COAGULATION PROFILE IN TYPE 2 DIABETES MELLITUS PATIENTS AND ITS CORRELATION WITH HBA1C

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ABSTRACT

Introduction: Diabetes mellitus is a widespread worldwide condition linked to heightened cardiovascular risk. Diabetic individuals often exhibit hypercoagulability, which increases the likelihood of developing thrombotic problems. **Aim:** The objective of the study is to evaluate the impact of coagulation dysfunction in individuals with type 2 diabetes mellitus (T2DM) by measuring routine prothrombin time (PT) and activated partial thromboplastin time (APTT). This assessment seeks to avoid the occurrence of thromboembolic cardiovascular disease (CVD). This study additionally investigates the correlation between coagulation markers, HbA1c levels, and the duration of diabetes. **Materials and Methods:** A cross-sectional study was performed on a sample of 100 individuals diagnosed with type 2 diabetes mellitus (T2DM) who were over the age of 35 and had a haemoglobin A1c (HbA1c) level more than 7%. PT, APTT, fasting blood glucose levels, post-prandial blood glucose levels, and HbA1c were assessed. The exclusion criteria encompassed the use of anticoagulants, hepatic insufficiency, coagulation problems, and cardiovascular disease. Information was gathered at a healthcare establishment for duration of one year. **Results:** The study comprised a cohort of 100 eligible patients diagnosed with type 2 diabetes mellitus (T2DM), predominantly aged 40 years or older. An analysis was conducted on the investigation outcomes pertaining to the patients. The study establishes a notable association between PT and the length of diabetes, PT and HBA1C, APTT and the duration of diabetes, APTT and HBA1C levels. **Conclusion:** The study emphasises that people with type 2 diabetes mellitus (T2DM) who have a haemoglobin A1c (HbA1c) level of 7 or higher show noticeable changes in blood clotting, indicating a higher risk of developing blood clots. Regular assessment of prothrombin time (PT) and activated partial thromboplastin time (APTT) is essential for evaluating coagulation dysfunction, which helps in the prevention of thromboembolic cardiovascular disease (CVD) in individuals with type 2 diabetes mellitus (T2DM). Glycemic management is important in managing hypercoagulability to reduce the risk of micro and macrovascular problems.

Keywords: *Type 2 diabetes mellitus, coagulation profile, HbA1c, thromboembolic cardiovascular disease, glycemic control.*

INTRODUCTION

DM is an intricate metabolic ailment. The countries with the highest prevalence of diabetic patients are India (31.7 million), followed by China (20.8 million) and the United States (17.7 million) [1]. According to recent estimations, the worldwide occurrence of Diabetes is projected to increase to 592 million by the year 2035 [2]. Diabetes mellitus (DM) is marked by persistent high blood sugar levels, leading to damage in several organs as a result of both microvascular and macrovascular consequences such as neuropathy, retinopathy, nephropathy, and others [3].

Cardiovascular disease is the most prevalent symptom of diabetic macrovascular complications. Diabetic individuals face a 2- to 4-fold higher likelihood of developing coronary artery disease. The incidence of microvascular problems in individuals with diabetes is frequently observed in those who have had the disease for a prolonged period, individuals with inadequate management of blood sugar levels, and when accompanied by other concurrent illnesses such as hypertension and obesity. The microvascular consequences including retinopathy, nephropathy, and neuropathy [4]. Diabetics have a higher likelihood of experiencing thrombotic problems, which can be attributed to elevated blood sugar levels causing increased platelet reactivity, higher levels of fibrinogen in the blood, enhanced production of thrombin, and slower breakdown of fibrin [5].

Thrombotic status assessment is not a standard practice for screening diabetic patients. Therefore, individuals typically seek medical attention when they experience issues following the exposure of their organs to the full impact of the disease. Despite the robust administration, the restoration of the impaired organs to their normal state is uncertain. Only a limited number of research have conducted comparisons of the coagulation profile among diabetic patients, specifically based on their HbA1c levels. However, these investigations have yielded conflicting or inconsistent results. In a study conducted by Arpaci D *et al*., it was found that there were no significant changes in PT, APTT, and fibrinogen levels between diabetic patients in the regulated group (HbA1c <7.0) and the dysregulated group (HbA1c ≥7.0) [6]. The study did not incorporate measurements of bleeding time, platelet count, and d-Dimer.

This study aimed to examine the coagulation profile patients with poorly controlled Type 2 DM (HbA1c ≥ 7.1). Additionally, the study sought to assess the relationship between the coagulation profile and glycemic control in diabetic patients.

MATERIALS & METHODS

This is a cross sectional study among 100 Type 2 diabetes mellitus patients attending General medicine outpatient department in Central India tertiary care hospital. Over a period of 6 months, All Type 2 Diabetes mellitus patients above 35 years with HbA1c > 7 were included in the study, while Patients on anticoagulants, hepatic failure, history of coagulation disorders, malignancy, coronary artery disease, cerebrovascular accident, clinical evidence of macro vascular and micro vascular complications of diabetes mellitus were excluded.

- FBS
- PPBS

- HBA1C
- PT and APTT

The tests were done and following results and out comes were seen.

RESULTS

The study population comprises 100 patients who met the specified inclusion and exclusion criteria. The majority of the cases were over 40 years of age. The results are presented based on the examinations conducted on the patients.

Table 1 Distribution of patients based on duration of diabetes

DURATIONOFDIABETES	NUMBER	PERCENTAGE
1-5YEARS	70	70%
>5 YEARS	30	30%
HBA1C		
7-9	40	40%
>9	60	60%
Fasting blood sugar (FBS)		
>180 mg/dl	60	60%
130-180mg/dl	30	30%
<130mg/dl	10	10%
Post Prandial Blood Sugar(PPBS)		
>200mg/dl	85	85%
<200mg/dl	15	15%
PT AND APTT		
NORMAL	27	27%
LOW	73	73%
TOTAL	200	100%

Table Differences in PT values based on the length of diabetes

DURATIONOFDM	MEAN	S.D
1-5YEARS	10.5	1.2
>5YEARS	9.3	1.3
HBA1C		
7-9	10.5	1.2
>9	9.2	0.9
DURATIONOFDM		
1-5YEARS	31.3	5.7
>5 YEARS	20.8	4.3
HBA1C		
7-9	27.2	7.2
>9	19.5	1.5

The study demonstrates a significant correlation between PT and the duration of diabetes, with a p-value of 0.002.
The study demonstrates a significant correlation between PT and HBA1C, with a p-value of 0.001.
The study demonstrates a significant association (p-value = 0.003) between APTT and the duration of diabetes.
The study demonstrates a significant correlation between APTT and HBA1C levels, with a p-value of 0.001.

DISCUSSION

Atherothrombotic disease, characterized by metabolic and vascular abnormalities, is the primary cause of morbidity and mortality in people with diabetes. Diabetes is regarded as an autonomous risk factor for the progression of atherosclerosis. Thus, atherosclerosis is the primary factor leading to macrovascular problems. It induces heightened platelet activation, activation of coagulation factors, and impaired fibrinolysis, all of which are strongly linked to an elevated risk of cardiovascular disease. There is no text provided.There is a suggestion that antithrombin III, a natural anticoagulant, prevents the activity of natural procoagulants. Furthermore, protein C deactivates factors Va and VIIIa. Hyperglycemia leads to the non-enzymatic glycation of antithrombin III, reducing its biological activity and directly lowering the concentration of protein C. Impaired function of natural anticoagulants leads to the activation of clotting factors and contributes to the development of hypercoagulability in type 2 diabetes mellitus (DM2).

A study was conducted to examine the impact of the duration of diabetes on the coagulation profile. Out of a total of 100 patients with diabetes, 30 patients had been diagnosed with diabetes for more than 5 years, while the remaining 70 patients had been diagnosed with diabetes for a length between 1 to 5 years. There is a notable association between the duration of diabetes and the developed coagulation profile. A study was conducted to analyze the HbA1c levels in diabetic patients with a coagulation profile. Out of a total of 100 patients, 60 individuals had HbA1c levels greater than 9, while 40 patients had HbA1c levels between 7 and 9. The statistical difference in the p-value was 0.001, which was determined to be significant.

The majority of patients with inadequate glucose control exhibited reduced PT and APTT levels. the findings of Abdulrahaman Y and Dallatu MK, where PT and APTT was increased in untreated diabetics when compared to that of treated diabetics. The increase in PT is due to the conversion of inactive factor VII to active factor VII which triggers the extrinsic pathway [8].

An investigation carried out in Egypt and Sudan revealed that there was no statistically significant distinction between individuals with type 2 diabetes mellitus (T2DM) and the control group in terms of their peripheral neuropathy (PT) status. The observed variation may be attributed to differences in sample size, variations in study design, and variations in the study population.Conversely, a study conducted in Nigeria revealed that PT levels were considerably higher in individuals with T2DM compared to the control group.Twenty-three The potential cause for this variance could be the existence of heightened amounts of in vitro coagulation inhibitors, such as D-dimer, thrombin-antithrombin complex, and prothrombin activation fragment.

CONCLUSION

The current investigation demonstrated significant changes in the coagulation profile among individuals with diabetes who had a HbA1c level of 7 or higher. Thus, it is possible that T2DM is associated with an elevated risk of thrombosis, as seen by decreased levels of PT and APTT. Patients with diabetes mellitus have an increased susceptibility to developing a hypercoagulable state, as indicated by the findings of this study. Regular assessments of PT (prothrombin time) and APTT (activated partial thromboplastin time) are crucial for evaluating coagulation dysfunction in individuals with diabetes mellitus (DM) to mitigate the risk of thromboembolic cardiovascular disease. The management of hypercoagulable state may play a preventative role in both micro and macrovascular problems in individuals with diabetes mellitus.

Emphasis should be placed on effectively controlling glycemic status, as this has a direct impact on the change of the coagulation profile.

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