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Cardiac Manifestations of Hyperthyroidism: Clinical, Echocardiographic Profile and Outcomes in 150 Patients

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Abstract | **Original Research Article**

Background: Hyperthyroidism exerts profound cardiovascular effects through positive inotropic and chronotropic actions. The 'thyroid heart' encompassing sinus tachycardia, atrial fibrillation (AF), and high-output heart failure requires early multidisciplinary management. ***Methods:*** Retrospective, observational, single-centre study (STROBE-compliant) of 150 adults with confirmed hyperthyroidism and at least one cardiac manifestation, January 2020 – December 2023. Demographics, aetiology, ECG, echocardiographic, and therapeutic data collected. Multivariable logistic regression identified predictors of AF non-reversion to sinus rhythm after euthyroidism. ***Results:*** Cardiac complications documented in 117 patients (78%). Mean age 45.2±12.5 years; 71% female; Graves' disease leading aetiology (72%). Sinus tachycardia present in 60%; AF in 28% (n=42), mean ventricular rate 128±22 bpm. Echocardiography revealed hyperdynamic left ventricle (LVEF 68±5%) in 65% and diastolic dysfunction in 45%. After euthyroidism, spontaneous sinus rhythm reversion occurred in 64% of AF patients. Independent predictors of AF non-reversion: AF duration >3 months (OR 3.8; 95%CI 1.6–9.2; p=0.003), age >55 years (OR 2.9; 95%CI 1.2–7.1; p=0.018), and left atrial enlargement (LAVi >34 mL/m²; OR 2.4; 95% CI 1.1–5.3; p=0.031). ***Conclusions:*** The thyroid heart is dominated by tachyarrhythmias and high-output heart failure. Spontaneous AF reversion after euthyroidism occurs in 64%, guided by duration, age, and atrial enlargement. Systematic ECG and echocardiographic evaluation at diagnosis and urgent euthyroidism restoration are essential.

Keywords: Hyperthyroidism; Thyroid heart; Atrial fibrillation; Graves' disease; High-output heart failure; Echocardiography; Diastolic dysfunction; Sinus rhythm reversion.

1. BACKGROUND

Hyperthyroidism affects 1–2% of the general population and is among the most common endocrine disorders worldwide [1]. Its cardiovascular consequences collectively termed the 'thyroid heart' arise from the direct genomic actions of triiodothyronine (T3) on cardiomyocytes: upregulation of SERCA2 expression and myocardial β1-adrenergic receptors increases contractility and diastolic relaxation, while downregulation of phospholamban creates catecholaminergic hypersensitivity [2]. Concurrently, systemic arteriolar vasodilation reduces peripheral vascular resistance and activates the renin-angiotensin-aldosterone system (RAAS), creating the substrate for high-output heart failure.

Atrial fibrillation (AF) is the most feared complication, with prevalence 5–10 times that of the general population and an associated threefold increased stroke risk [3]. A unique feature of hyperthyroid AF is its potential spontaneous reversion after euthyroidism restoration, making aggressive early rhythm control potentially unnecessary in many patients. However, predictors of spontaneous reversion vs persistence of AF remain incompletely characterised. This study aimed to describe the cardiac profile of the thyroid heart in 150 consecutive patients and to identify predictors of AF non-reversion following euthyroidism restoration.

2. METHODS

2.1. Study population

Retrospective, observational, single-centre study, January 2020 – December 2023, Moulay Ismail Military Hospital, Meknes, Morocco. Included: 150 adults with confirmed primary hyperthyroidism (TSH <0.4 µIU/mL; elevated free T4 and/or T3) and at least one cardiac manifestation. Exclusion: pre-existing structural heart disease (LVEF <40%, prior ACS, severe organic valvulopathy). IRB-approved; consent waived (retrospective design).

2.2. Data collection

Collected: demographics, aetiology of hyperthyroidism, symptoms, vital signs, ECG (rhythm, rate, PR interval, repolarisation), standard echocardiography (LVEF by Simpson, LV mass index, LAVi, diastolic function per ASE/EACVI 2016, estimated PASP), thyroid hormones (TSH, fT4, fT3), and outcomes (antithyroid drugs, time to euthyroidism, beta-blocker use, anticoagulation, rhythm outcome at 6 months).

2.3. Statistical analysis

SPSS v25.0. Continuous variables: mean±SD; categorical: n (%). Student's t-test and chi-squared test for comparisons. Multivariable logistic regression for predictors of AF non-reversion; results expressed as OR (95%CI). Significance: $p<0.05$.

3. RESULTS

3.1. Baseline clinical and aetiological characteristics

Baseline characteristics are presented in Table 1. Mean age was 45.2±12.5 years; 71% female. Graves' disease was the leading aetiology (72%), followed by toxic multinodular goitre (20%) and toxic adenoma (8%).

Table 1: Baseline clinical and biological characteristics (n=150)

Variable	Value n (%) or mean±SD
Age (years)	45.2 ± 12.5 (range 18–78)
Female sex	107 (71%)
Graves' disease	108 (72%)
Toxic multinodular goitre	30 (20%)
Toxic adenoma	12 (8%)
TSH (µIU/mL)	0.04 ± 0.03
Free T4 (pmol/L)	42.8 ± 18.4
Free T3 (pmol/L)	12.4 ± 5.8
Heart rate at presentation (bpm)	112 ± 24
Systolic BP (mmHg)	138 ± 18
Palpitations	112 (75%)
Exertional dyspnoea	76 (51%)
Atypical chest pain	32 (21%)

BP: blood pressure; TSH: thyroid-stimulating hormone.

3.2. Cardiac manifestations and echocardiographic findings

Cardiac complications are detailed in Table 2. Sinus tachycardia was the most frequent manifestation (60%). AF occurred in 42 patients (28%), mean ventricular rate 128±22 bpm. High-output heart failure signs were present in 35%. Echocardiography revealed a hyperdynamic LV (LVEF 68±5%, cardiac output 8.2±1.8 L/min) in 65%, diastolic dysfunction (grade ≥I) in 45%, and elevated estimated PASP (>35 mmHg) in 22%.

Table 2: Cardiac manifestations and echocardiographic findings (n=117 with cardiac complications)

Parameter	Value n (%) or mean±SD
Sinus tachycardia (HR >100 bpm)	90 (60% of total cohort)
Atrial fibrillation	42 (28%); mean HR 128±22 bpm
Supraventricular extrasystoles	23 (15%)
Ventricular extrasystoles	12 (8%)
High-output heart failure (NYHA II–III)	53 (35%)
LVEF (%), mean±SD	68 ± 5%
Cardiac output (L/min)	8.2 ± 1.8
Diastolic dysfunction grade ≥I	53/117 (45%)
LAVi (mL/m²)	38 ± 11
Mild mitral regurgitation	35 (30%)
Estimated PASP >35 mmHg	26 (22%)

HR: heart rate; LAVi: indexed left atrial volume; LVEF: left ventricular ejection fraction; NYHA: New York Heart Association; PASP: pulmonary artery systolic pressure.

3.3. Treatment, outcomes, and predictors of AF non-reversion

Treatment and AF outcomes are summarised in Table 3. Antithyroid drugs were initiated in all patients; mean time to euthyroidism was 8.2±3.4 weeks. Beta-blockers were prescribed in 95% (predominantly propranolol for its anti-T4-to-T3 conversion effect). Among 42 AF patients, anticoagulation was initiated in

30 (71%; CHA_2DS_2-VASc ≥2). Spontaneous sinus rhythm reversion occurred in 27/42 (64%) after euthyroidism. Multivariable predictors of AF non-reversion: AF duration >3 months (OR 3.8; 95%CI 1.6–9.2; p=0.003), age >55 years (OR 2.9; 95%CI 1.2–7.1; p=0.018), and LAVi >34 mL/m² (OR 2.4; 95%CI 1.1–5.3; p=0.031).

Table 3: Treatment and rhythm outcomes in the 42 patients with atrial fibrillation

Parameter	n (%)	Notes
Antithyroid drug (methimazole/PTU)	42 (100%)	
Time to euthyroidism (weeks)	8.2 ± 3.4	Mean±SD
Beta-blocker (propranolol)	40 (95%)	Anti-T3 conversion property
Anticoagulation initiated	30 (71%)	CHA_2DS_2-VASc ≥2
Spontaneous SR reversion	27 (64%)	After euthyroidism
Electrical cardioversion required	10 (24%)	AF duration >3 months
AF ablation	5 (12%)	Failed cardioversion
Persistent AF at 12 months	8 (19%)	Age >55y or large LA

AF: atrial fibrillation; LA: left atrium; PTU: propylthiouracil; SR: sinus rhythm.

4. DISCUSSION

Our series confirms the thyroid heart as a frequent and clinically significant entity: 78% of hyperthyroid patients presenting with cardiac symptoms had at least one significant complication. The female predominance (71%) and Graves' disease leading aetiology (72%) align with global epidemiology [6]. The AF prevalence of 28% higher than the 10–15% in community-based cohorts likely reflects the secondary referral nature of our hospital [3].

The 64% spontaneous AF reversion rate after euthyroidism compares favourably with the literature (45–75%) and highlights the importance of prioritising rapid euthyroidism restoration over aggressive early rhythm control strategies [7]. The three predictors of non-reversion AF duration >3 months, age >55 years, and left atrial enlargement are pathophysiologically coherent: prolonged AF promotes irreversible atrial electrical and structural remodelling, particularly in older patients with pre-existing atrial stiffness [8]. These findings suggest a practical clinical algorithm: patients without these predictors can safely be managed with a watch-and-wait approach after euthyroidism restoration, reserving early cardioversion or ablation for those with one or more adverse predictors.

The finding of diastolic dysfunction in 45% of patients despite a hyperdynamic LVEF highlights that thyrotoxicosis impairs not only systolic mechanics but also diastolic relaxation, through calcium handling abnormalities and myocardial fibrosis in prolonged disease [9]. Limitations include the retrospective design, single-centre, and absence of systematic cardiac MRI for fibrosis quantification.

5. CONCLUSIONS

The thyroid heart is dominated by tachyarrhythmias and high-output heart failure, with 64% spontaneous AF reversion after euthyroidism. AF duration >3 months, age >55 years, and left atrial enlargement identify patients requiring early rhythm control procedures. Systematic ECG and echocardiographic evaluation at diagnosis of hyperthyroidism is recommended for all patients with cardiac symptoms, and rapid euthyroidism restoration remains the cornerstone of management.

List of Abbreviations

Abbreviation	Definition
AF	Atrial fibrillation
ECG	Electrocardiogram
ESC	European Society of Cardiology
fT3	Free triiodothyronine
fT4	Free thyroxine
LAVi	Indexed left atrial volume
LVEF	Left ventricular ejection fraction
NYHA	New York Heart Association
OR	Odds ratio
PASP	Pulmonary artery systolic pressure
PTU	Propylthiouracil
RAAS	Renin-angiotensin-aldosterone system
SD	Standard deviation
SR	Sinus rhythm
T3	Triiodothyronine
TSH	Thyroid-stimulating hormone

Declarations:

Ethics approval and consent to participate

This study was conducted in accordance with the Declaration of Helsinki. Ethical approval was obtained from the Institutional Review Board of Moulay Ismail Military Hospital, Meknes. Patient informed consent was waived due to the retrospective nature of the study.

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REFERENCES

1. Biondi B, Kahaly GJ, Robertson RP. Thyroid dysfunction and diabetes mellitus: two closely associated disorders. Endocr Rev. 2019;40(3):789-824.
2. Klein I, Danzi S. Thyroid disease and the heart. Circulation. 2007;116(15):1725-1735.
3. Sawin CT, Geller A, Wolf PA, *et al.,* Low serum thyrotropin concentrations as a risk factor for atrial fibrillation in older persons. N Engl J Med. 1994;331(19):1249-1252.
4. Hindricks G, Potpara T, Dagres N, *et al.,*2020 ESC guidelines for the diagnosis and management of atrial fibrillation. Eur Heart J. 2021;42(5):373-498.
5. Kahaly GJ, Bartalena L, Hegedüs L, Leenhardt L, Poppe K, Pearce SH. 2018 European Thyroid Association guideline for Graves' hyperthyroidism. Eur Thyroid J. 2018;7(4):167-186.
6. Bahn RS, Burch HB, Cooper DS, *et al.,* Hyperthyroidism and other causes of thyrotoxicosis: management guidelines of the American Thyroid Association. Thyroid. 2011;21(6):593-646.
7. Nakazawa HK, Sakurai K, Hamada N, Momotani N, Ito K. Management of atrial fibrillation in the post-thyrotoxic state. Am J Med. 1982;72(6):903-906.
8. Kirchhof P, Camm AJ, Goette A, *et al.,* Early rhythm-control therapy in patients with atrial fibrillation. N Engl J Med. 2020;383(14):1305-1316.
9. Osman F, Franklyn JA, Holder RL, Sheppard MC, Gammage MD. Cardiovascular manifestations of hyperthyroidism before and after antithyroid therapy. J Am Coll Cardiol. 2007;49(1):71-81.
10. Siu CW, Yeung CY, Lau CP, Kung AW, Tse HF. Incidence, clinical characteristics and outcome of congestive heart failure as the initial presentation in patients with primary hyperthyroidism. Heart. 2007;93(4):483-487.
11. Danzi S, Klein I. Thyroid hormone and the cardiovascular system. Med Clin North Am. 2012;96(2):257-268.
12. Frost L, Vestergaard P, Mosekilde L. Hyperthyroidism and risk of atrial fibrillation or flutter. Arch Intern Med. 2004;164(15):1675-1678.
13. Erem C, Ersöz HÖ, Karti SS, *et al.,* Blood coagulation and fibrinolysis in patients with hyperthyroidism. J Endocrinol Invest. 2002;25(4):345-350.
14. Biondi B, Palmieri EA, Fazio S, *et al.,* Endogenous subclinical hyperthyroidism affects quality of life and cardiac morphology and function in young and middle-aged patients. J Clin Endocrinol Metab. 2000;85(12):4701-4705.
15. Petersen P, Hansen JM. Stroke in thyrotoxicosis with atrial fibrillation. Stroke. 1988;19(1):15-18.