Journal of Surgery
2024, Vol. 12, No. 4, pp. 92-98
https://doi.org/10.11648/j.js.20241204.11

Research Article

Recurrent Laryngeal Nerve Injury After Thyroid Surgery at St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia

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Abstract

Background: Recurrent laryngeal nerve (RLN) injury, a dreaded complication in thyroid surgery, remains a concern even in the hands of seasoned surgeons. It stands as a significant cause for medical malpractice claims against surgeons. *Objective*: To assess Magnitude of RLN injury and associated factors in patients undergoing thyroid surgery at St. Paul's Hospital Millennium Medical College (SPHMMC), Addis Ababa, Ethiopia, from May 1st, 2021, to April 30th, 2022. *Methods*: A facility-based, observational study was conducted at SPHMMC, Addis Ababa, Ethiopia. Data was collected using a structured questionnaire designed with Google Forms. A census sampling approach was used to select the data charts to ensure a comprehensive perspective. This method ensured a representative sample of the population under study, enhancing the reliability of the results. The information was transferred to Excel and then imported into SPSS. Descriptive statistics were employed to summarize the key characteristics within the dataset concisely. Stepwise multiple logistic regression was implemented to explore the potential relationships between the independent and dependent variables. A significance level of $p < 0.05$ was adopted to identify statistically meaningful results. The findings are presented through a combination of text, tables, and figures. *Results*: The study included a total of 185 patients, with a mean ± SD age of 41.62 ± 12.72 and a median age of 40. Females constituted 78.9% of the participants. The study's key finding is a persistent RLN injury rate of 5.4% (10/185). After adjusting for other covariates, the odds of developing persistent RLN injury were found to be 30 times higher among patients who had central neck dissection than those who had not undergone central neck dissection (AOR=30.0, 95%CI=4.3,211.9, p-value=0.001). However, sex, substernal goiter, histologic finding, preoperative toxicity, extent of thyroidectomy, and identification of RLN intra-operatively were not associated with persistent RLN injury in bivariate logistic regression analysis. *Conclusion*: This study found a persistent, recurrent laryngeal nerve injury rate of 5.4% in patients undergoing thyroid surgery. Central neck dissection was the only factor significantly associated with an increased risk of recurrent laryngeal nerve injury. These findings suggest minimizing central neck dissection when feasible during thyroid surgery to reduce the risk of this complication.

Keywords

Thyroid Surgery, Recurrent Laryngeal Nerve Injury, Vocal Cord Paralysis

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Received: 18 May 2024; **Accepted:** 7 June 2024; **Published:** 3 July 2024

1. Introduction

Thyroidectomy is a surgical procedure used to excise all or part of the thyroid gland, an endocrine gland that secretes thyroid hormone. Thyroidectomy is one of the most common interventions in head and neck surgery [1]. The procedure can be used to treat malignancy, benign disease, or hormonal disease that is not responsive to conventional medical treatment [2]. It is a definitive surgical management modality for a range of thyroid disorders, such as thyroid nodules and hyperthyroidism [3, 4]. Thyroidectomy is potentially indicated in both malignant and benign pathologies, although with a high degree of selectivity [2].

Thyroidectomy, be it conventional or endoscopic, has long been associated with both minor and major complications. One of the best-known and well-described thyroid surgery complications is injury of the recurrent laryngeal nerve (RLN), a branch of the tenth cranial nerve (vagus) that innervates all the muscles of the larynx except the cricothyroid muscles [5]. This classical complication specific to thyroidectomy arises due to inadequate visualization of the nerve, anatomic variations of the course of both nerves, bleeding in the operative field, and/or postoperative edema [6]. The injury can involve only the myelin sheath (neuropraxia), or it can be axonotmesis (axonal rupture with Wallerian degeneration but with an intact neural sheath) [6].

Thyroidectomy-associated RLN injury can be unilateral or bilateral, with the latter being a rarer variant. Unilateral RLN injury is characterized by hoarseness of voice or dysphonia as a result of laryngeal paralysis with unilateral vocal cord immobility. On the other hand, bilateral RLN palsy results in dramatic symptoms such as biphasic stridor, aphonia due to the closure of the glottis, and acute life-threatening dyspnea [5, 7].

Prevention of iatrogenic RLN injury involves deliberate intraoperative identification and preservation of the RLN [8, 9]. In addition, intraoperative nerve neuromonitoring has been shown to reduce iatrogenic injury significantly. Ideally, techniques for assessing vocal fold mobility include indirect and fiberoptic laryngoscopy, while laryngeal electromyography (EMG) may be useful to distinguish vocal fold paralysis from injury to the cricoarytenoid joint secondary to intubation, and it may yield prognostic information [10].

In Africa, thyroid diseases and related surgical procedures, including thyroidectomy, are prevalent due to various factors such as iodine deficiency disorders, genetic predisposition, and exposure to environmental influences. Although thyroidectomy is an essential treatment for thyroid-related disorders, RLN injury remains a notable postoperative complication in African surgical settings. The impact of RLN injury extends beyond physical implications, affecting patients' quality of life and necessitating comprehensive care and rehabilitation.

In Ethiopia, it was described that voice change following thyroid surgery is an underreported yet common problem [11] However, although much has been documented about the rate and incidence of RLN injury following thyroidectomy in other parts of the world, only a few studies have evaluated such a complication in developing countries such as Ethiopia. Therefore, this study assessed the rate and factors of recurrent laryngeal nerve injury in post-thyroidectomy patients at St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia.

2. Methods

2.1. Study Design

A facility-based, observational study was conducted at Saint Paul Hospital Millennium Medical College in Addis Ababa, Ethiopia, from May 1/2021 to April 30th, 2022. the study included Patients who underwent thyroidectomy and have follow up for at least 6 months by the time of data collection. Patients with one or more of the following conditions were excluded from the study.

1) Patients who were intubated in the immediate postoperative period.
2) Patients whose charts were lost or incomplete.
3) Patients with pre-operative vocal cord hypomobility (paresis) or immobility (paralysis) resulting from cervical trauma, thyroid cancer, or esophageal cancer.
4) Patients who underwent concurrent laryngectomy.
5) Patients with laryngotracheal fixation or strap muscles were resected intraoperatively.

2.2. Study Procedure

The questionnaire was designed using Google Forms and administered through the same platform from eligible patients' medical records. The data collection format includes items divided into three sections (background information, preoperative, and postoperative variables), and it was adapted from related literature. Additionally, patients were contacted whenever it was appropriate for supplementary clinical and investigative details. Two professional healthcare workers were recruited and trained in data collection procedures.

2.3. Sampling Procedure

Since all patients who underwent thyroidectomy in the study period and fulfilled the inclusion criteria were included in the study, the sample size calculation was not necessary.

2.4. Statistical Analysis

A census sampling approach was employed to select the charts. Subsequently, the data collected was transferred from

Google Forms to Microsoft Excel spreadsheet and subsequently into SPSS version 27, IBM Corp for statistical analysis. Frequency and cross-tabulation were used to check for missed values and variables. Patients' background, preoperative, and intraoperative characteristics were computed using descriptive statistics such as mean ± standard deviation for continuous variables and percentage and frequencies for nominal variables.

Bivariable and multivariable logistic regression analyses were run to determine the potential factors associated with the outcome variable: the incidence of RLN injury. The multivariable logistic regression included those variables with a p-value of ≤0.25 in the bivariable logistic regression model. Odds ratios with corresponding 95% confidence intervals will be calculated, and statistical significance will be set at a p-value of <0.05. The Hosmer-Lemeshow goodness-of-fit test was run to check for the model's fitness, in which a p-value of >0.05 indicates data fitness. Finally, the study findings were presented using narratives, diagrams, tables, and figures.

3. Results

Demographic and Clinical Characteristics

In this study, a total of 185 patients were included, and the mean ± SD age of the participants was 41.62 ± 12.72, with a median age of 40. Gender distribution revealed 146 females (78.9%) and 39 males (21.1%). hypertension (HTN) was present in 10.8%. A majority of the patients, 173 (93.5%), had no prior neck surgery. Substernal goiter was identified in 10.8% of cases. Preoperative hyperthyroidism was noted in 59 (31.9%) patients. Thyroid volume evaluation indicated 70.8% (n=131) with large goiter (>20ml).

Table 1. *Preoperative variables.*

Preoperative variables		Frequency	Percent
Sex	Female	146	78.9
	Male	39	21.1
Comorbidity	HTN	20	10.8
	DM	7	3.8
	None	158	85.4
Previous surgery	Yes	12	6.5
	No	173	93.5
Substernal goiter	Yes	20	10.8
	No	165	89.2
Preop-hyperthyroidism	Yes	59	31.9
	No	126	68.1
Thyroid volume	Small	6	3.2
	Large	131	7
	Medium	131	70.8
	Undetermined	35	18.9

From a total of 185 cases in this study, 146 cases were categorized as benign (n=146). Among these subsets, the predominant lesions included Nodular Colloid Goiter, accounting for 68.1% (126 cases), whereas Thyroid Cancer represented 21.1% (39 cases) of the total cases.

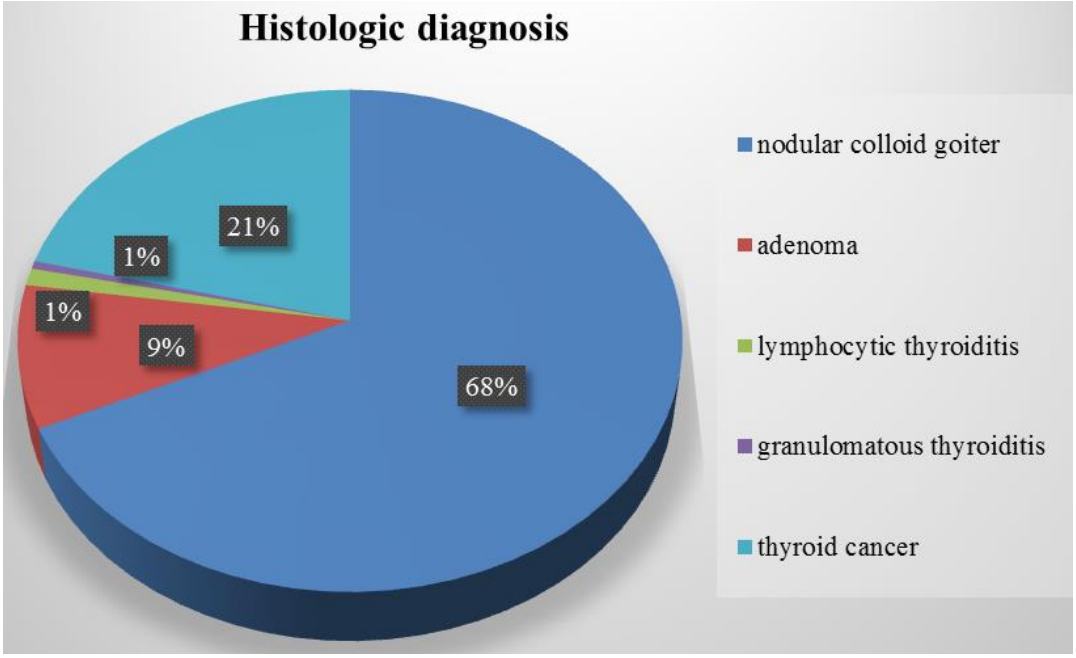

Figure 1. *Pattern of type of thyroid lesion injury among patients undergoing thyroid surgery at St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia.*

Among the diverse surgical approaches employed, Total Thyroidectomy was performed in 31.4%(n=58) of cases. The recurrent laryngeal nerve (RLN) intra-operatively was identified in 53.5% of cases (n=99). Furthermore, central neck dissection was performed in 15.1% (n=28) of cases (Table 2).

Table 2. *Intra-operative factors among patients undergoing thyroid surgery at St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia.*

Intraoperative variables		Frequency	Percent
Extent of thyroidectomy	Total	58	31.4
	Hemi thyroidectomy	47	25.4
	Near total	39	21.1
	Subtotal	37	20.0
	Isthmectomy	3	1.6
	Completion lobectomy	1	0.5
RLN injury	No	86	46.5
	Yes	99	53.5
Central neck dissection	No	157	84.9
	Yes	28	15.1

In this study, 9.7% (18 cases) reported hoarseness of voice. Among those with hoarseness of voice, 55.6% (n=10) experience persistence (table 3).

Table 3. *Post-operative factors among patients undergoing thyroid surgery at St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia.*

Postoperative variables		Frequency	percent
New onset hoarseness after post-op day 1	No	167	90.3%
	Yes	18	9.7%
Persistent hoarseness up to 6-month	No	8	44.4%
	Yes	10	33.3%
Laryngoscopy finding	Paresis unilateral	8	44.4%
	Paralysis unilateral	6	33.3%
	Paresis bilateral	2	11.1%
	Note done	2	11.1%

Using the odd ratio and 95% confidence interval, the degree of association between the independent and dependent variables was determined. As a result, bivariate logistic regression was performed for every independent variable, and multivariate logistic regression was applied to those with an a-p value less than 0.25.

After adjusting for other covariates, the odds of developing persistent RLN injury are 30 times higher among patients who had central neck dissection than those who had not undergone central neck dissection (AOR=30.0, 95%CI=4.3,211.9, p-value=0.001). However, sex, substernal goiter, histologic finding, preoperative toxicity, extent of thyroidectomy, and identification of RLN intra-operatively were not associated with persistent RLN injury in bivariate logistic regression analysis (table 4).

Table 4. *The bivariate and multivariate logistic regression of association between Persistent RLN injury and independent factors.*

Variable		Persistent RLN injury n (%)		COR (CI95%)	AOR (CI95%)	p-value
		No	Yes			
Sex	Female	141 (80.6)	5 (50)	4.2 (1.2,15.1)	0.3 (0.05,1.6)	0.2
	Male	34 (19.4)	5 (50)			
Substernal Goiter	No	159 (90.9)	6 (60)	0.2 (0.04,0.6)	0.4 (0.06,2.21)	0.3
	Yes	16 (9.1)	4 (40)			
Histologic finding	Benign	140 (80)	6 (60)	0.4 (0.1,1.4)	2.3 (0.3,15.7)	0.4
	Malignant	35 (20)	4 (40)			
Preop-toxicity	No	120 (68.6)	6 (60)	0.7 (0.2,2.5)		-
	Yes	55 (31.4)	4 (40)			
Extent of Thyroidectomy	Total	52 (29.7)	6 (60)	3.6 (0.9,13.1)	1.9 (0.3,11.8)	0.5
	Other	123 (70.3)	4 (40)			
RLN identified intra-op	No	83 (47.4)	3 (30)	0.5 (0.12,1.9)		-
	Yes	92 (52.6)	7 (70)			
Central neck dissection	No	155 (88.6)	2 (20)			0.001*
	Yes	20 (11.4)	8 (80)	31 (6.2,156.3)	30.0 (4.3,211.9)	

*Statistically significant

4. Discussion

In this study, comprising 185 patients undergoing thyroid surgery, the observed demographic and clinical characteristics align with existing literature on thyroid surgery outcomes. For instance, our findings resonate with studies done in Ethiopia and other parts of the world, indicating a higher prevalence of thyroid disorders in females, as evidenced by the gender distribution in our study (78.9% females) [9, 12-14]. The identification of comorbidities such as hypertension (10.8%) and diabetes mellitus (3.8%) is consistent with previous research highlighting the association between thyroid disorders and systemic health conditions [14, 15]. Moreover, our study emphasizes the importance of preoperative clinical toxicity assessment as 31.9% of cases were found to have preoperative clinical toxicity, corresponding to the recognition of the importance of evaluating patients' overall health before thyroid surgery. Additionally, our study's thyroid volume assessment found that most participants have medium and large volumes, comparable to a previous study [16].

In this study, most patients have benign thyroid lesions, and the predominant benign lesions, particularly Nodular Colloid Goiter, align with existing literature on thyroid pathology. Various prior studies reported that nodular colloid goiter is a common benign thyroid lesion, consistent with our findings, comprising a significant proportion of cases [9, 14, 17].

Furthermore, in our study, the notable proportion of cases categorized as thyroid cancer 21.1%, although consistent with prior research done in a tertiary university hospital in Riyadh, Saudi Arabia, 21%, is slightly higher than previous studies done in Ethiopia and Saud-Arabia, which showed 14.6% and 11.5% prevalence of thyroid cancer respectively in patients undergoing thyroidectomy [9, 17, 18]. While most of our findings align with existing literature, the specific distribution of thyroid cancer may vary across populations due to geographical and demographic differences and study sample size. Therefore, the observed higher prevalence of thyroid cancer in our study highlights the ongoing significance of thyroid pathology in diverse patients.

The distribution of surgical approaches in this study reflects the variability in thyroidectomy techniques, with Total Thyroidectomy being the most frequently employed procedure (31.4%). This finding aligns with the current literature emphasizing the increasing preference for total thyroidectomy, attributed to factors such as reduced recurrence rates and improved management of thyroid cancer [18, 19]. Furthermore, Hemi Thyroidectomy and Near Total Thyroidectomy were performed in 25.4% and 21.1% of cases, respectively. This significant utilization is consistent with their applicability in cases of unilateral pathology and the preservation of thyroid function, respectively [18, 20].

In our study, the identified rate of persistent recurrent laryngeal nerve (RLN) injury at 5.4% aligns with existing literature on RLN complications post-thyroidectomy. A study done in Saudi Arabia by Zakaria et al. reported permanent RLN injuries being 0.3%, transient injuries observed in 3.2%, and a study done in Ethiopia reported 2.5% RLN injuries, underscoring the varied nature of RLN complications [9, 14]. Our results shed light on the nuanced outcomes of RLN injury, and the documented incidence and persistence are consistent with the recognized complexity of managing RLN complications after thyroid surgery [21].

5. Conclusion

In this study, a total of 185 patients were included. the rate of persistent RLN injury is 5.4% (10/185), slightly higher than most studies. So, it can be used to guide informed consent discussions.

Only central node dissection showed a significant association with persistent RLN injury AOR 30.0 (4.3,211.9). This suggests that the sample size is small. Another study is needed to assess the association better.

6. Limitations

This study's retrospective design introduces several limitations. Due to the reliance on previously collected data, potential bias in information gathering cannot be ruled out. Prospective studies, where data is collected in real-time as the study unfolds, could offer more definitive results. Additionally, the generalizability of the findings may be limited as the study was conducted at a single center. Validation from multicenter studies would be necessary to determine applicability to a broader population. Furthermore, the relatively small sample size compared to other studies weakens the strength of the current results. Finally, the incompleteness of data in charts and logbooks presents another hurdle to drawing conclusive findings.

Abbreviations

AOR	Adjusted Odds Ratio
CI	Confidence Interval
EMG	Electromyography
HTN	Hypertension
RLN	Recurrent Laryngeal Nerve
SD	Standard Deviation
SPHMMC-St.	Paul's Hospital Millennium Medical College

Author Contributions

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Zekarias Ayalew: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Supervision, Visualization, Writing – review & editing

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Conflicts of Interest

The authors declare no conflicts of interest.

References

[1] Alyahya KA, Alarfaj AA, Alyahya AA, Alnaim AE. Indications and complications for surgical management of thyroid diseases: A single center experience. Ann Med Surg (Lond). 2022; 79: 103980. https://doi.org/10.1016/j.amsu.2022.103980

[2] Asban A, Anue A, Xie R, Chen H. Increasing use of thyroidectomy as definitive treatment for hyperthyroidism. Journal of Surgical Research. 2020; 246: 435-41. https://doi.org/10.1016/j.jss.2019.09.020

[3] Cipolla C, Graceffa G, Calamia S, Fiorentino E, Pantuso G, Vieni S, et al. The value of total thyroidectomy as the definitive treatment for Graves' disease: A single centre experience of 594 cases. J Clin Transl Endocrinol. 2019; 16: 100183. https://doi.org/10.1016/j.jcte.2019.100183

[4] Lukinović J, Bilić M. Overview of Thyroid Surgery Complications. Acta Clin Croat. 2020; 59(Suppl 1): 81-6. https://doi.org/10.20471/acc.2020.59.s1.10

[5] Christou N, Mathonnet M. Complications after total thyroidectomy. J Visc Surg. 2013; 150(4): 249-56 https://doi.org/10.1016/j.jviscsurg.2013.04.003

[6] Hayward NJ, Grodski S, Yeung M, Johnson WR, Serpell J. Recurrent laryngeal nerve injury in thyroid surgery: a review. ANZ J Surg. 2013; 83(1-2): 15-21. https://doi.org/10.1111/j.1445-2197.2012.06247.x

[7] Chandrasekhar SS, Randolph GW, Seidman MD, Rosenfeld RM, Angelos P, Barkmeier-Kraemer J, et al. Clinical practice guideline: improving voice outcomes after thyroid surgery. Otolaryngol Head Neck Surg. 2013; 148(6 Suppl): S1-37. https://doi.org/10.1177/0194599813487301

[8] Zakaria HM, Al Awad NA, Al Kreedes AS, Al-Mulhim AM, Al-Sharway MA, Hadi MA, et al. Recurrent laryngeal nerve injury in thyroid surgery. Oman Med J. 2011; 26(1): 34-8. https://doi.org/10.5001/omj.2011.09

[9] Pardal-Refoyo JL, Parente-Arias P, Arroyo-Domingo MM, Maza-Solano JM, Granell-Navarro J, Mart ńez-Salazar JM, et al. Recommendations on the use of neuromonitoring in thyroid and parathyroid surgery. Acta Otorrinolaringol Esp (Engl Ed). 2018; 69(4): 231-42. https://doi.org/10.1016/j.otorri.2017.06.005

[10] Chawaka HJ, Teshome ZB. The Underreported Postoperative Suffering after Thyroid Surgery: Dysphagia, Dysphonia, and Neck Pain-A Cross-Sectional Study. Anesthesiol Res Pract. 2023; 2023: 1312980. https://doi.org/10.1155/2023/1312980

[11] Suga Y, Abebe E. Patterns of Surgically Treated Thyroid Disease: A Two Years Review at St. Paul Hospital Millennium medical Collage, Addis Ababa, Ethiopia. Ethiop J Health Sci. 2020; 30(1): 31-6. https://doi.org/10.4314/ejhs.v30i1.5

[12] Ramos JM, Abate N, Reyes F, Belate W, Mohammed F, Gorgolas M. Thyroid surgery in a district hospital in Southern Ethiopia: experience from a rural center. World J Surg. 2013; 37(7): 1571-3. https://doi.org/10.1007/s00268-013-2029-2

[13] Aygun N, Kostek M, Unlu MT, Isgor A, Uludag M. Clinical and Anatomical Factors Affecting Recurrent Laryngeal Nerve Paralysis During Thyroidectomy via Intraoperative Nerve Monitorization. Front Surg. 2022; 9: 867948. https://doi.org/10.3389/fsurg.2022.867948

[14] Biondi B, Kahaly GJ, Robertson RP. Thyroid Dysfunction and Diabetes Mellitus: Two Closely Associated Disorders. Endocr Rev. 2019; 40(3): 789-824. https://doi.org/10.1210/er.2018-00163

[15] Liu N, Chen B, Li L, Zeng Q, Sheng L, Zhang B, et al. Recurrent Laryngeal Nerve Injury Near the Nerve Entry Point in Total Endoscopic Thyroidectomy: A Retrospective Cohort Study. Cancer Manag Res. 2021; 13: 8979-87. https://doi.org/10.2147/cmar.s338551

[16] Wondwosen M, Bekele M, Abebe K, Tantu T, Zewdu D. Factors associated with thyroidectomy complications in resource-limited settings: An observational study. International Journal of Surgery Open. 2022; 42: 100468. https://doi.org/10.1016/j.ijso.2022.100468

[17] Alsaleh N, Albaqmi K, Alaqel M. Effectiveness of hemi-thyroidectomy in relieving compressive symptoms in cases with large multi nodular goiter. Annals of Medicine and Surgery. 2021; 63: 102140. https://doi.org/10.1016/j.amsu.2021.01.088

[18] Padur AA, Kumar N, Guru A, Badagabettu SN, Shanthakumar SR, Virupakshamurthy MB, et al. Safety and Effectiveness of Total Thyroidectomy and Its Comparison with Subtotal Thyroidectomy and Other Thyroid Surgeries: A Systematic Review. J Thyroid Res. 2016; 2016: 7594615. https://doi.org/10.1155/2016/7594615

[19] Addasi N, Fingeret A, Goldner W. Hemithyroidectomy for Thyroid Cancer: A Review. Medicina (Kaunas). 2020; 56(11). https://doi.org/10.3390/medicina56110586

[20] Gambardella C, Polistena A, Sanguinetti A, Patrone R, Napolitano S, Esposito D, et al. Unintentional recurrent laryngeal nerve injuries following thyroidectomy: Is it the surgeon who pays the bill? Int J Surg. 2017; 41 Suppl 1: S55-s9. https://doi.org/10.1016/j.ijsu.2017.01.112

[21] Gunn A, Oyekunle T, Stang M, Kazaure H, Scheri R. Recurrent Laryngeal Nerve Injury After Thyroid Surgery: An Analysis of 11,370 Patients. J Surg Res. 2020; 255: 42-9. https://doi.org/10.1016/j.jss.2020.05.017