Research Article

Impact Of Hypothyroidism On Coagulation Parameters, Implications For Early Hemostatic Screening

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Abstract

Objective: Thyroid hormones interact closely with the coagulation and fibrinolytic systems, yet coagulation testing is not part of routine hypothyroidism work-up. This study compared coagulation parameters between people with hypothyroidism and people with normal thyroid function, and examined whether thyroid hormone levels correlate with these parameters, to build the case for coagulation screening in hypothyroidism.
Methods: In this comparative study, 200 adults were allocated to two groups of 100 each: euthyroid controls and patients with hypothyroidism, based on serum thyroid-stimulating hormone, triiodothyronine, and thyroxine levels. Prothrombin time, activated partial thromboplastin time, 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 assessed with Pearson correlation.
Results: The hypothyroid and control groups differed significantly in every coagulation marker studied ($p<0.001$). The hypothyroid group showed a longer activated partial thromboplastin time (43.0±7.3 seconds versus 32.0±3.1 seconds in controls), a shorter prothrombin time (10.7±0.6 seconds versus 12.1±0.5 seconds in controls), a lower plasma fibrinogen (233.0±47.7 mg/dL versus 270.0±47.2 mg/dL), and a higher plasma D-dimer than controls. Correlation between individual thyroid hormones and coagulation markers was generally weak, except for a strong positive correlation between thyroid-stimulating hormone and fibrinogen within the hypothyroid group ($r=0.999$, $p<0.001$).
Conclusion: Hypothyroidism is associated with a distinct coagulation profile relative to euthyroid individuals, most notably a longer activated partial thromboplastin time and lower fibrinogen, consistent with a hypo-coagulable tendency, alongside a shorter prothrombin time. These findings support incorporating basic coagulation screening into the clinical evaluation of hypothyroid patients, particularly before invasive or surgical procedures.

Keywords: Hypothyroidism; Blood Coagulation Tests; Fibrinogen; Thyroid Function Tests; Prothrombin Time.

Introduction

Hypothyroidism alters hemostasis mainly by reducing procoagulant and platelet-related activity, so overt disease tends to produce a hypocoagulable,bleeding-prone state. The most important mechanism is acquired von Willebrand syndrome, with additional reductions in platelet function, coagulation factors and other fibrinolytic proteins[1].Hypothyroidism has been associated with a hypocoagulable, hyperfibrinolytic tendency and an increased risk of bleeding compared with euthyroid individuals, particularly in the perioperative setting or during invasive procedures[2].Despite this recognised association, coagulation tests such as prothrombin time, activated partial thromboplastin time, and fibrinogen are not routinely included in the clinical evaluation of patients with hypothyroidism in most settings. Moreover, reported abnormalities in coagulation parameters have been inconsistent across studies, likely reflecting differences in disease severity, sample size, study design, and the specific hemostatic markers assessed. [3].Clarifying this relationship in a well-defined comparative sample is therefore useful, both to strengthen the biological argument for the association and to inform whether basic coagulation screening deserves a place in the routine care of hypothyroid patients.
The objective of the present study was to compare prothrombin time, activated partial thromboplastin time, plasma fibrinogen, and plasma D-dimer between people with hypothyroidism and people with normal thyroid function, and to examine the correlation between thyroid hormone levels and these coagulation markers, to evaluate the rationale for coagulation screening in hypothyroidism.

Methods

This was a comparative, cross-sectional study conducted at a tertiary care hospital in Kerala. Patients were selected based on thyroid function test results and enrolled in two groups of one hundred each, comprising euthyroid controls and patients with hypothyroidism. Individuals on anticoagulant or antiplatelet therapy, those with known bleeding or thrombotic disorders, pregnant women, and those with hepatic, renal, or other endocrine diseases likely to affect coagulation were excluded.

After informed consent, venous blood samples were collected for estimation of thyroid-stimulating hormone, triiodothyronine, thyroxine, prothrombin time, activated partial thromboplastin time, plasma fibrinogen, and plasma D-dimer, using standard laboratory assays. Data were analysed using SPSS Version 29. Continuous variables are expressed as mean ± standard deviation. The Kolmogorov–Smirnov test was used to assess normality of distribution. The independent-samples t-test was used to compare continuous variables between the two groups. The chi-square test was used for sex distribution, and Pearson correlation coefficients were calculated between thyroid hormones and coagulation markers within each group. A p-value below 0.05 was considered statistically significant.

Results

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

Variable	Control (n=100)	Hypothyroidism (n=100)
Age, years (mean±SD)	31.30±7.97	35.98±10.91
Male, n (%)	38 (38.0)	27 (27.0)
Female, n (%)	62 (62.0)	73 (73.0)

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

Hormone (mean±SD)	Control	Hypothyroidism
Thyroid-stimulating hormone, mIU/L	2.101±0.802	12.500±4.523
Triiodothyronine, ng/mL	1.499±0.251	0.900±0.251
Thyroxine, µg/dL	8.000±1.206	4.200±1.105

Table 3. Coagulation and haemostatic parameters in the control and hypothyroid groups (independent-samples t-test, all p<0.001).

Marker (mean±SD)	Control	Hypothyroidism	p-value
Prothrombin time, s	12.100±0.462	10.700±0.623	<0.001
Activated partial thromboplastin time, s	32.000±3.116	43.000±7.336	<0.001
Fibrinogen, mg/dL	270.001±47.235	233.031±47.733	<0.001
D-dimer, ng/mL	137.081±71.685	241.208±135.231	<0.001

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

Group	Strongest correlation observed	r	p-value
Control	Thyroxine – activated partial thromboplastin time	0.209	0.037

Group	Strongest correlation observed	r	p-value
Hypothyroidism	Thyroid-stimulating hormone – fibrinogen	0.999	<0.001

Discussion

The main finding of this study is that hypothyroidism carries a coagulation profile distinct from that of euthyroid individuals, a markedly longer activated partial thromboplastin time and a lower plasma fibrinogen, alongside a shorter prothrombin time. The activated partial thromboplastin time and fibrinogen changes are consistent with previous reports describing a hypocoagulable, bleeding-prone tendency in hypothyroidism[4]. The reduced hepatic synthesis of clotting factors and von Willebrand factor that accompanies thyroid hormone deficiency offers a plausible biological explanation for these findings[5]. The shortened prothrombin time runs against the more commonly reported prothrombin time prolongation in hypothyroidism and may reflect cohort-specific factors. These findings merit confirmation and should be interpreted cautiously.

The activated partial thromboplastin time result is clinically the most relevant. A mean prolongation relative to controls is large enough to be noticed on a routine coagulation panel and in an individual patient, could signal an increased risk of bleeding during surgery, dental extraction, or other invasive procedures. Because hypothyroidism is common, often insidious in onset, and frequently unrecognised before elective procedures, a coagulation screen that includes activated partial thromboplastin time and fibrinogen, interpreted along with prothrombin time, is a low-cost way to identify patients who may benefit from optimisation of thyroid status or closer perioperative monitoring, before such procedures[6].

The correlation analysis reveals, within the hypothyroid group, only thyroid-stimulating hormone showed a strong relationship with fibrinogen, while triiodothyronine and thyroxine did not correlate significantly with any of the four markers studied. This suggests that group-level classification of thyroid status, rather than a single hormone value, may be more informative for anticipating coagulation changes in clinical practice.bers et al. (2018), Kristensen et al. (2022), Chadarevian et al. (2001), and Rogers et al. (2023) collectively show that hypothyroidism produces normal to prolonged PT, prolonged aPTT, low fibrinogen, and elevated D-dimer, a hypocoagulable, hyperfibrinolytic state that tracks with severity of thyroid failure

Limitations

Its cross-sectional design does not allow assessment of whether coagulation parameters normalise once euthyroidism is restored. The hypothyroid group was, on average, older than the control group, and age was not adjusted for in the group comparisons. Coagulation factor assays (such as factor VIII and von Willebrand factor), which have shown particularly consistent associations with thyroid status in the literature, were not measured here. The study population consisted of adults. Because thyroid abnormalities and their haemostatic consequences also occur in adolescents, with equally relevant perioperative and bleeding-risk implications, dedicated studies in adolescent hypothyroidism would extend the clinical relevance of these findings to paediatric and adolescent endocrine practice.

Conclusion

Hypothyroidism was associated with a significantly prolonged activated partial thromboplastin time and lower plasma fibrinogen than in euthyroid controls, alongside a shorter prothrombin time. These findings provide a biological and clinical rationale for including basic coagulation screening, which includes activated partial thromboplastin time, prothrombin time, fibrinogen levels, and D-dimer, in the routine evaluation of patients with hypothyroidism, particularly before surgery or other invasive procedures, so that an unrecognised bleeding 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.

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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References

1. Ordookhani A, Burman KD. Hemostasis in Hypothyroidism and Autoimmune Thyroid Disorders. Int J Endocrinol Metab. 2017 Mar 9;In press(In press). doi:10.5812/ijem.42649
2. Tsotsolis S, Kenanidis E, Pegios VF, Potoupnis M, Tsiridis E. Is thyroid disease associated with post-operative complications after total joint arthroplasty? A systematic review of the literature. EFORT Open Rev. 2023 Feb 1;8(2):54–62. doi:10.1530/EOR-22-0085
3. Gao F. Variation Tendency of Coagulation Parameters in Different Hypothyroidism Stages. Acta Endocrinol Buchar. 2016;12(4):450–4. doi:10.4183/aeb.2016.450
4. Ordookhani A, Burman KD. Hemostasis in Hypothyroidism and Autoimmune Thyroid Disorders. Int J Endocrinol Metab. 2017 Mar 9;In press(In press). doi:10.5812/ijem.42649
5. Federici A. Acquired von Willebrand Syndrome Associated with Hypothyroidism: A Mild Bleeding Disorder to Be Further Investigated. Semin Thromb Hemost. 2011 Feb;37(01):035–40. doi:10.1055/s-0030-1270069
6. Gao F. Variation Tendency of Coagulation Parameters in Different Hypothyroidism Stages. Acta Endocrinol Buchar. 2016;12(4):450–4. doi:10.4183/aeb.2016.450
7. Xu Q, Wang Y, Shen X, Zhang Y, Fan Q, Zhang W. The Effect of Subclinical Hypothyroidism on Coagulation and fibrinolysis: A Systematic Review and Meta-Analysis. Front Endocrinol. 2022 Apr 29;13:861746. doi:10.3389/fendo.2022.861746
8. Atia YA, Mohammed ST, Abdullah SS, Abbas AS, Fawzi HA. Effects of subclinical hypothyroidism in type II diabetes mellitus patients on biochemical, coagulation, and fibrinolysis status. J Adv Pharm Technol Res. 2024 Apr;15(2):130–4. doi:10.4103/JAPTR.JAPTR_89_24
9. Chadarevian R, Jublanc C, Bruckert E, Giral P, Ankri A, Leenhardt L, et al. Effect of levothyroxine replacement therapy on coagulation and fibrinolysis in severe hypothyroidism. J Endocrinol Invest. 2005 Jul;28(7):398–404. doi:10.1007/BF03347217