

# Complications of Thyroid Surgery-Can We Further Minimize the Risk?

ANA LAURA MANDA<sup>1</sup>, SANDA AMELIA DRACEA<sup>2</sup>, ANA LAURA DIMA<sup>1</sup>,  
DRAGOS VIRGIL DAVITOIU<sup>3</sup>, DANUT VASILE<sup>3</sup>, DANIEL IULIAN VOICULESCU<sup>3</sup>

<sup>1</sup>Carol Davila University of Medicine and Pharmacy Bucharest Doctoral School, Department of Surgery

<sup>2</sup>University of Medicine and Pharmacy of Craiova, Department of Biophysics

<sup>3</sup>Carol Davila University of Medicine and Pharmacy Bucharest, Department of Surgery

**ABSTRACT:** Thyroid surgery is nowadays a mostly safe and standardized procedure, with low complication and mortality rates. The specific complications of thyroid surgery are lesion of the recurrent laryngeal nerve (RLN), hypoparathyroidism, either transient or permanent, and hemorrhage that can be in some cases life-threatening; even if not, the impact on the quality of life can be negative. The identification of risk factors for complications of thyroid surgery and development of strategies for reducing morbidity are important for the thyroid surgeon. We conducted a retrospective study on a database of 60 patients operated for a thyroid disease in a period of two years in the setting of a non-specialized general emergency hospital in both general surgery department and thoracic surgery department. The main complication was transient hypoparathyroidism (defined by lower than 8mg/dl serum calcium postoperatively)-18.33% of the group, followed by cervical minor hematoma-5.00% of cases and RLN injury in one case-1.67%. Regression analysis showed type of thyroid surgery (p-value 0.0471), histopathology type of disease (p-value 0.0566) and difficulty of surgery defined by operative time (p-value 0.0494) as the risk factors for postoperative complications, of which only the last one can be modifiable by some extent. Identifying and minimizing the risk factors of difficult surgery might improve also complication rates.

**KEYWORDS:** Complications of thyroid surgery, hypoparathyroidism, difficult thyroidectomy.

## Introduction

Thyroid surgery's history is linked to the evolution of modern surgery and development of techniques and equipment.

Although is nowadays the most commonly performed endocrine surgery worldwide, there was a time when it was prohibited due to high mortality rates of up to 40%.

The standardized surgical procedure for thyroidectomy was mainly perfected in the late 1900s by Billroth, Kocher and Halsted and its main surgical steps and considerations are still of use today; as a result of both standardization and modern medical techniques and therapies the mortality rate nowadays is below 1%.

Nonetheless, complications do occur, but with a reduced frequency. [1-3]

The specific complications of thyroid surgery are lesion of the recurrent laryngeal nerve (RLN), hypoparathyroidism, either transient or permanent, and hemorrhage [1-3].

Lesions of the RLN is the most feared complication due to its impact on quality of life, including hoarseness, dysphonia and in rare cases respiratory insufficiency by vocal fold paralysis.

Fortunately, permanent lesions of RLN by either cutting or crushing the nerve are a rare occurrence, accounting for less than 1% of thyroid surgery.

Transient impaired fold mobility occurrence ranges from 1.8% to 2.6% or even higher [1-6].

Hypoparathyroidism is the main complication after thyroid surgery, accounting for up to 50% of thyroid surgery as temporary postoperative complication and up to 10% as a permanent condition, with negative impact on the quality of life [1,7-11].

Hemorrhage in the postoperative setting is a rare occurrence of less than 5% in most studies, but cervical compressive hematoma can be a life-threatening complication that needs immediate recognition and treatment [1,3,12,13].

Thus, identification of risk factors for complications of thyroid surgery and development of strategies for reducing morbidity are important for the thyroid surgeon.

## Material and Methods

We conducted a retrospective study on a database of 60 patients operated for a thyroid condition in a period of two years from 01.01.2023 to 31.12.2024; the setting was the general surgery department and the thoracic surgery department of a non-specialized general emergency hospital.

All patients signed standard informed consent that included usage of data for studies.

Operations were performed both by thyroid experienced surgeons and less experienced

surgeons (as defined in literature-with less than 25 thyroidectomies per year).

Inclusion criteria were thyroid surgery and exclusion criteria were lack of all data collected.

Data was collected from charts, both surgery department and anesthesiology and operating protocol registry: admission and discharge diagnosis, comorbidities, anatomopathological results, total hospital stay and postoperative stay, the presence of complications; imagistic studies recording both volume and structural data of the thyroid parenchyma; preoperative assessment including thyroid function tests (dosage of free T3 and free T4 levels and TSH), dosage of blood levels of calcium and magnesium, imagistic studies of the neck region, BMI, and anesthesiology exam.

In addition, operative time was collected from the anesthesiology chart, defined by the time frame between incision and closure of the wound.

As for the surgical technique, most patients underwent total extracapsular thyroidectomy (with or without cervical lymphadenectomy) with identification of RLN and the parathyroid glands and careful hemostasis; drains were used.

A few underwent lobectomies and fewer revision thyroidectomy with modified lymphadenectomy.

The endpoint of the study was the presence of one or more postoperative complications:

- recurrent laryngeal nerve (RLN) injuries defined by hoarseness and dysphonia;
- hypoparathyroidism defined either by the need for supplementary calcium and magnesium therapy or calcium and magnesium blood values under the normal range;

- and hemorrhage with cervical hematoma.

The aim was to identify factors that can predict development of a complication in the preoperative setting of thyroid surgery.

Statistical analysis-Microsoft Excel (Microsoft Corp., Redmond, WA, USA) was used for data processing, together with the IBM SPSS Statistics 20.0 software (IBM Corporation, Armonk, NY, USA).

The data obtained was recorded in Microsoft Excel files, then statistically processed in order to analyze the relationships between clinical and paraclinical data in the study group.

The descriptive analysis of the study group, according to different parameters, was done by computing percentages, for qualitative data, or the fundamental statistical parameters, mean and standard deviation for numerical data.

SPSS was used to perform data normality tests (Shapiro-Wilks and Anderson-Darling) and complex statistical tests (Chi-squared test, Mann-Whitney test).

The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Ethics Committee of University Emergency Hospital Bucharest (protocol code 73983/14.12.2022).

## Results

After the exclusion of cases which had incomplete data a total of 60 patients that underwent thyroid surgery were enrolled. The descriptive statistics is detailed in Table 1.

**Table 1. Descriptive statistics of the group.**

Variable	Category	No. cases	Percentage
Total		60	100.00%
Gender	Females	44	73.33%
	Males	16	26.67%
Admission diagnosis	Basedow-Graves' disease (BG)	3	5.00%
	Multinodular goiter (MNG)	34	56.67%
	Thyroid nodule (TN)	11	18.33%
	Differentiated thyroid carcinoma (FNA confirmed) (DTC)	12	20.00%
	Multinodular goiter, euthyroid	26	43.33%
Functional admission diagnosis	Hyperthyroidia	11	18.33%
	Thyroid nodule, euthyroid	11	18.33%
	Differentiated thyroid carcinoma (FNA confirmed), euthyroid	12	20.00%
Thyroid functional treatment	Thyroid hormone replacement	11	18.33%
	Antithyroid drugs	13	21.67%
	None	36	60.00%
Ultrasound	Yes	49	81.67%
	No	11	18.33%
CT scan	Yes	18	30.00%
	No	41	68.33%
Ultrasound volume	Normal (<20ml)	4	6.66%
	Goiter (20-50ml)	39	65%
	Very large goiter (>50ml)	17	28.33%
Ultrasound structure	Multinodular	42	70.00%

	Nodular	15	25.00%
	Other (heterogenous)	3	5%
Ultrasound extra-thyroid	Compression of surrounding structures	5	8.33%
	Cervical adenopathy	3	5.00%
	None	52	86.67%
Comorbidities	Yes	38	63.33%
	No	22	36.67%
BMI	BMI<30	39	65.00%
	BMI≥30	21	35.00%
Mallampati score	1	15	25.00%
	2	31	51.67%
	3	13	21.67%
	4	1	1.67%
ASA score	1	7	11.67%
	2	30	50.00%
	3	23	38.33%
Main surgical intervention	Total thyroidectomy (TT)	48	80.00%
	Unilateral thyroid lobectomy (TL)	8	13.33%
	Modified radical neck lymphadenectomy (MRL)	4	6.67%
Associated surgical intervention	Modified radical neck lymphadenectomy (MRL)	7	11.67%
	Parathyroidectomy	3	5.00%
	None	50	83.33%
Operative time	<180min (standard thyroidectomy)	25	41.67%
	>180min (difficult thyroidectomy)	35	58.33%
Discharge diagnosis	Basedow-Graves' disease (BG)	2	3.33%
	Multinodular goiter (MNG)	38	63.33%
	Thyroid nodule (TN)	8	13.33%
	Differentiated thyroid carcinoma (DTC)	12	20.00%
Postoperative complications	Hypoparathyroidism	11	18.33%
	Cervical hematoma	3	5.00%
	Recurrent laryngeal nerve (RLN) injury	1	1.67%
	None	45	75.00%
Histopathology	Thyroid adenoma	9	15.00%
	Basedow- graves' disease	1	1.67%
	Differentiated thyroid carcinoma (DTC)	17	28.33%
	Poorly differentiated thyroid carcinoma (PDTC)	3	5.00%
	Multinodular goiter (MNG)	26	43.33%
Histopathology category	Hashimoto disease	4	6.67%
	Benign	40	66.67%
	Malignant	20	33.33%
Postoperative hospital stay	<3 days	26	43.33%
	3 days	15	25.00%
	>3 days	19	31.66%

FNA=fine needle aspiration; BMI=body mass index; ASA=American Society of Anesthesiologists

The admission diagnosis was split in between four main categories, as shown in the table; we also considered a different approach of the functional diagnosis as euthyroid or hyperthyroid-also shown in Table 1.

Although most of the patients had euthyroid status at the time of admission, in order for this to be achieved in some cases administration of substitutive treatment or antithyroid drugs was needed, as reflected above.

The clinical assessment also recorded imagistic studies (volume split in three categories, structure and surrounding tissues), comorbidities, BMI and ASA scores as it is featured in Table 1.

In regard to surgery, most recordings were of total thyroidectomy.

7 cases also underwent concurrent modified lymphadenectomy.

A number of 8 patients underwent solely unilateral lobectomy, but with extemporaneous histology exam that prolonged operative time and 4 patients underwent revision thyroidectomy and modified lymphadenectomy for thyroid malignancies.

Operative time ranged from 120 minutes to 300 minutes, with a median of 180 minutes.

We divided the group by this threshold as we considered all above 180 minutes as difficult thyroidectomies.

Postoperative complications considered as a whole represented 25% of cases, but 18.33% was in fact transitory hypoparathyroidism resolved with ease by calcium and magnesium administration; none was a permanent condition.

Hemorrhage with cervical hematoma occurred in three cases, none of which required reintervention and there was one case of RLN injury due to tumoral invasion, with compromised function even before surgery.

As for the histopathological reports, the majority was represented by benign diseases,

primarily multinodular goiter. The second largest category was DTC.

Regarding hospital stay, we took into consideration for reference postoperative hospital stay as an indicator of the need for care and as such the time frame ranged from 1 day to 12 days, with a mean of 3.08 days and a median of 3 days.

We considered the threshold of 3 days that divided the group into three categories: less than 3 days, 3 days and more than 3 days.

We performed statistical analysis to assess the impact of different factors on the prevalence of

complications, both as a whole, and, separately, for postoperative hypoparathyroidism, as the number of cases with RLN injury and hematoma were too few to have statistical significance.

From the analysis, a few of the qualitative variables showed statistical significance for increased complications (Table 2 and Table 3, respectively), but, for the numerical variables, none could be considered as risk factors, both for complications as a whole or only hypoparathyroidism-Table 4.

**Table 2. Statistical analysis using the chi square test for qualitative data, complications as a whole, significant variables.**

Variable	Complications		p-value	
	Yes	No		
Main surgical intervention	Total thyroidectomy (TT)	11	37	0.0471
	Unilateral thyroid lobectomy (TL)	1	7	
	Modified radical neck lymphadenectomy (MRL)	3	1	
Operative time	<180 min (standard thyroidectomy)	3	22	0.0494
	>180 min (difficult thyroidectomy)	12	23	
Histopathology	Thyroid adenoma	0	9	0.0566
	Basedow-graves' disease	1	0	
	Differentiated thyroid carcinoma (DTC)	5	12	
	Poorly differentiated thyroid carcinoma (PDTC)	2	1	
	Multinodular goiter (MNG)	5	21	
	Hashimoto disease	2	2	

**Table 3. Statistical analysis using the chi square test for qualitative data, hypoparathyroidism, significant variables.**

Variable	Hypoparathyroidism		p-value	
	Yes	No		
Main surgical intervention	Total thyroidectomy (TT)	8	40	0.0168
	Unilateral thyroid lobectomy (TL)	1	7	
	Modified radical neck lymphadenectomy (MRL)	3	1	
Operative time	<180 min (standard thyroidectomy)	2	23	0.0495
	>180 min (difficult thyroidectomy)	10	25	
Histopathology	Thyroid adenoma	0	9	0.02350
	Basedow-graves' disease	1	0	
	Differentiated thyroid carcinoma (DTC)	3	14	
	Poorly differentiated thyroid carcinoma (PDTC)	2	1	
	Multinodular goiter (MNG)	4	22	
	Hashimoto disease	2	2	

**Table 4. Statistical analysis using the Mann-Whitney test for numerical data, complications as a whole.**

Variable	Complications		p Mann-Whitney
	Yes	No	
Total hospital stay	6.20±3.21	4.96±1.78	0.1907
Time from intervention to discharge	4.07±2.63	2.76±0.91	0.0637
Age	54.60±12.89	54.36±12.86	0.8176
FT3	3.59±0.84	3.48±0.67	0.6882
FT4	0.92±0.21	0.84±0.16	0.2033
TSH	3.17±4.26	1.41±0.91	0.2255
BMI	26.86±3.01	28.49±5.30	0.2937
Volume (imaging)	54.49±40.78	48.71±33.06	0.1641
Operative duration	3.23±0.70	2.98±0.87	0.2360
Calcium	9.38±0.49	9.39±0.71	0.8310
Magnesium	1.96±0.20	2.08±0.48	0.3838

## Discussions

Complications developed in 25% of cases in our study group.

The number might seem high, but is accordance with most studies nowadays [1,8,14,15], as the definition of complications of thyroid surgery includes temporary ones, that are usually easily treated and resolve in a time frame from a few days to 6 months, depending on the type of complication-usually RLN temporary injuries have a longer recuperative time [1,3-6,8,10,14].

Taking under consideration the high prevalence of hypoparathyroidism in our cohort (18.33% of patients), representing 73.33% of all complications, and the fact that there was none in the permanent hypoparathyroidism category, the figure is not so high compared to other published studies [7-11,16-22].

As we defined it, one might consider it was over-diagnosed, but we took under consideration the definition of the French Society of Endocrinology recommendations of diagnosing hypoparathyroidism after surgery as a lower than 2mmol/L (8mg/dl) serum calcium in the time frame of the first postoperative week, with or without symptoms [11].

The importance of recognizing low calcium levels in the postoperative setting of thyroid surgery lies in the fact that the symptoms, although rarely life-threatening, are very unpleasant and often have high impact on patient's quality of life; there is also the fact that the condition is easily treated if recognized with calcium, magnesium and vitamin D supplementation [8,16,19].

Bleeding and cervical hematoma, that can cause re-operation and even death, are fortunately a rare event, due to the fact that most thyroid surgeons are well accustomed to the "dry" operating field, essential in thyroid surgery both for prevention of postoperative bleeding and the correct identification and preservation of the RLN [1,2,3,5,6,12,13,23].

In our study, there were only 3 cases that developed minor cervical hematomas, none of which required reoperation; there were two older patients with prior oral anticoagulation treatment and in one case a large papillary thyroid tumor with extrathyroidal extension and cervical lymph node metastases, both of which are risk factors in prior studies [1,12,13,23].

The most dreaded complication of thyroid surgery, RLN injury, has a low occurrence rate in all studies [1-6,8].

Correct identification, usage of nerve monitoring and a dry operative field at all times are strategies that can lower the risk of injury and the consequent vocal fold paralysis.

The one case that presented RLN injury in our cohort was in fact a prior injury due to tumoral invasion of the left RLN, and cannot be considered a de facto postoperative complication.

Thus, as the hematoma and RLN injury were very few in our study there was no significant statistical conclusion to be drawn from our study group.

The statistical analysis showed only three variables that can be linked to postoperative complications after thyroid surgery.

In regard to complications as a whole, one of them, the histopathology report, had a p-value slightly higher than the confidence interval of 95%, but as it was very close to the threshold, we considered it to be of approximate significance, especially considering the hypoparathyroidism group, which constituted the main part of complications, that had a p-value in the significance interval.

Of the three, two are mostly patient related variables-surgical intervention that was appropriate for the type of disease, and histopathology report.

Difficulty of the surgical intervention defined by operative time is correlated to development of complications and can be to a certain extent modifiable by identifying its own risk factors and the need for more caution during the dissection of the thyroid gland for the difficult group, thus improving complication rates in thyroid surgery [1,8,14,15,24].

## Conclusions

Complications of thyroid surgery, although not at high occurrence rates, may impact quality of life.

We identified type of thyroid surgery, histopathology type of disease and difficulty of surgery defined by operative time as the risk factors for postoperative complications.

Identifying and minimizing the risk factors of difficult surgery might improve also complication rates.

## Conflict of interest

None to declare.

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*Corresponding Author: Sanda Amelia Drăcea, Department of Biophysics,  
University of Medicine and Pharmacy of Craiova, 2, Petru Rareș St, Craiova 200349,  
e-mail: sanda.amelia.dracea@gmail.com*