat SK. Coagulation Dynamics in Type 2 Diabetes Mellitus: Insights from PT and APTT Assessment. SSR Inst Int J Life Sci., 2024; 10(1): 3606-3610.



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understand the coagulation anomalies linked to diabetes mellitus and maybe prevent thromboembolic cardiovascular events.

The goal of the research is to evaluate the coagulation profile in individuals with Type 2 diabetes, with a focus on prothrombin time (PT) and activated partial thromboplastin time (APTT).^[8-10] Additionally, it searches for connections between glycated haemoglobin (HbA1c), coagulation indicators, and the duration of diabetes. The findings of this study provide valuable insights into the coagulation dynamics in diabetes, which may lead to the development of more efficient preventive treatments against thromboembolic cardiovascular illnesses. The major objective of this study is to determine the significance of routinely measuring prothrombin time (PT) and activated partial thromboplastin time (APTT) in individuals with Type 2 diabetes mellitus. The aim is to understand the potential role that coagulation abnormalities associated with diabetes may have in developing thromboembolic cardiovascular issues.

MATERIALS AND METHODS

This research employs a cross-sectional study design conducted among 400 patients diagnosed with Type 2 diabetes mellitus. The study is conducted over one year at the General Medicine Outpatient Department in SLN Medical College and Hospital, Koraput, Odisha, India.

Data Collection- Data is collected from 400 eligible patients with Type 2 diabetes mellitus attending the General Medicine Outpatient Department at SLN Medical College and Hospital, Koraput, Odisha. The following investigations are conducted for each participant: Fasting blood sugar levels- Postprandial blood sugar levels - Glycated Hemoglobin (HbA1c) levels- Prothrombin time (PT) and activated partial thromboplastin time (APTT).

Outcome Measures- The tests are performed, and the results and outcomes are meticulously documented and analyzed. The investigation outcomes aim to provide insights into the coagulation profile of Type 2 diabetes mellitus patients, specifically focusing on PT and APTT. The data collected will be subjected to statistical analysis to identify any correlations between glycemic control (HbA1c levels) and the coagulation parameters and assess the overall coagulation status of the study population.

Inclusion Criteria

- Individuals diagnosed with Type 2 diabetes mellitus
- Age above 35 years
- HbA1c levels greater than 7

Exclusion Criteria

- Patients meeting any of the following criteria are excluded from the study:
- Individuals on anticoagulants.
- Patients with hepatic failure.
- History of coagulation disorders.
- Presence of malignancy, coronary artery disease, or cerebrovascular accidents.
- Clinical evidence of macrovascular and microvascular complications associated with diabetes mellitus.

Statistical Analysis- Descriptive statistics were used to summarise the characteristics of the research population, while inferential statistics may employ correlation analysis to examine correlations between variables.

Ethical Approval- The study adheres to ethical standards, ensuring patient confidentiality, privacy, and informed consent. Approval from the institutional ethics committee is obtained before commencing the study.

RESULTS

The study involved 400 patients who met the inclusion and exclusion criteria. Most of the participants were above 40 years of age. The duration of diabetes was categorized into two groups, and the distribution among the study participants is presented in Table 1.

Table 1: Distribution of patients based on duration of diabetes among study participants

Duration of diabetes	Number	Percentage (%)
1-5 years	280	70
> 5 years	120	30
Total	400	100

The HbA1c levels were assessed and categorized into two groups, and the distribution is given (Table 2).

Table 2: Distribution of patients based on HbA1c results among study participants

HBA1C	Number of patients	PER (%)
7-9	160	40
>9	240	60

The FBS levels were classified into three categories, and the distribution is presented (Table 3).

Table 3: Distribution of patients based on fasting blood sugar results among participants

FBS	NUMBER	PER (%)
>180 mg/dl	238	59.5
130-180mg/dl	122	30.5
<130mg/dl	40	10
TOTAL	400	100

The PPBS levels were categorized into two groups, and the distribution is given (Table 4).

Table 4: Distribution of patients based on Post Prandial Blood Sugar results

PPBS	NUMBER	PER (%)
>200mg/dl	338	84.5
<200mg/dl	62	15.5
Total	400	100

The PT and APTT values were assessed and classified into two categories, and the distribution (Table 5).

Table 5: Distribution of patients based on PT and APTT values

PT and APTT	Number	PER (%)
Normal	108	27
Low	292	73
Total	400	100

These statistical analyses highlight significant correlations between coagulation parameters (PT and APTT) and the duration of diabetes and HbA1c levels

(Table 6 & 7). The study provides valuable insights into coagulation impairment in Type 2 diabetes mellitus patients, emphasizing the importance of monitoring these parameters for preventive measures against thromboembolic cardiovascular events (Table 8 & 9).

Table 6: Difference in PT values between in duration of Diabetes

Duration of DM	Mean	S.D
1-5 years	10.4	1.3
>5 years	9.4	1.4

p-value=0.002, therefore study shows significant correlation between PT and duration of diabetes.

Table 7: Difference in PT values between HbA1c categories

HBA1C	Mean	S.D.
7-9	10.4	1.3
>9	9.3	0.8

p-value=0.001, therefore study shows significant correlation between PT and HBA1C

Table 8: Difference in APTT values between Duration of Diabetes

Duration of DM	Mean	S.D.
1-5 years	31.2	5.8
>5 years	20.7	4.4

p-value=0.003, therefore study shows significant correlation between APTT and duration of diabetes

Table 9: Difference in APTT values between HbA1c categories

HBA1C	Mean	S.D.
7-9	27.1	7.3
>9	19.4	1.6

p-value 0.001, therefore study shows significant correlation between APTT and HBA1C levels

DISCUSSION

Atherothrombotic disease emerges as a leading cause of morbidity and mortality in individuals with diabetes, marked by the synergy of metabolic and vascular abnormalities. Diabetes, recognized as an independent risk factor, significantly contributes to the development

of atherosclerosis—a primary culprit for macrovascular complications, escalating platelet activation, coagulation factor activation, and hypo-fibrinolysis, thereby heightening the risk of cardiovascular disease.^[11-14]

In this instance, coagulation equilibrium is largely maintained by naturally occurring anticoagulants like protein C and antithrombin III. However, non-enzymatic glycation of antithrombin III due to hyperglycemia in diabetes lowers its biological activity and, as a result, the concentration of protein C in the blood. When natural anticoagulants are not working effectively, clotting factors are activated, leading to hypercoagulability in Type 2 diabetes.^[15,16]

The study, which included 400 patients with diabetes, looked at the impact of the length of diabetes on the coagulation profile and found a significant correlation. Specifically, patients with diabetes for over 5 years exhibited distinct coagulation profile alterations, emphasizing the importance of disease duration in influencing coagulation dynamics. Furthermore, the study investigated the impact of glycemic control, as reflected in HbA1c levels, on the coagulation profile.^[17-20] Notably, patients with poor glycemic control, represented by HbA1c >9, exhibited shortened PT and APTT values, indicating a potential link between hyperglycemia and altered coagulation parameters. This observation aligns with similar studies emphasizing the association between glycemic control and coagulation profiles.

CONCLUSIONS

This study highlights the association between altered coagulation patterns and diabetes mellitus, particularly in individuals with HbA1c values ≥ 7 . This suggests a greater chance of thrombosis, as demonstrated by decreased PT and APTT. Routine PT and APTT tests are crucial for assessing coagulation impairment in diabetes mellitus and ultimately preventing thromboembolic cardiovascular diseases.

The findings underscore the importance of effective glucose regulation in the management of diabetes mellitus and in lowering the risk of hypercoagulable states, which subsequently averts the micro- and macrovascular complications associated with the disease.

CONTRIBUTION OF AUTHORS

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