

Trends in thyroid surgery from 2015 to 2025: a retrospective analysis at a regional general hospital

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Aim To evaluate demographic characteristics, histopathological distribution, and temporal trends in thyroid surgery over a 10-year period at a single regional otorhinolaryngology department.

Methods This retrospective single-center study enrolled all patients who underwent thyroid surgery at the Department of Otorhinolaryngology, Dr. Josip Benčević General Hospital, Slavonski Brod, Croatia, from 2015 to 2025. Data were collected on patients' demographic characteristics, histopathological findings, and temporal trends in surgical procedures.

Results The study enrolled 742 patients (85.3% women) with a median age of 55 years (range 14-85). Overall, 71.3% of patients had benign thyroid disease, most commonly thyroid follicular nodular disease. Malignant tumors were diagnosed in 28.7% of patients, predominantly papillary thyroid carcinoma (91.5%). Patients with malignant tumors were predominantly older. In patients with malignant disease, total thyroidectomy was the most frequently performed procedure. During the study period, the number of total thyroidectomies increased, the number of completion thyroidectomies decreased, while the number of lobectomies did not significantly change. The annual number of thyroid surgeries varied across the study period, with the highest operative volumes recorded in 2024 and 2025.

Conclusion This study provides a long-term overview of thyroid surgical practice in a single otorhinolaryngology department. Patient demographics and histopathological distribution in our patients were consistent with published data. Surgical volume and operative patterns varied across the study period.

INTRODUCTION

Thyroid nodules are highly prevalent in the general adult population. Ultrasound studies show that more than half of adults develop one or more thyroid nodules during their lifetime, with only a small proportion of these nodules being malignant (1). Nevertheless, the high prevalence of thyroid nodules results in numerous diagnostic evaluations and surgical procedures, making thyroid surgery one of the most frequently performed endocrine operations. Global epidemiological data show a steady increase in thyroid cancer incidence. Thyroid cancer was the seventh most common malignancy worldwide in 2022, whereas mortality remains low (2). Similar trends are observed in Croatia, with an increased annual incidence of papillary carcinoma (3). In 2019, thyroid cancer was the fifth most common malignant tumor among Croatian women, accounting for 6% of all female malignancies (4). Ten-year cancer-specific survival rates remained high, reaching 98.6% for papillary and 89.8% for follicular carcinoma (5).

The increasing use of high-resolution neck ultrasonography, including its incorporation into routine health check-ups, has resulted in more frequent detection of asymptomatic thyroid nodules. This has contributed to overdiagnosis, particularly of small papillary thyroid carcinoma (6). Current guidelines recommend fine-needle aspiration only for the nodules meeting predefined clinical and sonographic criteria, supported by risk-stratification systems such as EU-TIRADS (1,7). Cytological evaluation using the Bethesda System remains central when considering surgical management. Indeterminate cytological categories are increasingly managed with active surveillance rather than immediate surgery (8). However, uncertainty related to indeterminate findings and the need for repeated follow-up may contribute to a preference for surgical management in some cases.

The organization of thyroid surgical care differs internationally. Thyroidectomy may be performed by general or endocrine surgeons as well as otorhinolaryngologists (9). In Croatia, thyroid surgery is traditionally performed within otorhinolaryngology departments, which provides a specific institutional context for the present study.

Published Croatian data on thyroid surgery remain limited and predominantly originate from tertiary referral centers or focus on selected outcomes. In this context, the current study aimed to evaluate demographic characteristics, histopathological distribution, and

temporal trends in thyroid surgery over a 10-year period at a single regional otorhinolaryngology department.

PATIENTS AND METHODS

We retrospectively reviewed the medical records of all consecutive patients who underwent thyroid surgery at the Department of Otorhinolaryngology, Dr. Josip Benčević General Hospital in Slavonski Brod, Croatia, a regional general hospital serving approximately 50,000 inhabitants. The hospital's electronic medical database was searched to identify all consecutive thyroid surgeries performed from January 1, 2015, to November 1, 2025. Duplicate database entries were excluded, and each patient was included only once regardless of staged procedures. The study was approved by the Institutional Ethics Committee of Dr. Josip Benčević General Hospital (04000000/25-18) and conducted in accordance with the Declaration of Helsinki.

Clinical, surgical, and histopathological data were extracted. The collected variables included age, sex, year of surgery, final histopathological diagnosis, and, for malignant tumors, type of surgical procedure.

Histopathological findings were classified as benign or malignant. Benign diseases included thyroid follicular nodular disease, follicular adenoma, oncocytic adenoma, thyroiditis, and other non-malignant conditions. Malignant tumors included papillary, follicular, oncocytic, medullary, and anaplastic carcinomas.

The type of surgical procedure was recorded for malignant tumors. Procedures were classified as lobectomy, total thyroidectomy, or completion thyroidectomy. Completion thyroidectomy was defined as the removal of the contralateral lobe following an initial lobectomy, typically after histopathological confirmation of malignancy.

Statistical analysis

Categorical data are summarized as counts and percentages, while continuous data are presented as medians and ranges. Differences in age between patients with benign and malignant disease were evaluated using the Mann-Whitney U test. Differences in categorical variables were assessed using the chi-square test. Temporal variation in the annual distribution of benign and malignant diseases and in operative techniques was assessed using the chi-square test. Monotonic trends over time were evaluated using Spearman's rank

correlation coefficient. A p-value < 0.05 was considered statistically significant. Statistical analysis was conducted with SPSS 21.0 (IBM Corp., Armonk, NY, USA).

RESULTS

A total of 777 thyroid surgery records were initially identified. After removing duplicate entries, 742 unique patients remained in the final analysis. The cohort was predominantly female (n=633, 85.3%), with a broad age range (median age 55; range 14-85 years). Four patients (0.5%) were younger than 18 years.

Overall, 529 patients (71.3%) had benign thyroid disease and 213 patients (28.7%) had malignant tumors. Patients with malignant tumors were significantly older than those with benign disease (Mann-Whitney $U=49107.5$, $p=0.006$). Female predominance was observed in both groups; however, malignant disease was more common in men ($\chi^2 = 8.489$, $p = 0.004$).

The spectrum of benign histopathological diagnoses is presented in Table 1. The most frequent type of benign thyroid disease was thyroid follicular nodular disease (63.1%), followed by follicular adenoma and Hashimoto thyroiditis. Other benign lesions were observed infrequently.

Among the 213 patients with malignant disease, the predominant type was papillary carcinoma, whereas follicular, medullary, oncocytic, and anaplastic carcinomas occurred sporadically (Table 2).

TABLE 1. Benign histopathological thyroid diagnoses in patients who underwent thyroid surgery in the study period (N = 529)

Diagnosis	n	%
Thyroid follicular nodular disease	334	63.1
Follicular adenoma	90	17.0
Hashimoto's thyroiditis	63	11.9
Oncocytic adenoma	16	3.0
Parathyroid adenoma	14	2.6
Thyroiditis (nonspecific)	6	1.1
Follicular tumor of uncertain malignant potential	1	0.2
Intrathyroid branchial cleft-like cyst	1	0.2
Non-invasive follicular thyroid neoplasm with papillary-like nuclear features	1	0.2
Unspecified/missing data	3	0.6
Total	529	100

TABLE 2. The types of malignant thyroid cancer in patients who underwent thyroid surgery in the study period (N = 213)

Type of thyroid cancer	n	%
Papillary	195	91.5
Follicular	5	2.3
Medullary	5	2.3
Oncocytic (Hürthle cell)	6	2.8
Anaplastic	2	0.9
Total	213	100

The proportion of patients with benign and malignant disease varied significantly across the study period ($\chi^2 = 31.416$, $p = 0.001$). However, the annual proportions of malignant tumors followed no significant monotonic trend (Spearman $\rho = 0.418$, $p = 0.201$). The number of patients per year is presented in Figure 1.

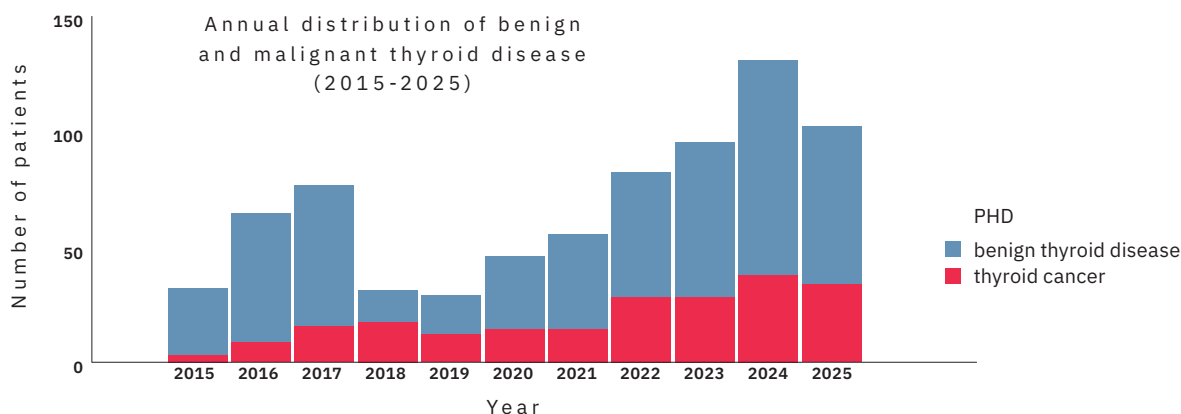


FIGURE 1. The number of patients with benign (blue) and malignant (red) thyroid disease per year from 2015 to 2025. Abbreviations: PHD – pathohistological diagnosis.

Surgical procedure data were available for 211 of 213 malignant cases, as two anaplastic carcinomas were unresectable. The most frequently performed procedure was total thyroidectomy, followed by lobectomy and completion thyroidectomy (Table 3).

TABLE 3. Surgical procedures performed in patients with malignant thyroid disease (N = 213*)

Surgical procedure	n	%
Total thyroidectomy	101	47.9
Lobectomy	59	28.0
Completion thyroidectomy	51	24.2
Total	211	100

* Two patients with anaplastic carcinoma who underwent a diagnostic biopsy only were excluded.

The annual number of thyroid surgeries fluctuated markedly throughout the study period. The temporal variation was related to institutional and external factors. Surgical activity was lowest between 2018 and 2021, but it substantially increased in 2024 and 2025. A significant positive monotonic trend in overall surgical volume was identified across the study period (Spearman $\rho = 0.700$, $p = 0.016$).

The distribution of types of surgical procedures among patients with malignant tumors varied significantly across years ($\chi^2 = 49.86$, $p < 0.001$). A significant positive monotonic trend in the proportion of total thyroidectomies was observed (Spearman $\rho = 0.820$, $p = 0.002$), whereas completion thyroidectomy demonstrated a significant decreasing trend ($\rho = -0.642$, $p = 0.033$). No significant temporal trend was detected for lobectomy ($\rho = -0.518$, $p = 0.102$).

DISCUSSION

This study provides a long-term overview of thyroid surgical practice in a single otorhinolaryngology department. Patients’ demographics and histopathological distribution were consistent with published data. Surgical volume and operative patterns varied across the study period. The demographic characteristics of our study sample followed typical patterns for patients with thyroid disease. Female patients predominated. More frequent participation of women in preventive and routine health examinations may further contribute to the detection of thyroid nodules (10). Although thyroid surgery in our sample was performed predominantly in

women, malignant tumors were more frequent in men, a pattern well documented in previous studies (3,5). Patients with malignant tumors were older than patients with benign disease, consistent with established risk profiles for thyroid carcinoma (11).

The majority of benign lesions in our cohort were classified as thyroid follicular nodular disease, a term introduced in the 2022 WHO classification for hyperplastic and involutional changes traditionally referred to as multinodular goiter (12). Among malignant tumors, papillary thyroid carcinoma accounted for more than 90% of cases, consistent with both global and Croatian registry data (2,3,5). Other histological subtypes, including follicular, medullary, oncocytic, and anaplastic carcinoma, were observed sporadically.

The annual number of thyroid surgeries considerably fluctuated over the study period. The lowest operative volumes were recorded in 2018 and 2019, when a smaller number of specialists in the department limited surgical capacity. In the following years, the introduction of neck ultrasonography to the department improved diagnostic accessibility and increased the number of patients who were referred for surgery. At the same time, preventive health examinations, including neck ultrasonography, became more available in the local community, which led to more frequent detection of thyroid nodules. The number of procedures during 2020 and 2021 reflects the conditions during COVID-19 pandemic, when the number of elective surgeries decreased both nationally and internationally (13,14). After a full surgical capacity was restored, operative volume increased, reaching its highest levels in 2024 and 2025.

In patients with malignant disease, total thyroidectomy was the most frequently performed operation, consistent with traditional surgical practice. Although recent guidelines support lobectomy in selected low-risk papillary carcinomas (1,7), its application in everyday practice remains limited, and lobectomy rates in our cohort remained relatively stable over time. The increasing proportion of total thyroidectomies observed in the later study years may reflect a combination of institutional practice patterns and a preference for definitive surgical management rather than overtreatment *per se*, particularly given that this study did not assess long-term oncologic outcomes and complication rates. Conversely, the decline in the number of completion thyroidectomies likely reflects improvements in preoperative diagnostic

assessment, including wider use of standardized ultrasound risk-stratification systems and more accurate cytological evaluation. As a result, malignancy is less often identified only after initial lobectomy, which reduces the need for staged procedures. Overall, these findings reflect the evolution of thyroid surgical practice within a regional clinical setting.

The strengths of this study include a large, unselected sample representing all patients who underwent thyroid surgery within a defined region, as well as a long study period that allowed evaluation of temporal trends. Published Croatian data on thyroid surgery remain limited and predominantly originate from tertiary referral centers or focus on selected outcomes; therefore, our study provides a long-term regional perspective on everyday surgical practice within a non-tertiary otorhinolaryngology department. Nevertheless, several limitations should be acknowledged. Due to the single-center setting, the findings may not be generalizable. Furthermore, long-term oncologic outcomes and postoperative complication rates were not assessed, which limits conclusions about treatment effectiveness. Finally, the indications for surgery, such as compressive symptoms, tumor size, cytological findings, or patient preference, were not systematically recorded and therefore were not analyzed.

In conclusion, this study offers a long-term overview of thyroid surgery in a single otorhinolaryngology department, demonstrating that surgical practice is influenced not only by guidelines but also by organizational and diagnostic factors. In patients with malignant disease, total thyroidectomy remained the predominant procedure, while completion thyroidectomy declined over time, likely due to improved preoperative diagnostic assessment. These findings provide insights into thyroid surgical practice and highlight the importance of contextual factors when interpreting surgical trends.

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Ethical approval

Granted by the Ethics Committee of Dr. Josip Benčević General Hospital (04000000/25-18).

Declaration of authorship

IPM, KVK conceived and designed the study; BGB, DD, TS acquired the data; AM analyzed and interpreted the data; AM, IPM, KVK drafted the manuscript; BGB, DD, TS critically reviewed the manuscript for important intellectual content; all authors gave approval of the version to be submitted; all authors agree to be accountable for all aspects of the work.

Competing interests

All authors have completed the Unified Competing Interest form at www.icmje.org/coi_disclosure.pdf (available on request from the corresponding author) and declare: no support from any organization for the submitted work; no financial relationships with any organizations that might have an interest in the submitted work in the previous 3 years; no other relationships or activities that could appear to have influenced the submitted work.

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