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Assessing Management and Outcomes in Toxic Goitre: A Multicentre Retrospective Cohort Study from Sidama Regional State of Ethiopia

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Abstract

Background: Hyperthyroidism in Ethiopia is treated mainly with antithyroid drugs and surgery, but adherence to international standards is unknown. We assessed thyroid-function test (TFT) ordering, antithyroid drugs use, and operative practice in adults with toxic goitre managed at three public hospitals in Sidama Regional State, and explored factors linked to procedure choice and early morbidity.

Methods: A retrospective cohort included every adult (≥18 years) who underwent thyroidectomy for toxic goitre from 1 October 2020 to 30 September 2024. Case notes, theatre registers and a brief telephone interview provided clinical data. Primary outcomes were guideline-concordant TFTs ordering, appropriate antithyroid drugs prescribing, and extent of surgery. Secondary outcomes were drug adverse events, postoperative thyroxine prescribing, length of hospital stay, and complications within three months. Logistic regression examined predictors.

Results: We analysed 287 patients; 89.9% were women, median age 38 years (IQR 30-45). Toxic multinodular goitre accounted for 93.4% of cases. Baseline testing most often comprised TSH + total T_3 + total T_4 (54.3%); TSH alone was ordered in 16.1%. Every patient received propylthiouracil and 70.7 % also received propranolol; methimazole was unavailable. Near-total or total thyroidectomy (NTT/TT) was performed in 153 patients (53.3 %) and subtotal resections in 134 (46.7%). Complications occurred in 17.4% (hypocalcaemia 3.8 %, hoarseness 3.8 %, haematoma 0.7%). Only 19% of those who underwent NTT/TT received postoperative thyroxine. Treatment facility was the only independent predictor of NTT/TT (χ^2 21.6, $p<0.001$). Median hospital stay was shorter after NTT/TT than after subtotal surgery (3 vs 4 days, $p<0.001$).

Conclusions: This study showed clear areas to improve clinical practice in keeping with guideline standards. Region-specific protocols, stable access to methimazole and levothyroxine, and concentration of thyroid surgery in higher-volume teams are warranted to improve the quality and safety of toxic-goitre care.

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Introduction

Goitre, an enlargement of the thyroid gland, affects more than 200 million people worldwide[1]. Because iodine deficiency is common, the burden falls chiefly on low- and middle-income countries[1]. Hyperthyroidism, defined by excessive production and secretion of thyroid hormones, is seen in 0.2% to 1.3% of the global population[2-4]. The disorder is reported across Africa, including Ethiopia, although good quality epidemiological data are scarce. Hyperthyroidism is the principal cause of thyrotoxicosis, which may be overt or subclinical according to biochemical findings[1-7]. In iodine-replete regions autoimmune disease, particularly Graves' Disease, accounts for most toxic goitres, whereas toxic multinodular goitre, and toxic adenoma predominate where iodine intake is low[2]. All forms of toxic goitre are more common in women[2-9].

Diagnosis relies on thyroid function tests (TFTs) that measure serum thyroid-stimulating hormone (TSH), total triiodothyronine (TT3), and free thyroxine (fT4)[3,4,8,9]. Management uses one or a combination of three approaches: antithyroid drugs (ATDs), radio-iodine (I^{-131}), and surgery[2]. The choice depends on aetiology, disease severity, resource availability, pregnancy status, response to initial therapy, and patient preference[2]. Antithyroid drugs, mainly methimazole and less often propylthiouracil, are usually prescribed first to achieve euthyroidism[2,10]. Toxic nodular goitre is often treated definitively with surgery, although radio-iodine may be selected where operative expertise is limited. However the need for higher doses increase the risk of hypothyroidism in toxic multinodular goitre. This makes surgery as a better option[2,3]. The surgical options include total, near-total, and subtotal thyroidectomy as well as lobectomy, chosen according to nodule distribution[2,11,12].

Despite published algorithms, clinicians differ in their ordering of thyroid function tests and prescription of ATDs, increasing costs and risking suboptimal care[2,13-16]. Treatment patterns also vary between regions, and leading guidelines have not been updated for more than five years[2,9]. In Ethiopia many resources integral to contemporary management (therapeutic nuclear medicine, advanced laboratory assays, thyroid scintigraphy, and specialist endocrine surgeons) are scarce[12]. Clinicians therefore rely mainly on antithyroid drugs and surgery, yet the optimal extent of thyroidectomy remains contested[4,14,17]. Ethiopia lacks national or institutional guidance for toxic goitre, and most international studies focus on Graves' disease, which is relatively uncommon locally. Toxic multinodular goitre and toxic adenoma predominate in our setting. This study examined three hospitals in Sidama Regional State, Ethiopia, to describe current practice in ordering thyroid function tests and prescribing antithyroid drugs and to characterise the pattern of thyroidectomy procedures undertaken in adult patients with toxic goitre.

Methods

Study design and setting

We conducted a multicentre retrospective cohort study across three public hospitals in Sidama Regional State, southern Ethiopia. Clinical records of patients managed for hyperthyroidism from 1 October 2020 to 30 September 2024 were reviewed. A short telephone interview with each patient (or a close relative if the patient was unavailable) verified sociodemographic details, antithyroid-drug use, and thyroxine prescriptions. Hawassa University Comprehensive Specialised Hospital (HUCSH) is a 400–450-bed tertiary referral centre that provides undergraduate and postgraduate training. Adare General Hospital is the region's main general hospital and has no academic programme. Yirgalem Hospital Medical College, about 90 km from Hawassa, functioned for many years as a general hospital and introduced residency training three years ago.

Study population

The source population comprised all patients with goitre managed in the surgical departments of the three hospitals during the study period. The study population included adult patients (≥18 years) with toxic goitre who underwent thyroidectomy. Adult toxic goitre patients who had thyroidectomy at any of the three centres during the study period were included. Patients without a single postoperative follow-up visit and those whose records lacked one or more study variables were excluded.

Outcomes

The predefined primary outcome set contained three components:

1. Guideline-concordant TFTs: ordering of serum TSH for screening and, when indicated, TSH plus free T4 and total T3, with repeat testing every 2–6 weeks after initiation of ATDs[3,5].

2. Appropriate ATD prescription: methimazole (MMI) as first-line therapy or, when propylthiouracil (PTU) was chosen, a starting dose of 100 mg orally three times daily; documentation of either a titration or a block-and-replace regimen[3,9,18].

3. Extent of surgery: classification of the procedure as near-total or total thyroidectomy versus subtotal resections (bilateral or unilateral), hemithyroidectomy, or lobectomy[5,19].

Secondary outcomes were adverse reactions to ATDs, thyroxine-prescribing practice, duration of hospital stay, and postoperative complications within three months.

Data collection

A structured checklist, developed from published literature, guided data abstraction. Data were captured electronically with KoboToolbox and checked for completeness; missing values were minimal and were not imputed.

Statistical analysis

The sample size was a convenience sample size taken between the study dates, with at least 200 patients expected from normal surgical volumes. Data were analysed in SPSS v26. Categorical variables are reported as frequencies and percentages and compared with Pearson's χ^2 or Fisher's exact test. Continuous variables are summarised as mean and standard deviation or median (interquartile range), according to distribution. Binary logistic regression identified predictors of procedure type and postoperative complications. Model adequacy was assessed with variance-inflation factor, Hosmer-Lemeshow, Cox-Snell R^2, and Nagelkerke R^2 statistics. Associations were considered significant at $p < 0.05$.

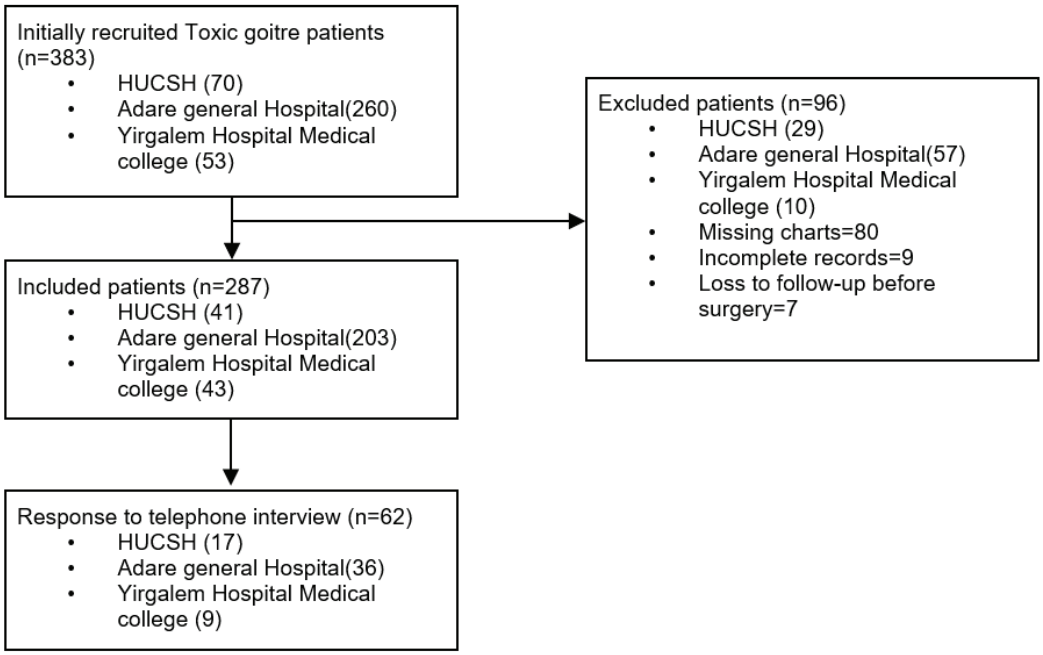

Figure 1: Flowchart of participant selection for the chart review and phone call interview of toxic goitre patients at the three centres, Sidama regional state, Ethiopia. HUCSH=Hawassa University Comprehensive Specialised Hospital

Ethics

Ethical clearance was obtained from the Hawassa University Institutional Review Board (IRB/337/16), and a supporting letter was issued by the Sidama Public Health Institute. The study is reported in accordance with STROBE guidelines.

Results

Participant flow and baseline characteristics

A total of 287 patients met the inclusion criteria; 62 completed the telephone interview, giving a response rate of 21.6% (Figure 1). Women represented 89.9% of the cohort (258/287). Median age was 38 years (IQR 30-45). Three-quarters of participants resided in Sidama Regional State, and 45% lived in urban areas. Two-thirds of operations were performed at Adare General Hospital (Table 1).

Most patients (85.4%) were American Society of Anesthesiologists grade I and 14.6 % had at least one comorbidity. Toxic multinodular goitre dominated the case-mix (268/287, 93.4%), with toxic adenoma accounting for a further 4.9%. Only one quarter of records contained a TIRADS ultrasound report. Two or more primary thyrotoxic symptoms were documented in 70.7% of patients; palpitations being the most common (198/234 with symptom data, 84.6%) (Supplementary Figure 1).

Thyroid function testing

At diagnosis the commonest thyroid function panel was TSH with total T3 and total T4 (152/280, 54.3 %). TSH alone was requested in 16.1 % of cases. The same full panel remained the usual choice at the first three follow-up visits (50.2%, 48.0%, and 45.1%, respectively; Table 2). General practitioners ordered nearly 80% of baseline tests, whereas surgeons ordered about two-thirds of follow-up tests (Supplementary Table 1).

Antithyroid-drug prescribing

All patients received PTU as their sole antithyroid drug. PTU combined with propranolol was given to 70.7%, the remainder receiving PTU alone. The standard starting dose of 100 mg orally three times daily was used for 94.4% of patients (Table 3). Dose adjustment was recorded in 34.5%, usually an increase, with a median of one adjustment (IQR 1-2). Adverse events were rare: agranulocytosis with hepatitis in one patient and a generalised rash in another (0.69%). After thyroidectomy 31% of patients continued an antithyroid drug (Supplementary Table 2). Among interview respondents, 22.5% had stopped PTU at least once and 35.7% of these had discontinued more than once.

Surgical management

Near-total or total thyroidectomy (NTT/TT) was performed in 153 patients (53.3%); the remainder underwent a subtotal resection (Figure 2). Almost all operations (284/287, 99%) were carried out by general surgeons, two-thirds of whom had at least five years' experience. Postoperative complications occurred in 17.4% of patients (Table 4). Only 18.9% of those who had NTT/TT received thyroxine after surgery. Median hospital stay was longer after limited surgery than after NTT/TT (4 days, IQR 3-5 vs 3 days, IQR 3-4; Mann–Whitney U=7479, Z=-4.53, p < 0.001).

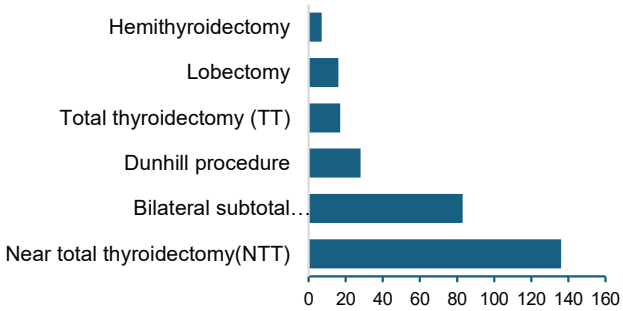

Figure 2. Types of thyroidectomies (n=287) of toxic goitre patients at the three centres, Sidama regional state, Ethiopia

Determinants of procedure type

In multivariable logistic regression, treatment facility was the only independent predictor of procedure type (χ^2=21.62, p<0.001). Compared with Adare General

Table 1: Sociodemographic and base line clinical characteristics of toxic goitre patients at the three centres, Sidama Regional State, Ethiopia

		Count	%
Age(years)	19-39	167	58.2%
	40-60	111	38.7%
	61-80	9	3.1%
Sex	Male	29	10.1%
	Female	258	89.9%
Region of residence	Oromia regional state	62	21.6%
	Sidama regional state	215	74.9%
	South Ethiopia regional state	8	2.8%
	Central Ethiopia regional state	1	0.3%
	West Ethiopia regional state	1	0.3%
Residence	Urban	129	44.9%
	Rural	158	55.1%
Facility of care	Hawassa University Comprehensive Specialised Hospital	41	14.3%
	Adare General Hospital	203	70.7%
	Yirgalem Hospital Medical College	43	15.0%
Referral status of patients	Not referred	253	88.2%
	referred	34	11.8%
ASA grade	ASA I	245	85.4%
	ASA II	41	14.3%
	ASA III	1	0.3%
Type of medical co-morbidities (n=42)	Cardiac	10	8.33%
	Hypertension	18	42.8%
	Liver	1	2.4%
	Others (diabetes, asthma, RVI)	13	31%
WHO grade of the goitre	Grade I	22	7.7%
	Grade II	118	41.1%
	Grade III	147	51.2%
Type of goitre (ultrasound+clinical findings)	Toxic multinodular	268	93.4%
	Solitary nodule	14	4.9%
	Diffuse goitre	5	1.7%
TIRADS	TIRADS 1	1	0.3%
	TIRADS 2	32	11.1%
	TIRADS 3	27	9.4%
	TIRADS 4	8	2.8%
	TIRADS 5	1	0.3%
	Not reported	218	76.0%

Table 2: Thyroid Function Tests ordered at baseline and subsequent visits of toxic goitre patients at the three centres, Sidama Regional State, Ethiopia

		Count	%
TFTs at baseline	TSH	45	16.1%
	TSH,Free T3, Free T4	74	26.4%
	TSH, Free T4	7	2.5%
	TSH, Free T3	1	0.4%
	TSH, Total T3, Total T4	152	54.3%
	Free T3, Free T4	1	0.4%
	others	0	0.0%
	Total	280	100.0%
TFT at 2nd visit	Free T4	0	0.0%
	Free T4 & Free T3	12	4.2%
	TSH,Free T4	5	1.8%
	TSH,Free T3, Free T4	96	33.7%
	TSH, Total T3, Total T4	143	50.2%
	others	29	10.2%
	Total	285	100.0%
TFT at 3rd visit	Free T4	0	0.0%
	Free T4, Free T3	9	5.2%
	TSH, Free T4	4	2.3%
	TSH, Free T3, Free T4	47	27.2%
	TSH, Total T3, Total T4	83	48.0%
	others	30	17.3%
	Total	173	100.0%
TFT at 4th visit	Free T4	0	0.0%
	Free T4, Free T3	11	9.0%
	TSH, Free T4	3	2.5%
	TSH, Free T3, Free T4	37	30.3%
	TSH, Total T3, Total T4	55	45.1%
	others	16	13.1%
	Total	122	100.0%

Hospital, the odds of receiving NTT/TT were lower at Yirgalem Hospital Medical College (OR 0.21, 95 % CI 0.04-0.96, p=0.044) and markedly lower at Hawassa University Comprehensive Specialised Hospital (OR 0.04, 95% CI 0.01-0.20, p<0.001, Table 5).

Determinants of postoperative complications

Because the logistic model for postoperative complications failed goodness-of-fit testing, associations were explored with χ^2 or Fisher's exact test only. Complication rates differed significantly by the presence of compressive symptoms, surgeon's experience, and treatment facility (Supplementary Table 3).

Discussion

The main finding of this study is the recognition of a clinical practice gap, showing divergence from guideline recommendations in several areas of toxic goitre care. The key areas were in the choice of thyroid function panels, exclusive reliance on propylthiouracil, and limited postoperative thyroxine replacement. Near-total or total thyroidectomy was undertaken in just over half of patients, with the rest receiving a subtotal procedure. These patterns mirror reports from other African centres, where toxic multinodular goitre is the dominant pathology and access to radio-iodine or methimazole is restricted[1,7,12]. In high-income settings, by contrast, Graves' disease predominates and near-total or total resection is routine[3,5,9].

Table 3: Preoperative antithyroid drug (ATD) and propranolol prescription of toxic goitre patients at the three centres, Sidama Regional State, Ethiopia

		Count	%
ATDs used	PTU	84	29.3%
	PTU+Propranolol	203	70.7%
The initial dose of propylthiouracil (PTU)	50 TID	3	1.0%
	100 TID	271	94.4%
	150 TID	8	2.8%
	200 TID	5	1.7%
PTU adjusted during follow-up?	Yes	99	34.5%
	No	188	65.5%
The dose of PTU while euthyroidism was achieved	100 TID	188	65.5%
	150 TID	16	5.6%
	200 TID	51	17.8%
	300 TID	32	11.1%
The initial dose of propranolol	20 DAILY	14	6.9%
	20 BID	31	15.3%
	40 DAILY	149	73.4%
	40 BID	9	4.4%

ATD:antithyroid drug; PTU=propylthiouracil; TID=three times a day; BID=twice a day.

Table 4: Post-op complications of toxic goiter patients at the three centers, Sidama Regional State, Ethiopia

		Number needed to treat		Limited form of Thyroidectomy	
		Count	Percent %	Count	Percent %
Post-op complications	yes	32	20.9%	18	13.4%
	no	121	78.9%	116	86.7%
	Total	153	100.0%	134	100.0%
Seroma	yes	6	18.8%	4	22.2%
	no	26	81.3%	14	77.8%
	Total	32	100.0%	18	100.0%
Hematoma	yes	1	3.1%	1	5.6%
	no	31	96.9%	17	94.4%
	Total	32	100.0%	18	100.0%
Hypocalceamia	yes	8	25.0%	3	16.7%
	no	24	75.0%	15	83.3%
	Total	32	100.0%	18	100.0%
Hoarsness	yes	5	15.6%	6	33.3%
	no	27	84.4%	12	66.7%
	Total	32	100.0%	18	100.0%
Wound infection	yes	1	3.1%	4	22.2%
	no	31	96.9%	14	77.8%
	Total	32	100.0%	18	100.0%
Hypothyroidism	yes	14	43.8%	3	16.7%
	no	18	56.3%	15	83.3%
	Total	32	100.0%	18	100.0%

Table 5: Univariate and multivariable logistic regression analysis of factors associated with the choices of surgeries of toxic goitre patients at the three centres, Sidama regional state, Ethiopia.

Variable	Category	Crude odds ratio (95%CI)	Adjusted odds ratio (95%CI)	p-value
Age	18-39	-	-	0.604
	40-59	0.641 (0.27-1.525)	0.589 (0.209-1.655)	0.315
	60-74	0.556 (0.224-1.375)	0.650 (0.233-1.807)	0.409
Facility of care	Adare General Hospital	-	-	<.001
	Yirgalem Hospital Medical College	0.623 (0.222-1.751)	0.200 (0.042-0.955)	0.044
	Hawassa University Comprehensive Specialised Hospital	0.120 (0.053-.273)	0.040 (0.008-0.195)	<.001
WHO grade of goitre	Grade 1	-	-	0.775
	Grade 2	0.995 (0.405-2.447)	0.868 (0.296-2.543)	0.796
	Grade 3	1.154 (0.710-1.875)	0.789 (0.410-1.517)	0.477
Type of goitre	Toxic Multinodular	-	-	0.278
	Toxic solitary	0.203 (0.022-1.838)	0.766 (0.064-9.196)	0.834
	Diffuse	0.917 (0.073-11.577)	2.665 (0.151-47.182)	0.504
Level of experience of surgeon	<=5 years	-	-	-
	>5 years	0.794 (0.477-1.320)	0.718 (0.390-1.320)	0.286

Thyroid function testing most often comprised a full panel of TSH with total T4 and total T3, applied both at diagnosis and during follow-up. Current international guidance advises an initial TSH alone, adding free T4 and total T3 only when thyrotoxicosis is likely and thereafter monitoring free T4 and total T3 during antithyroid therapy[3,5,18]. Over-ordering has been documented in the United Kingdom and the United States, where it increases laboratory workload and cost[15,16], and the present findings suggest a similar opportunity for rationalisation in Ethiopia.

Propylthiouracil was the sole antithyroid agent prescribed, largely because methimazole has not been available on the national market for several years[6]. Propylthiouracil remains appropriate in pregnancy, thyroid storm, and in patients who cannot tolerate methimazole, but it is otherwise less potent and carries a risk of severe hepatotoxicity[9,18,20]. Dose titration was recorded in only one third of patients, implying that limited access to repeat testing may have constrained optimal adjustment.

Half of operations were subtotal resections, a proportion higher than that recommended by American and European thyroid associations, which favour near-total or total thyroidectomy in high-volume centres[3,9]. In settings where follow-up is difficult and levothyroxine costly, subtotal surgery may appear attractive; however, bilateral subtotal resection carries a greater risk of recurrence and potential morbidity if re-operation becomes necessary[19]. Only one patient in five received thyroxine after near-total or total thyroidectomy, which saved cost but left the remainder at risk of hypothyroidism and its complications.

Postoperative complications occurred in 17 % of patients, similar to a previous Ethiopian series[22] and higher than the rates reported from specialised endocrine units

elsewhere[3]. Hypocalcaemia and hoarseness were each observed in 3.8 %, and two haematomas. These outcomes again identify the need for careful case selection and surgeon experience when more extensive resection is considered.

This study has several limitations. It was retrospective and confined to one region; results may not represent other Ethiopian hospitals. Data quality depended on the completeness of operative notes and laboratory records, and inter-observer validation of abstraction was not performed. One quarter of telephone numbers were invalid or unanswered, limiting postoperative follow-up. Important long-term outcomes such as recurrence, malignancy, and cost were beyond the scope of the present audit. Finally, absence of a control group precluded formal comparison of subtotal with near-total or total thyroidectomy

Addressing the gaps identified could begin with a regional protocol that standardises test ordering, introduces methimazole when available, and clarifies indications for near-total or total versus subtotal resection. Prospective studies that incorporate cost-effectiveness analyses and longer follow-up would allow a fuller evaluation of these interventions.

Conflicts of interest: the authors have no conflict of interest to disclose

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Data sharing statement: The data supporting the findings of this study are available from the corresponding author upon reasonable request.

GAIT statement[23] for Generative AI use: Generative AI was used for language editing in this manuscript. No content generation, data analysis, or substantive rewriting was performed. The authors take full responsibility for the accuracy and integrity of the work.

References

1. Abate G, Amentie E, Abdulahi AA, Nigussie S. Patterns, treatment outcome, and factors associated with surgically treated thyroid disease in eastern Ethiopia: retrospective cross-sectional study. BMC Surg 2024; 24: 250.

2. Veríssimo D, Pereira B, Vinhais J, Ivo C, Martins AC, e Silva JN, et al. Long-term follow-up of treatment outcomes in Graves disease and toxic nodular disease. Endocrine 2025; 234–42.

3. Ross DS, Burch HB, Cooper DS, Greenlee MC, Laurberg P, Maia AL, et al. American Thyroid Association guideline for the diagnosis and management of hyperthyroidism and other causes of thyrotoxicosis. Thyroid 2016; 26: 1343–421.

4. Taylor PN, Albrecht D, Scholz A, Gutierrez-Buey G, Lazarus JH, Dayan CM, et al. Global epidemiology of hyperthyroidism and hypothyroidism. Nat Rev Endocrinol 2018; 14: 301–16.

5. Patel KN, Yip L, Lubitz CC, Grubbs EG, Miller BS, Shen W, et al. Definitive surgical management of thyroid disease in adults: American Association of Endocrine Surgeons guidelines. Ann Surg 2020; 271: 21–93.

6. Maldey H, Tadesse S, Alem AZ, Hagezom HM, Gufue ZH. Time to euthyroidism and its determinants among patients with thyrotoxicosis on antithyroid drugs in south Tigrai, Ethiopia. Ther Clin Risk Manag 2021; 17: 1091–101.

7. Mengesha S, Tadesse A, Worku BM, Alamrew K, Yesuf T, Gedamu Y. Control of hyperthyroidism and associated factors after prolonged antithyroid therapy in northwest Ethiopia. Medicine 2024; 103: e38201.

8. Mariani G, Tonacchera M, Grosso M, Orsolini F, Vitti P, Strauss HW. Role of nuclear medicine in benign thyroid disorders. J Nucl Med 2021; 62: 304–12.

9. Kahaly GJ, Bartalena L, Hegedüs L, Leenhardt L, Poppe K, Pearce SH. European Thyroid Association guideline for management of Graves hyperthyroidism. Eur Thyroid J 2018; 7: 167–86.

10. Emiliano AB, Governale L, Parks M, Cooper DS. Trends in propylthiouracil and methimazole use in the United States, 1991–2008. J Clin Endocrinol Metab 2010; 95: 2227–33.

11. El-Sayed WM, Mekhaeel MSF, Ibn-Burud I, Elhariri S. Total versus subtotal thyroidectomy for benign thyroid disease. West Afr J Med 2024; 41: in press.

12. Martínez JG, González M, Hernández Q, Rodríguez MA, Torregrosa N, Gil E, et al. Goitre surgery recommendations in sub-Saharan Africa in humanitarian settings. Laryngoscope Investig Otolaryngol 2022; 7: 417–24.

13. Bokulić A, Zec I, Goreta S, Gabaj NN, Kocijančić M, Hiršl TS, et al. National survey of laboratory policies for thyroid function testing in Croatia. Biochem Med (Zagreb) 2022; 32: 030703.

14. Toubert ME, Chevret S, Cassinat B, Schlageter MH, Beressi JP, Rain JD. Reducing inappropriate ordering of thyroid hormone and antibody tests. Eur J Endocrinol 2000; 142: 605–10.

15. Zhelev Z, Abbott R, Rogers M, Fleming S, Patterson A, Hamilton WT, et al. Interventions to reduce unnecessary thyroid function testing: systematic review. BMJ Open 2016; 6: e010507.

16. Kluesner JK, Beckman DJ, Tate JM, Beauvais AA, Kravchenko MI, Wardian JL, et al. Current patterns in thyroid function test

ordering. J Eval Clin Pract 2018; 24: 347–52.

17. Kamel AA, Kamel M. Total versus subtotal thyroidectomy for multinodular goitre: meta-analysis. Egypt J Otolaryngol2024; 40: in press.

18. Abdi H, Amouzegar A, Azizi F. Antithyroid drugs: an overview. Iran J Pharm Res 2019; 18: 1–12.

19. Barczyński M, Konturek A, Hubalewska-Dydejczyk A, Gołkowski F, Nowak W. Ten-year outcomes of total thyroidectomy versus Dunhill and bilateral subtotal procedures for multinodular non-toxic goitre. World J Surg 2018; 42: 384–92.

20. National Institute for Health and Care Excellence. Thyroid disease: assessment and management (NICE guideline NG145). London: NICE, 2019.

21. Ozbaş S, Koçak S, Aydıntuğ S, Çakmak A, Demirkıran A, Wishart GC. Complications of subtotal, near-total, and total thyroidectomy for multinodular goitre. Endocr J 2005; 52: 199–205.

22. Wondwosen M, Bekele M, Abebe K, Tantu T, Zewdu D. Factors linked to thyroidectomy complications in a resource-limited setting. Int J Surg Open 2022; 42: 100537.

23. GAIT 2024 Collaborative Group. Generative Artificial Intelligence Transparency (GAIT 2024) guidance. Impact Surg 2025; 2: 6–11. Available from: https://www.impact-surgery.org/index.php/pub/article/view/134