Research Article

Early Hemostatic Screening in Hyperthyroidism: A Comparative Study of Coagulation Parameters in Hyperthyroid and Euthyroid Adults

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Abstract

Objective: Thyroid hormones interact closely with coagulation and fibrinolytic systems. However, coagulation testing is not routinely included in thyroid evaluations. This study compared coagulation parameters between adults with hyperthyroidism and euthyroid controls and assessed correlations between thyroid hormone levels and these parameters to evaluate the rationale for early hemostatic screening in hyperthyroidism.

Methods: This comparative, cross-sectional study included 200 adults divided into two groups of 100: euthyroid controls and patients with hyperthyroidism, classified according to serum thyroid-stimulating hormone (TSH), triiodothyronine (T3), and thyroxine (T4) levels. Prothrombin time (PT) activated partial thromboplastin time (aPTT), plasma fibrinogen, and plasma D-dimer were measured and compared between groups using the independent-samples t-test. Associations between thyroid hormones and coagulation markers were evaluated using Pearson correlation analysis.

Results: Significant differences were observed between the hyperthyroid and control groups for all coagulation markers studied ($p<0.001$). The hyperthyroid group exhibited a shorter aPTT (28.4±7.0 s vs. 32.0±3.1 s), a shorter PT (10.5±0.6 s vs. 12.1±0.5 s), higher plasma fibrinogen (375.0±79.4 mg/dL vs. 270.0±47.2 mg/dL), and substantially higher plasma D-dimer (500.5±241.2 ng/mL vs. 137.1±71.7 ng/mL) compared to controls. Correlations between individual thyroid hormones and coagulation markers were generally weak, except for a strong positive correlation between TSH and fibrinogen in the hyperthyroid group ($r=0.999$, $p<0.001$).

Conclusion: Hyperthyroidism is associated with a distinct coagulation profile compared to euthyroid individuals, characterized by shortened aPTT and PT, as well as elevated fibrinogen and D-dimer levels, indicating a hypercoagulable and relatively hypofibrinolytic state. These findings support the inclusion of basic coagulation screening in the routine clinical evaluation of hyperthyroid patients, especially prior to invasive or surgical procedures.

Keywords: Hyperthyroidism; Blood Coagulation Tests; Fibrinogen; D-dimer; Thyroid Function Tests; Prothrombin Time.

Introduction

Thyroid hormones exert widespread effects on multiple organ systems, and their influence on hemostasis has been increasingly recognized over the past three decades. Hyperthyroidism, characterized by excess circulating triiodothyronine (T3) and thyroxine (T4), has been reported to induce a relatively hypercoagulable and hypofibrinolytic state [1,2]. Proposed mechanisms include thyroid hormone–mediated upregulation of hepatic synthesis of coagulation factors, which together shift the hemostatic balance towards thrombosis. Clinically, this has translated into epidemiological associations between overt hyperthyroidism and an increased risk of venous thromboembolic events, atrial-fibrillation-related thromboembolism, and, in some reports, arterial thrombotic complications [2].

Despite this body of evidence, coagulation testing is not routinely incorporated into the clinical evaluation of patients with thyroid dysfunction. This gap is of practical importance because many hyperthyroid patients eventually undergo invasive procedures, thyroidectomy, radioiodine-related interventions, or unrelated surgery, during which an unrecognized prothrombotic or bleeding tendency could materially affect outcomes.

The objective of this study was to compare prothrombin time, activated partial thromboplastin time, plasma fibrinogen, and plasma D-dimer between adults with hyperthyroidism and those with normal thyroid function. Additionally, the study aimed to examine correlations between thyroid hormone levels and these coagulation markers to assess the rationale for early hemostatic screening in hyperthyroidism.

Materials and Methods

This investigation employed a comparative, cross-sectional design and was undertaken at a tertiary care hospital in Kerala, India. Study participants were recruited based on their thyroid function profiles and stratified into two cohorts of 100 each: euthyroid controls and patients newly diagnosed with hyperthyroidism. Exclusion criteria comprised current use of anticoagulant or antiplatelet agents, a documented history of bleeding or thrombotic disorders, pregnancy, and the presence of hepatic, renal, or other endocrine pathology with the potential to confound coagulation parameters.

Following informed consent, venous blood specimens were obtained for the assessment of TSH, T3, T4, PT, aPTT, plasma fibrinogen, and plasma D-dimer using standard laboratory techniques. Statistical analysis was performed using SPSS (Version 29), and continuous variables were reported as mean ± standard deviation. The normality of data distribution was evaluated using the Kolmogorov–Smirnov test, and intergroup comparisons of continuous variables were conducted using the independent-samples t-test. The chi-square test was applied to examine sex distribution between groups, and Pearson correlation coefficients were computed to explore associations between thyroid hormone levels and coagulation markers within each cohort. Statistical significance was set at $p<0.05$.

Results

The two groups were broadly comparable in age and sex distribution (Table 1). Thyroid hormone profiles confirmed clear biochemical separation between the groups, with markedly suppressed TSH and elevated T3 and T4 in the hyperthyroid cohort (Table 2, all $p<0.001$).

Table 1. Demographic characteristics of the control and hyperthyroid groups.

Age, years (mean±SD)	31.30±7.97	32.06±7.58
Male, n (%)	38 (38.0)	33 (33.0)
Female, n (%)	62 (62.0)	67 (67.0)

Table 2. Thyroid hormone profile of the control and hyperthyroid groups (all comparisons p<0.001).

TSH, mIU/L	2.101±0.802	0.040±0.020
Triiodothyronine (T3), ng/mL	1.499±0.251	3.799±0.901
Thyroxine (T4), µg/dL	8.000±1.206	16.527±2.768

All coagulation parameters differ significantly between the groups (Table 3). Compared to controls, the hyperthyroid group demonstrated shorter aPTT and PT, as well as substantially higher fibrinogen and D-dimer levels, consistent with a hypercoagulable and relatively hypofibrinolytic state.

Table 3. Coagulation and hemostatic parameters in the control and hyperthyroid groups (independent-samples t-test).

Prothrombin time, s	12.100±0.462	10.500±0.603	<0.001
Activated partial thromboplastin time, s	32.000±3.116	28.400±7.035	<0.001
Fibrinogen, mg/dL	270.001±47.235	375.003±79.403	<0.001

D-dimer, ng/mL	137.081±71.685	500.503±241.202	<0.001

Correlations between individual thyroid hormones and coagulation markers were generally weak. In the control group, the strongest correlation was observed between T4 and aPTT (r=0.209, p=0.037). In the hyperthyroid group, a strong positive correlation was identified between TSH and fibrinogen (r=0.999, p<0.001), indicating a close biochemical association between thyroid axis suppression and the acute-phase or procoagulant response in this cohort (Table 4).

Table 4. Principal correlations between thyroid hormone levels and coagulation markers, by group.

Control	Thyroxine (T4) – aPTT	0.209	0.037
Hyperthyroidism	TSH – Fibrinogen	0.999	<0.001

Discussion

The present findings are consistent with the broader literature indicating that hyperthyroidism shifts the hemostatic balance toward a hypercoagulable and relatively hypofibrinolytic state [1,2] The shortening of aPTT and, in this cohort, PT, supports the concept of accelerated coagulation cascade activity in thyrotoxicosis. However, this finding has not been uniform across all studies, possibly reflecting differences in disease severity, duration of thyrotoxicosis, and assay methodology [9].

Elevated fibrinogen levels, a consistent finding across multiple studies, further support a prothrombotic tendency, since fibrinogen serves both as a coagulation substrate and as an acute-phase reactant that may be independently upregulated by excess thyroid hormone [6,8]. Elevated D-dimer levels in hyperthyroid subjects, as observed in the present cohort, have similarly been reported by several independent groups [3,4,5], reinforcing the concept of enhanced fibrin turnover accompanying the prothrombotic state. Correspondingly, elevated fibrinogen has been a recurrent observation across cross-sectional and prospective cohorts of hyperthyroid patients [6,7,8].

These hemostatic alterations carry clinically meaningful implications. Patients with overt hyperthyroidism, particularly those with coexisting atrial fibrillation, a well-recognized complication of thyrotoxicosis, may face compounded thromboembolic risk, warranting closer monitoring and possibly individualized consideration of thromboprophylaxis. Beyond thrombotic risk, abnormal coagulation parameters identified before surgery, radioiodine-related procedures, or other invasive interventions could meaningfully alter perioperative management, supporting a role for basic hemostatic screening as part of the routine work-up of newly diagnosed hyperthyroid patients rather than testing reserved for symptomatic or high-risk cases alone.

In conclusion, hyperthyroidism appears to induce a measurable shift toward a hypercoagulable, hypofibrinolytic hemostatic profile, mediated through multiple interacting mechanisms. Recognition of these changes is clinically relevant for clinicians managing hyperthyroid patients, particularly for thromboembolic risk assessment and perioperative planning.

Limitations

This study has several limitations. Its cross-sectional design does not allow assessment of whether coagulation parameters normalize once euthyroidism is restored. Coagulation factor assays such as factor VIII and von Willebrand factor, which have shown particularly consistent associations with thyroid status in the literature [10,11,12], were not measured here. The study population consisted exclusively of adults; because thyroid abnormalities and their hemostatic consequences also occur in adolescents, with equally relevant perioperative and bleeding-risk implications, dedicated studies in adolescent hyperthyroidism would extend the clinical relevance of these findings to paediatric and adolescent endocrine practice.

Conclusion

Hyperthyroidism was associated with a significantly shortened aPTT, shortened PT, and higher plasma fibrinogen and D-dimer than in euthyroid controls, consistent with a hypercoagulable, relatively hypofibrinolytic state. These findings provide a biological and clinical rationale for incorporating basic coagulation screening, comprising aPTT, PT, fibrinogen, and D-dimer, into the routine evaluation of patients with hyperthyroidism, particularly before surgery or other invasive procedures, so that an unrecognized thrombotic tendency is not missed.

Conflict of Interest

The authors declare no conflicts of interest. The authors received no financial support or other benefits that could have influenced the conduct or reporting of this study.

Ethical Declarations

Ethical approval for the study was obtained from the Institutional Ethics Committee, and all procedures were conducted in compliance with the Declaration of Helsinki.

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