ORIGINAL RESEARCH PAPER
Volume - 15 | Issue - 07 | July - 2026 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

ASSESSMENT OF COAGULATION PROFILE IN PATIENTS WITH THYROID DISORDERS

Pathology

Dr. Seema Kaur	Junior Resident , Department of Pathology
Dr. Vinay Sharma*	Assistant Professor, Department of Pathology*Corresponding Author
Dr. Permeet Kaur Bagga	Professor and Head, Department of Pathology
Dr. Pooja	Senior Resident, Department of Pathology
Dr. Jaspreet Singh	Professor, Department of Pathology
Dr. Mandeep Randhawa	Associate Professor, Department of Pathology
Dr. Sukhraj Kaur	Associate Professor, Department of Biochemistry
Dr. Saurabh Kumar Wadhwa	Senior Resident, Department of Pathology
Dr. Gurpreet Singh	Medical Officer, PCMS

ABSTRACT

Background: Thyroid hormones significantly influence the coagulation and fibrinolytic systems. Thyroid dysfunction may therefore predispose patients to bleeding or thrombotic complications. **Methodology:** This prospective observational study was conducted in the Department of Pathology, Government Medical College, Amritsar, from June 2024 to July 2025. A total of 100 participants aged ≥18 years were categorized into hypothyroid, subclinical hypothyroid, hyperthyroid, and euthyroid groups. Thyroid profile and coagulation parameters were analyzed using standard laboratory methods. **Results:** Among the study participants, 35 were hypothyroid, 15 subclinical hypothyroid, 30 hyperthyroid, and 20 euthyroid controls. Females constituted 82% of the study population. Hypothyroid patients demonstrated prolonged PT and aPTT values suggestive of hypocoagulability, whereas hyperthyroid patients showed hypercoagulable tendencies. **Conclusion:** Thyroid dysfunction significantly affects coagulation parameters. Routine coagulation assessment in thyroid disorder patients may facilitate early detection of hemostatic abnormalities and reduce complications

KEYWORDS

Thyroid, Coagulation, prothrombin, Hemostasis

INTRODUCTION

Thyroid disorders are among the most common endocrine diseases worldwide, affecting about 1–10% of adults. Their prevalence varies depending on factors such as geographic region, iodine intake, age, and gender.[1] Thyroid disorders are common endocrine conditions caused by either decreased or increased thyroid gland activity, leading to imbalance in thyroid hormone production. The thyroid gland produces the hormones triiodothyronine (T3) and thyroxine (T4), which regulate metabolism, energy balance, and overall hormonal function. Their secretion is controlled by thyroid-stimulating hormone (TSH) from the pituitary gland. In India, nearly one in ten people is affected by thyroid disease, with women aged 17–54 years being more commonly affected. Thyroid dysfunction may lead to complications such as hypertension, hypercholesterolemia, cardiovascular disease, infertility, and depression.[2] The association between thyroid dysfunction and hemostatic abnormalities has been recognized since the early 20th century. Evidence suggests that thyroid hormones have an important role in regulating coagulation and fibrinolytic systems.[3].Patients with thyroid disorders may show various abnormalities in coagulation and fibrinolysis, ranging from subclinical laboratory changes to significant hemostatic disorders, although major bleeding or thromboembolic events are relatively uncommon.[4] Thyroid dysfunction affects hemostasis through complex mechanisms. Thyroid hormones regulate the synthesis of several coagulation factors via their effects on liver and endothelial cells, while thyroid autoimmunity further alters secondary hemostasis. Hyperthyroidism is usually associated with a hypercoagulable, hypofibrinolytic state, whereas the hemostatic changes in hypothyroidism vary according to disease severity.[5]

The coagulation pathway is a regulated process that maintains hemostasis by forming blood clots after vascular injury. It consists of intrinsic and extrinsic pathways, which converge into a common pathway leading to the conversion of fibrinogen into fibrin. Hemostasis occurs in two stages: primary hemostasis, involving platelet aggregation and temporary plug formation, and secondary hemostasis, where coagulation pathways generate fibrin to stabilize the platelet plug.[6,7] Coagulation maintains hemostasis through intrinsic, extrinsic, and common pathways involving various clotting factors. Most factors circulate as inactive zymogens and are activated sequentially to form fibrin. The intrinsic pathway is triggered by exposed endothelial collagen, while the extrinsic pathway is initiated by tissue factor released after vascular injury.[8,9] According to the current concept of coagulation, the intrinsic pathway mainly amplifies thrombin generation initiated by the extrinsic pathway. Coagulation begins when tissue factor (TF) binds factor VIIa, activating factors IX and X, which leads to thrombin formation. The TF–VIIa complex also links the extrinsic and intrinsic pathways. [10.]

Amplification phase: Thrombin activates factors V and VIII, enhancing thrombin generation through positive feedback.

Propagation phase: These enzyme complexes on platelet surfaces produce large amounts of thrombin, leading to fibrin formation and clot development.

Stabilization phase: Thrombin activates factor XIII, which stabilizes fibrin, and TAFI, which protects the clot from fibrinolysis.

In hypothyroidism, the hemostatic profile varies with disease severity, with overt cases showing a hypocoagulable state and increased bleeding tendency.Patients may show prolonged bleeding time, PT, and aPTT with decreased coagulation factors.[11]

Hyperthyroidism is associated with a prothrombotic state due to increased levels of coagulation factors (VIII, IX, vWF, fibrinogen, and PAI-1) and reduced fibrinolytic activity. This leads to shortened aPTT and a sustained hypercoagulable state. Clinically, it is linked to a higher risk of venous thromboembolism, including DVT, pulmonary embolism, and cerebral venous sinus thrombosis.[12,13]

Methodology

This single-center, hospital-based, prospective study was conducted over a period of one year (June 2024 to July 2025) in the Department of Pathology at a tertiary care center in north India.

A total of 100 participants aged ≥18 years with clinical features suggestive of thyroid dysfunction or palpable goiter were enrolled.

Exclusion criteria included pregnancy, chronic liver disease, malignancy, anticoagulant therapy, diabetes mellitus, hypertension, smoking, alcohol use, and known bleeding disorders.

Blood samples were collected under aseptic precautions. Thyroid profile including T3, T4, and TSH was measured using chemiluminescent microparticle immunoassay. Coagulation profile including PT, INR, and aPTT was analyzed using citrate-anticoagulated plasma.

Statistical analysis was performed using descriptive and inferential statistical methods. A p-value <0.05 was considered statistically significant.

Ethical Approval

Was obtained from the Institutional Ethics Committee (approval number:40795/D-26/2025). . Written informed consent was secured from all participants. Patient confidentiality was maintained throughout the study.

Data Analysis:

Data were recorded in Microsoft Excel and analyzed using IBM SPSS Statistics for Windows, Version 28. Categorical variables were expressed as percentages. Statistical comparisons were made using Chi-square tests, and correlations between cytological and histological grades were assessed using Pearson's correlation coefficient. A p-value < 0.05 was considered statistically significan

Observations and results

A total of 100 participants aged ≥18 years with clinical features suggestive of thyroid dysfunction or palpable goiter were enrolled between June 2024 and July 2025

TABLE NO. 12: DISTRIBUTION OF STUDY PARTICIPANTS BASED ON aPTT

aPTT		DIAGNOSIS				Total
		Hypothyroid	Subclinical hypothyroidism	Hyperthyroid	Euthyroid	
BELOW NORMAL	NUMBER	8	4	12	6	30
	%AGE	22.9%	26.7%	40.0%	30.0%	30.0%
NORMAL	NUMBER	7	4	7	5	23
	%AGE	20.0%	26.7%	23.3%	25.0%	23.0%
ABOVE NORMAL	NUMBER	20	7	11	9	47
	%AGE	57.1%	46.7%	36.7%	45.0%	47.0%
TOTAL	NUMBER	35	15	30	20	100
	%AGE	100.0%	100.0%	100.0%	100.0 %	100.0 %

Abnormal aPTT values were observed in 77% of participants, with prolonged aPTT being most common (47%). Prolonged aPTT was predominantly seen in hypothyroid (57.1%) and subclinical hypothyroid (46.7%) patients, whereas shortened aPTT was more frequent in hyperthyroid patients (40.0%). The association between aPTT and thyroid status was statistically significant (p = 0.038).

TABLE NO. 14: DISTRIBUTION OF STUDY PARTICIPANTS BASED ON PT

PT		DIAGNOSIS				Total
		Hypothyroid	Subclinical hypothyroidism	Hyperthyroid	Euthyroid	
BELOW NORMAL	NUMBER	5	3	4	2	14
	%AGE	14.3%	20.0%	13.3%	10.0%	14.0%
NORMAL	NUMBER	14	7	15	10	46
	%AGE	40.0%	46.7%	50.0%	50.0%	46.0%
ABOVE NORMAL	NUMBER	16	5	11	8	40
	%AGE	45.7%	33.3%	36.7%	40.0%	40.0%
TOTAL	NUMBER	35	15	30	20	100
	%AGE	100.0%	100.0%	100.0%	100.0%	100.0

PT abnormalities were observed in 54% of participants, with prolonged PT being the most common abnormality (40%). Prolonged PT was most frequent among hypothyroid patients (45.7%), while normal PT predominated in subclinical hypothyroid, hyperthyroid, and euthyroid groups. A significant association was found between PT and thyroid status (p = 0.041).

TABLE NO. 16: DISTRIBUTION OF STUDY PARTICIPANTS BASED ON INR

INR		DIAGNOSIS				Total
		Hypothyroid	Subclinical hypothyroidism	Hyperthyroid	Euthyroid	
NORMAL	NUMBER	18	10	20	13	61
	%AGE	51.4%	66.7%	66.7%	65.0%	61.0%
ABOVE NORMAL	NUMBER	17	5	10	7	39
	%AGE	48.6%	33.3%	33.3%	35.0%	39.0%
TOTAL	NUMBER	35	15	30	20	100
	%AGE	100.0%	100.0%	100.0%	100.0%	100.0%

INR was elevated in 39% of participants and was most commonly observed in hypothyroid patients (48.6%). Normal INR predominated in the subclinical hypothyroid, hyperthyroid, and euthyroid groups. A significant association was found between INR and thyroid status (p = 0.044).

DISCUSSION

This prospective study included 100 adults (≥18 years) attending Government Medical College, Amritsar, with symptoms suggestive of thyroid dysfunction or palpable goiter and no evident bleeding disorder. Thyroid profile (T3, T4, and TSH) and coagulation parameters (PT, INR, and aPTT) were assessed to evaluate the relationship between thyroid dysfunction and coagulation abnormalities. Based on thyroid function tests, participants were categorized as hypothyroid (n=35), subclinical hypothyroid (n=15), hyperthyroid (n=30), or euthyroid (n=20).

aPTT abnormalities were common in the study population, with prolonged aPTT observed in 47% of participants and a significant association between aPTT and thyroid status (p = 0.038). Hypothyroid patients had the highest mean aPTT (38.26 ± 7.67 s), while hyperthyroid patients had the lowest (31.83 ± 5.42 s). The difference between hypothyroid and hyperthyroid groups was statistically significant (p < 0.001), suggesting a relative hypercoagulable state in hypothyroidism and a hypercoagulable tendency in hyperthyroidism. These findings are consistent with previous studies by Mohamed Ahmed KA et al.[14], Lippi G et al.[15], and Hoffmann MA et al.[16], which reported prolonged aPTT in hypothyroidism and shortened aPTT in hyperthyroidism, likely reflecting the effects of thyroid hormones on coagulation factors, particularly factor VIII and von Willebrand factor. Prothrombin time was significantly higher in hypothyroid patients in study by Pratap N et al[17], similar to findings of present study. Studies by Gullu S et al [18] and Gao F et al[19] showed that patients with severe hypothyroidism displayed a bleeding tendency as reflected by higher levels of PTT, PT, and INR. Another study by Erem C et al[8] evaluating coagulation parameters in thyroid dysfunction found that patients with hypothyroidism showed prolongation of certain coagulation parameters and alterations in hemostatic balance. These results further support the finding of increased PT among hypothyroid individuals in the present study.

INR was prolonged in 39% of participants, with the highest mean values seen in hyperthyroid patients (1.185 ± 0.260). However, differences in mean INR across thyroid groups were not statistically significant (p = 0.062). These findings suggest only mild variations in INR with thyroid dysfunction, likely due to multifactorial influences on coagulation. INR levels also showed no significant difference between cases and the control group in study by Mohamedahmed KA et al.[14] 66% showed normal INR and 34% showed prolonged INR.

CONCLUSION

Thyroid dysfunction significantly influences coagulation parameters and hemostatic balance. Hypothyroidism was associated with prolonged PT and APTT, indicating a bleeding tendency, while

hyperthyroidism showed shortened coagulation times and higher platelet counts, suggesting a prothrombotic state. These findings highlight the importance of coagulation assessment in patients with thyroid disorders for early detection and management of hemostatic complications.

Conflict of Interest: NIL
Fundings: NIL

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