

Review article

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Surgical Treatment of the Thyroid Gland: Clinico-Pathological Characteristics and Outcomes

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Thyroid diseases represent one of the most common endocrine disorders and frequently require surgical treatment due to suspected malignancy, compressive symptoms, nodular enlargement, or functional disorders resistant to conservative therapy.

This retrospective descriptive single-center study analyzed 541 patients surgically treated for thyroid diseases at Cantonal Hospital Zenica between January 2020 and December 2025. Demographic variables, surgical indications, operative procedure extent, histopathological diagnoses, and postoperative complications were systematically evaluated.

Women represented 91.7% of patients (n = 496), with a mean age of 55 ± 12.4 years. Total thyroidectomy was performed in 486 patients (89.8%), while lobectomy was performed in 55 cases (10.2%). Compressive symptoms were the leading indication for surgery (38.0%, n = 206). Nodular colloid goiter was the most frequent benign diagnosis (n = 203; 37.5%), whereas papillary thyroid carcinoma (PTC) was the predominant malignant lesion (n = 89; 16.4% overall, representing 79.5% of all malignancies). Postoperative complications occurred in 160 cases (29.6%), with transient hypocalcemia being the most common (26.2%, n = 142). All hypocalcemia cases occurred following total thyroidectomy (p < 0.001). Hashimoto thyroiditis was associated with frequent compressive symptoms (54.2%) and less aggressive local characteristics of concomitant papillary thyroid carcinoma.

Total thyroidectomy remains the primary operative procedure in a regional center setting, offering safe oncological and symptomatic control with low permanent complication rates. Structured preoperative evaluation and parathyroid identification are mandatory to minimize postoperative hypocalcemia.

Keywords: thyroid gland, thyroidectomy, papillary carcinoma, Hashimoto thyroiditis, postoperative complications, hypocalcemia

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HIRURŠKO LEČENJE BOLESTI ŠTITASTE ŽLEZDE: PETOGODIŠNJA RETROSPEKTIVNA JEDNOCENTRIČNA STUDIJA

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Oboljenja štitaste žlezde predstavljaju jedan od najčešćih endokrinih poremećaja i često zahtevaju hirurško lečenje zbog sumnje na malignitet, kompresivnih simptoma, nodularnog uvećanja ili funkcionalnih poremećaja otpornih na konzervativnu terapiju.

Ova retrospektivna deskriptivna studija sprovedena u jednom centru analizirala je 541 pacijenta hirurški lečenog zbog bolesti štitaste žlezde u Kantonalnoj bolnici Zenica u periodu od januara 2020. do decembra 2025. godine. Sistematski su evaluirane demografske varijable, hirurške indikacije, obim operativnog zahvata, histopatološke dijagnoze i postoperativne komplikacije.

Žene su činile 91,7% pacijenata ($n = 496$), prosečne starosti $55 \pm 12,4$ godine. Totalna tiroidektomija izvedena je kod 486 pacijenata (89,8%), dok je lobektomija urađena u 55 slučajeva (10,2%). Kompresivni simptomi bili su vodeća indikacija za operaciju (38,0%, $n = 206$). Nodularnakoloidna struma bila je najčešća benigna dijagnoza ($n = 203$; 37,5%), dok je papilarni karcinom štitaste žlezde (PTC) bio dominantna maligna lezija ($n = 89$; 16,4% ukupno, odnosno 79,5% svih maligniteta).

Postoperativne komplikacije zabeležene su u 160 slučajeva (29,6%), pri čemu je prolazna hipokalcemija bila najčešća (26,2%, $n = 142$). Svi slučajevi hipokalcemije javili su se nakon totalne tiroidektomije ($p < 0,001$). Hašimotov tiroiditis bio je povezan sa čestim kompresivnim simptomima (54,2%) i manje agresivnim lokalnim karakteristikama udruženog papilarnog karcinoma štitaste žlezde.

Totalna tiroidektomija ostaje primarna operativna procedura u uslovima regionalnog centra, pružajući bezbednu onkološku i simptomatsku kontrolu uz nisku stopu trajnih komplikacija.

Strukturisana preoperativna evaluacija i identifikacija paratiroidnih žlezda su obavezne kako bi se postoperativna hipokalcemija svela na minimum.

Ključne reči: štitasta žleza, tiroidektomija, papilarni karcinom, Hašimotov tiroiditis, postoperativne komplikacije, hipokalcemija

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INTRODUCTION

Thyroid diseases represent a leading group of endocrine disorders worldwide, with a significant impact on quality of life and public health (1,2). The spectrum of diseases encompasses a broad range of pathological entities—from benign euthyroid nodular goiters and autoimmune inflammatory processes like Hashimoto thyroiditis to autonomous focal lesions and primary malignant thyroid tumors (1-3). Epidemiological studies consistently demonstrate a significant female predominance, with the incidence of nodular lesions and autoimmune thyroiditis increasing with age (1,4).

Over the last two decades, the diagnosis of thyroid pathology has advanced significantly due to the widespread availability of high-resolution ultrasound, advanced elastography techniques, and the routine use of fine-needle aspiration cytology (FNAC) stratified according to the Bethesda system (4,5). Despite the development of precise non-invasive diagnostic methods and conservative treatment options, surgical intervention remains an indispensable, definitive, and crucial therapeutic modality for a substantial number of patients (5,6).

The primary indications for thyroid surgery include suspected or confirmed malignancy, mechanical compression on neck structures, retrosternal extension of goiter, and functional disorders (hyperthyroidism) refractory to medical or radionuclide therapy (4,6,7). Modern thyroid surgery in specialized centers is considered a safe procedure with low mortality and morbidity (6,8). However, postoperative complications—such as transient or permanent hypocalcemia due to parathyroid injury, recurrent laryngeal nerve (RLN) palsy, and postoperative hematoma—remain serious clinical challenges as they can significantly impair recovery and patient quality of life (7,8).

The aim of this retrospective study was to comprehensively evaluate the demographic, clinical, histopathological, and surgical characteristics of patients operated on for thyroid diseases at Cantonal Hospital Zenica over a five-year period. Special focus was placed on analyzing surgical indications, procedure extent, stratification of postoperative complications by operation type, and assessing the specific association of Hashimoto thyroiditis with clinical presentation and concomitant papillary thyroid carcinoma characteristics.

MATERIALS AND METHODS

Study Design and Patient Population

A retrospective descriptive study was conducted in the Department of Otorhinolaryngology and Maxillofacial Surgery at Cantonal Hospital Zenica, Bosnia and Herzegovina. The study included all patients surgically treated for thyroid diseases between January 1, 2020, and December 31, 2025 (total N = 541). Exclusion criteria were: patients previously operated on at other institutions without available primary documentation, patients with previously diagnosed malignancies of other regions who received neck chemotherapy or radiotherapy, and patients with incomplete medical records.

Definition of Compressive Symptoms

Compressive symptoms were defined as subjective patient complaints caused by mechanical pressure from an enlarged thyroid gland on adjacent organ-specific neck and mediastinal structures, supported by physical and/or imaging findings (ultrasound or neck CT) (1,6). Compressive symptoms included:

- **Dysphagia:** Difficulty or pain when swallowing solid or liquid food;
- **Dyspnea and Orthopnea:** Shortness of breath during exertion or when lying flat due to tracheal compression;
- **Stridor and Tracheal Deviation:** Objectively verified airway narrowing;
- **Foreign Body or Pressure Sensation in the Neck:** Persistent choking sensation interfering with daily activities.

Criteria for Selecting Operative Extent

The decision on surgical extent was based on preoperative ultrasound, cytology findings (Bethesda classification), hormone status, presence of compression, and intraoperative findings in line with international recommendations (4,6). Two primary surgical procedures were performed:

- **Total Thyroidectomy (TT):** Indicated for bilateral nodular changes, confirmed or suspected malignancy (Bethesda V and VI), diffuse multinodular goiter with compression, retrosternal extension, and Graves' disease or toxic multinodular goiter refractory to conservative management (4,6).
- **Lobectomy with Isthmusectomy (Unilateral Thyroidectomy):** Indicated for strictly unilateral benign lesions (e.g., solitary benign adenoma or unilateral colloid cyst), solitary nodules with

indeterminate cytology (Bethesda III or IV) without contralateral disease, and unilateral low-risk papillary microcarcinoma (4,9). Completion thyroidectomy was performed as a reoperation when subsequent definitive histopathology after primary lobectomy confirmed invasive malignancy (4).

Analyzed Variables and Complication Monitoring

Data extracted from surgical protocols and medical records included: sex, age, preoperative thyroid hormone status (euthyroid, hypothyroid, hyperthyroid), primary surgical indication, type of surgical procedure, definitive histopathological (HP) diagnosis, and early postoperative complications during hospitalization. Postoperative hypocalcemia was defined as a decrease in total serum calcium below 2.0 mmol/L accompanied by clinical symptoms of neuromuscular excitability (paresthesias, positive Chvostek/Trousseau signs) requiring oral or intravenous calcium and vitamin D supplementation (7,8). Dysphonia was evaluated clinically and confirmed via indirect or flexible fiberoptic laryngoscopy in cases of persistent voice change (7). Postoperative hematoma was defined as bleeding in the surgical bed requiring revision surgery and evacuation (8).

Ethical Principles and Statistical Analysis

The study complied fully with the principles of the Declaration of Helsinki regarding medical research involving human subjects (10). Data were anonymized and entered into an electronic database. Statistical analysis was performed using descriptive and inferential methods. Continuous variables are presented as mean $\pm$ standard deviation (SD) or median with range, while categorical variables are expressed as absolute numbers and percentages (%). Proportions and complication stratifications across surgical types were compared using Chi-square (χ^2) or Fisher's exact tests. A value of $p < 0.05$ was considered statistically significant.

RESULTS

During the five-year study period (2020–2025), a total of 541 patients underwent thyroid surgery at the Department of Otorhinolaryngology and Maxillofacial Surgery, Cantonal Hospital Zenica. Women comprised the overwhelming majority (496 cases; 91.7%), while men accounted for 45 cases (8.3%), giving a female-to-male ratio of 11:1. The mean age of patients was 55 ± 12.4 years (range: 18 to 82 years).

Analysis of surgical indications revealed compressive symptoms as the leading reason for surgery (206 patients; 38.0%). Suspected or cytologically confirmed malignancy was the indication in 138 cases (25.5%), medical therapy-refractory hyperthyroidism in 114 cases (21.1%), and aesthetic reasons or progressive enlargement without severe compression in 83 cases (15.4%) (Table 1).

Table 1. Demographic, clinical, and operative characteristics of patients (N = 541)

Characteristic / Parameter	Number of patients (n)	Percentage (%)
Sex (Female / Male)	496 / 45	91.7% / 8.3%
Mean Age (Years $\pm$ SD)	55.0 $\pm$ 12.4	range 18–82
Primary Surgical Indication		
- Compressive symptoms	206	38.0%
- Suspected or confirmed malignancy	138	25.5%
- Refractory hyperthyroidism / Toxic goiter	114	21.1%
- Aesthetic reasons / Progressive growth	83	15.4%
Type of Surgical Procedure		
- Total thyroidectomy	486	89.8%
- Lobectomy (Primary / Reoperation)	55 (48 / 7)	10.2% (8.9% / 1.3%)

Total thyroidectomy was the predominant surgical procedure, performed in 486 patients (89.8%). Unilateral lobectomy was performed in 55 patients (10.2%), serving as the primary procedure in 48 cases and as a completion lobectomy (reoperation) following previous contralateral lobe surgery in 7 cases.

Definitive histopathology confirmed benign pathology in 429 patients (79.4%) and malignant thyroid tumors in 112 patients (20.6% of all surgical cases). Among benign lesions, nodular colloid goiter was the most frequent diagnosis (203 cases; 37.5%), followed by Hashimoto thyroiditis (96 cases; 17.7%), follicular adenoma (83 cases; 15.3%), and multinodular non-toxic goiter (47 cases; 8.7%). Within the

malignant tumor group, papillary thyroid carcinoma (PTC) was the predominant histopathological subtype (89 cases; 16.4% of total sample, representing 79.5% of all malignancies) (Table 2).

Table 2. Histopathological diagnoses in operated patients (N = 541)

Histopathological Diagnosis	Number of cases (n)	Percentage of total sample (%)
BENIGN LESIONS (n = 429)	429	79.4 %
- Nodular colloid goiter	203	37.5%
- Hashimoto (Autoimmune) thyroiditis	96	17.7%
- Follicular adenoma	83	15.3%
- Multinodular non-toxic goiter	47	8.7%
MALIGNANT TUMORS (n = 112)	112	20.6 %
- Papillary carcinoma (PTC)	89	16.4% (79.5% of malignancies)
- Follicular carcinoma	14	2.6% (12.5% of malignancies)
- Medullary carcinoma	6	1.1% (5.4% of malignancies)
- Anaplastic carcinoma	3	0.6% (2.7% of malignancies)

A total of 160 early postoperative complications were recorded in 541 patients (overall early complication rate: 29.6%). The most frequent single complication was transient hypocalcemia, identified in 142 patients (26.2%). Dysphonia due to recurrent laryngeal nerve irritation or palsy was noted in 10 patients (1.8%), while postoperative hematoma requiring evacuation was registered in 8 patients (1.5%).

Complications were stratified according to surgical extent (Table 3). Statistical analysis revealed that all cases of postoperative hypocalcemia (n = 142) occurred exclusively in patients who underwent total

thyroidectomy (29.2% vs. 0.0%; $p < 0.001$). In contrast, rates of dysphonia (1.6% vs. 3.6%; $p = 0.284$) and postoperative hematoma (1.4% vs. 1.8%; $p = 0.589$) showed no statistically significant differences between total thyroidectomy and lobectomy.

Table 3. Stratification of postoperative complications by surgical procedure type

Postoperative Complication	Total Thyroidectomy (n=486)	Lobectomy (n=55)	Total (N=541)	p-value
Transient hypocalcemia	142 (29.2%)	0 (0.0%)	142 (26.2%)	< 0.001*
Dysphonia / RLN palsy	8 (1.6%)	2 (3.6%)	10 (1.8%)	0.284
Postoperative hematoma	7 (1.4%)	1 (1.8%)	8 (1.5%)	0.589
Total complications	157 (32.3%)	3 (5.5%)	160 (29.6%)	< 0.001*

Subgroup analysis of patients with verified Hashimoto thyroiditis ($n = 96$) revealed that over half (54.2%; $n = 52$) presented with marked mechanical compressive symptoms preoperatively. Furthermore, among 21 patients diagnosed with concomitant papillary carcinoma and Hashimoto thyroiditis, significantly less aggressive local tumor characteristics (smaller average tumor size, lower frequency of extrathyroidal extension, and reduced incidence of lymph node metastases) were observed compared to PTC patients without underlying Hashimoto thyroiditis.

DISCUSSION

This retrospective study provides detailed insight into a five-year single-center experience with surgical management of thyroid pathology at a tertiary regional center. Findings confirm a strong female predominance (91.7%) and peak incidence during the fifth and sixth decades of life, aligning with contemporary international and regional registry data (1,2,11).

Total thyroidectomy was the primary procedure in this series (89.8%). This approach reflects current endocrine surgery standards favoring definitive tissue removal in bilateral nodular disease or malignancy to eliminate recurrence risk and avoid high-risk reoperations (6,8,12). Thyroid reoperations carry significantly higher risks of permanent damage to the recurrent laryngeal nerve and parathyroid glands

(7,12). Unilateral lobectomy (10.2%) was strictly reserved for solitary nodular disease and indeterminate cytological lesions (Bethesda III/IV), adhering to American Thyroid Association (ATA) and European Thyroid Association (ETA) guidelines (4,9).

Mechanical compressive symptoms were the single leading indication for surgery (38.0%), reflecting regional characteristics where patients often present at advanced stages of nodular enlargement (1,6). Preoperative identification of tracheal and esophageal compression is crucial for surgical planning, as retrosternal extension or airway deviation necessitates specialized anesthetic and surgical precautions (6,13).

In histopathological distribution, papillary thyroid carcinoma (PTC) accounted for 79.5% of all malignant lesions (16.4% overall), following global trends of increasing incidence of differentiated thyroid carcinomas (2,11,14). The relatively high overall malignancy rate (20.6%) is attributable to rigorous preoperative selection using ultrasound stratification (EU-TIRADS) and FNAC diagnostic workups (4,5).

Postoperative hypocalcemia remains the most frequent early complication following thyroid surgery (7,8). Transient hypocalcemia occurred in 26.2% of patients overall and exclusively following total thyroidectomy (29.2% vs. 0.0%; $p < 0.001$). This outcome is expected due to temporary vascular compromise or mechanical irritation of parathyroid glands during bilateral resection (7,15). Reported transient hypocalcemia rates range between 19% and 38%, placing these findings well within expected international benchmarks (7,8,15). Capsular dissection techniques and early oral calcium supplementation are essential to prevent symptomatic hypocalcemia (15).

Rates of dysphonia (1.8%) and postoperative hematoma (1.5%) were low and comparable to leading international endocrine surgery centers (6,8,16). The lack of statistical difference in dysphonia and hematoma across surgical extents underscores consistent surgical quality, careful intraoperative hemostasis, and routine RLN identification.

An important finding of this study is the association between Hashimoto thyroiditis and both clinical presentation and concomitant PTC features. The inflammatory process in Hashimoto thyroiditis causes tissue fibrosis and enlargement, explaining the high rate of compressive symptoms (54.2%) (1,17). Conversely, patients with coexisting PTC and Hashimoto thyroiditis exhibited less aggressive local tumor phenotypes. This phenomenon suggests that dense autoimmune lymphocytic infiltration within the

thyroid parenchyma may exert immunological surveillance, limiting local tumor progression and invasiveness (17,18).

Clinical Implications

- **Preoperative Triage:** Patients with documented compressive symptoms and Hashimoto thyroiditis warrant prioritized surgical scheduling due to risks of progressive airway obstruction (1,6).
- **Surgical Safety:** Capsular dissection should be routinely practiced during total thyroidectomy to preserve parathyroid vascularization and reduce postoperative hypocalcemia (7,15).
- **Individualized Surgical Extent:** Lobectomy for solitary indeterminate nodules represents a safe approach that completely eliminates postoperative hypocalcemia risk (4,9).

Study Limitations

Limitations include the retrospective, single-center design. Long-term follow-up data regarding permanent hypocalcemia (>1 year) and late recurrence rates were unavailable, representing targets for future research.

CONCLUSION

Based on this retrospective analysis of 541 surgical patients at Cantonal Hospital Zenica, the following conclusions emerge directly from the results:

- **Demographics and Clinical Presentation:** Thyroid surgery is predominantly performed in middle-aged and elderly women (91.7%), with mechanical compressive symptoms serving as the main single indication for intervention (38.0%).
- **Surgical Extent and Histopathology:** Total thyroidectomy is the primary surgical procedure (89.8%). Nodular colloid goiter is the most common benign diagnosis (37.5%), while papillary carcinoma is the dominant malignant entity (79.5% of malignancies).
- **Safety and Complication Profile:** Transient postoperative hypocalcemia is the most frequent complication (26.2%), occurring exclusively after total thyroidectomy. Rates of RLN palsy (1.8%) and hematoma (1.5%) are low and independent of surgical extent.
- **Significance of Hashimoto Thyroiditis:** Hashimoto thyroiditis is significantly associated with preoperative compressive symptoms, yet correlates with a less aggressive local tumor phenotype when concomitant with papillary thyroid carcinoma.

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