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CLINICAL UTILITY OF THE CERNEA CLASSIFICATION DURING THYROIDECTOMY: ANATOMICAL VARIATIONS OF THE EXTERNAL BRANCH OF THE SUPERIOR LARYNGEAL NERVE AND THEIR ASSOCIATION WITH POSTOPERATIVE VOICE CHANGES

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ABSTRACT

Background: Injury to the external branch of the superior laryngeal nerve (EBSLN) is a recognized but often underappreciated complication of thyroidectomy that may result in postoperative voice dysfunction. The Cernea classification provides a practical anatomical framework for identifying EBSLN variants that are at increased risk of injury during superior pole dissection. However, evidence correlating the Cernea classification with postoperative voice outcomes remains limited.

Methods: A prospective descriptive observational study was conducted among 40 consecutive patients undergoing thyroid surgery in the Department of General Surgery, Sree Balaji Medical College and Hospital, Chennai. The EBSLN was identified intraoperatively whenever feasible and classified according to the Cernea classification. Demographic characteristics, clinical diagnosis, indication for surgery, operative procedure, histopathological findings, and postoperative voice changes were recorded. The association between Cernea classification and postoperative voice changes was evaluated using Fisher's exact test.

Results: The mean age of the study population was 40.5 ± 11.4 years, with females comprising 75% of patients. Multinodular goitre was the most common clinical diagnosis (45%), while pressure symptoms were the leading indication for surgery (35%). Total thyroidectomy was performed in 87.5% of patients. The EBSLN was successfully identified in 34 patients (85%). Among the identified nerves, Cernea Type IIa was the most frequent anatomical variant (41.2%), followed by Type I (35.3%) and Type IIb (23.5%). Histopathological examination demonstrated benign thyroid disease in 82.5% of patients. Overall, postoperative voice changes occurred in 15% of patients. No patient with Cernea Type I anatomy developed postoperative voice changes, whereas voice alterations were observed in 14.3% of Type IIa and 50% of Type IIb nerves, demonstrating an increasing frequency of voice dysfunction with anatomically lower nerve courses.

Conclusion: Routine intraoperative identification of the EBSLN is feasible during thyroidectomy and facilitates recognition of anatomical variations using the Cernea classification. The higher frequency of postoperative voice changes observed among patients with Cernea Type IIb anatomy highlights the clinical utility of the Cernea classification in identifying high-risk nerve variants during superior pole dissection. Careful anatomical identification and meticulous surgical technique may contribute to improved nerve preservation and better postoperative functional outcomes.

KEYWORDS: Thyroidectomy; External branch of superior laryngeal nerve; Cernea classification; Thyroid surgery; Voice changes; Superior thyroid pole.

Introduction

Injury to the external branch of the superior laryngeal nerve (EBSLN) remains an under-recognized complication of thyroid surgery, despite significant advances in operative techniques. Cernea et al. demonstrated that the anatomical relationship between the EBSLN and the superior thyroid vessels determines the nerve's susceptibility to injury during superior pole dissection and proposed a practical classification system that continues to guide thyroid surgeons **[1]**. Subsequently, Cernea et al. emphasized that meticulous dissection and preservation of the EBSLN are essential to avoid functional voice impairment following thyroidectomy **[2]**.

The EBSLN provides the only motor innervation to the cricothyroid muscle, which increases vocal cord tension and controls voice pitch. Kierner et al. demonstrated the anatomical course of the EBSLN and highlighted its close relationship with the superior thyroid pedicle, making it particularly vulnerable during ligation of the superior thyroid vessels **[3]**. Jansson et al. reported that superior laryngeal nerve injury may occur before or after thyroid surgery and often results in subtle but clinically significant voice alterations that may remain undetected on routine laryngoscopic examination **[4]**.

Thyroidectomy remains the definitive treatment for a wide range of benign and malignant thyroid disorders, including multinodular goitre, solitary thyroid nodules, toxic goitre, and thyroid carcinoma. Advances in surgical technique and perioperative care have considerably improved the overall safety of thyroidectomy. Delbridge described meticulous capsular dissection and detailed anatomical knowledge as foundational to modern thyroid surgery, significantly reducing postoperative complications while ensuring complete disease clearance **[5]**. Randolph emphasized that preservation of the laryngeal nerves is fundamental to safe thyroidectomy, as nerve injury can substantially affect postoperative voice quality and patient quality of life **[6]**.

Anatomical variability of the EBSLN presents a significant challenge during superior pole dissection. Furlan et al. demonstrated considerable variation in the extralaryngeal course of the nerve, reinforcing the need for careful intraoperative identification **[7]**. Bergamaschi et al. reported that meticulous surgical technique is associated with lower complication rates following thyroidectomy, highlighting the importance of preserving critical neurovascular structures during surgery **[8]**.

Routine identification of the EBSLN during thyroidectomy has been advocated to minimize the risk of inadvertent injury. Friedman et al. demonstrated that deliberate intraoperative identification of the nerve improves its preservation and facilitates safer superior pole dissection **[9]**. Dionigi et al. confirmed the clinical relevance of the Cernea classification, noting that Type II variants are more frequently encountered than Type I and are associated with a greater risk of operative injury due to their proximity to the superior thyroid vessels **[10]**. Selvan et al. reported similar anatomical findings in an Indian population, further supporting the importance of anticipating anatomical variations during thyroidectomy **[6]**.

While visual identification remains central to EBSLN preservation, several adjunctive techniques have been proposed to improve intraoperative nerve recognition. Barczyński et al. demonstrated that intraoperative neuromonitoring facilitates functional identification of the EBSLN and may reduce the likelihood of nerve injury **[11]**. Cernea et al. emphasized that a detailed understanding of laryngeal nerve anatomy is essential regardless of the surgical technique employed **[12]**. Aina and Hisham similarly recommended routine recognition and preservation of the EBSLN whenever feasible to improve postoperative functional outcomes **[14]**. Randolph et al. later incorporated electrophysiological nerve monitoring into international recommendations for thyroid and parathyroid surgery, particularly in technically challenging procedures **[15]**.

Despite increasing awareness of EBSLN anatomy, postoperative voice changes continue to be reported following thyroidectomy. Friedman et al. demonstrated that patients may experience measurable voice alterations even in the absence of recurrent laryngeal nerve palsy, indicating a significant contribution of EBSLN dysfunction **[17]**. Stojadinovic et al. reported postoperative impairment in voice quality despite normal vocal cord mobility using prospective functional voice assessment **[18]**. Sinagra et al. also observed postoperative voice changes following thyroidectomy that could not be explained solely by recurrent laryngeal nerve injury **[19]**. Lombardi et al. demonstrated that both voice and swallowing functions may be affected after thyroid surgery, even when , even with procedures are uncomplicated **[20]**. Behlau and Oliveira highlighted that these subtle functional deficits may significantly influence patient satisfaction following thyroidectomy **[21]**, and Sataloff emphasised their particular importance in individuals with high vocal demands **[22]**.

Although numerous anatomical studies have described the EBSLN and several investigators have evaluated techniques for its preservation, relatively few studies have directly correlated intraoperative Cernea classification with postoperative voice outcomes. Additionally, data from Indian patients undergoing thyroidectomy remain limited. Therefore, the present study was undertaken to evaluate intraoperative identification of the external branch of the superior laryngeal nerve, describe its anatomical distribution according to the Cernea classification, and determine its association with postoperative voice changes in patients undergoing thyroidectomy. The study also documents the demographic profile, clinical indications, operative procedures, and histopathological findings to provide a comprehensive assessment of patients undergoing thyroid surgery.

AIM

To evaluate the clinical utility of the Cernea classification during thyroidectomy by assessing the anatomical variations of the external branch of the superior laryngeal nerve (EBSLN) and its association with postoperative voice changes.

OBJECTIVES

Primary Objective

To evaluate the clinical utility of the Cernea classification during thyroidectomy.

Secondary Objectives

- To identify the anatomical variations of the EBSLN according to the Cernea classification.

- To determine the frequency of intraoperative identification of the EBSLN.
- To evaluate the association between Cernea classification and postoperative voice changes.

MATERIALS AND METHODS

Study Design

A prospective descriptive observational study was conducted to evaluate the clinical utility of the Cernea classification in patients undergoing thyroid surgery.

Study Setting

The study was conducted in the Department of General Surgery, Sree Balaji Medical College and Hospital, Chennai, Tamil Nadu, India.

Study Duration

The study was conducted from **June 2024 to October 2025** following approval from the Institutional Human Ethics Committee.

Ethical Approval

The study was approved by the Institutional Human Ethics Committee, Sree Balaji Medical College and Hospital, Chennai (Approval No. **002/SBMCH/IHEC/2024/2222**, dated **25 June 2024**).

Written informed consent was obtained from all participants before enrolment.

Study Population

Adult patients undergoing thyroid surgery during the study period were consecutively recruited.

Sample Size

Cernea et al. and Friedman et al. reported EBSLN identification rates of approximately **85%**. Using **p = 0.85** and an absolute precision of **10%**:

$$n = \frac{(1.96)^2 \times 0.85 \times 0.15}{(0.10)^2}$$

$$n = \frac{3.84 \times 0.1275}{0.01}$$

$$n = 48.96$$

≈ **49 patients**

Considering feasibility and the duration of the study, **40 patients were recruited consecutively**.

Inclusion Criteria

- Age ≥18 years
- Patients undergoing thyroid surgery
- Written informed consent

Exclusion Criteria

- Thyroiditis
- Congenital thyroid anomalies
- Patients unwilling to participate

Surgical Technique

All operations were performed according to standard thyroidectomy principles. Following mobilization of the superior thyroid pole, meticulous capsular dissection was carried out to identify the EBSLN before ligation of the superior thyroid vessels. Whenever identified, the nerve was carefully preserved throughout the procedure.

Cernea Classification

The anatomical relationship of the EBSLN to the superior thyroid pole was classified intraoperatively according to the Cernea classification:

- **Type I:** Nerve crosses >1 cm above the superior thyroid pole.
- **Type IIa:** Nerve crosses within 1 cm above the superior pole.
- **Type IIb:** Nerve crosses below the superior pole.

Outcome Measures

Primary Outcomes

- Identification of the EBSLN
- Cernea classification
- Association between Cernea classification and postoperative voice changes

Secondary Outcomes

- Histopathological diagnosis
- Distribution of Cernea variants
- Frequency of postoperative voice changes

Statistical Analysis

Data were entered into Microsoft Excel and analysed using **IBM SPSS Statistics version XX**.

Continuous variables were expressed as mean ± standard deviation.
Categorical variables were expressed as frequencies and percentages.
The association between Cernea classification and postoperative voice changes was assessed using **Fisher's exact test** because of the small sample size and expected cell counts less than five.
A secondary analysis comparing **Type I** with **combined Type II (Type IIa + Type IIb)** variants was performed to estimate the risk associated with anatomically vulnerable nerves.
A **p-value <0.05** was considered statistically significant.

RESULTS

Baseline Characteristics

A total of 40 patients undergoing thyroidectomy were included in the study. The mean age of the study population was 40.5 ± 11.4 years, with the highest proportion of patients belonging to the 31–40-year age group (30%), followed by the 41–50-year age group (27.5%). Female patients constituted the majority (75%), resulting in a female-to-male ratio of 3:1.
Multinodular goitre was the most common preoperative diagnosis (45%), followed by solitary thyroid nodules (25%), colloid goitre (15%), thyroid malignancy (10%), and toxic goitre (5%). Pressure symptoms represented the leading indication for surgery (35%), followed by cosmetic concerns (25%) and suspicion of malignancy (20%). Total thyroidectomy was the predominant operative procedure, accounting for 87.5% of all surgeries.

Table 1. Baseline demographic and clinical characteristics of patients undergoing thyroidectomy (n = 40)

Characteristic	**n (%)**
Age group (years)	
18–30	8 (20.0)
31–40	12 (30.0)
41–50	11 (27.5)
51–60	6 (15.0)
>60	3 (7.5)
Mean age (years)	40.5 ± 11.4
Gender	
Male	10 (25.0)
Female	30 (75.0)
Clinical diagnosis	
Multinodular goitre	18 (45.0)
Solitary thyroid nodule	10 (25.0)
Colloid goitre	6 (15.0)
Thyroid malignancy	4 (10.0)
Toxic goitre	2 (5.0)
Indication for surgery	
Pressure symptoms	14 (35.0)
Cosmetic reasons	10 (25.0)
Suspicion of malignancy	8 (20.0)
Toxic symptoms	5 (12.5)
Recurrent goitre	3 (7.5)
Type of surgery	
Total thyroidectomy	35 (87.5)

Right hemithyroidectomy	3 (7.5)
Left hemithyroidectomy	2 (5.0)

Intraoperative Identification of the External Branch of the Superior Laryngeal Nerve

The external branch of the superior laryngeal nerve (EBSLN) was successfully identified intraoperatively in 34 patients (85%), while it could not be identified in 6 patients (15%).

Among the identified nerves, Cernea Type IIa was the most common anatomical variant (41.2%), followed by Type I (35.3%) and Type IIb (23.5%). Overall, Type II variants constituted 64.7% of all identified nerves.

Side-wise assessment demonstrated comparable anatomical distribution, with the EBSLN identified in 18 right-sided and 16 left-sided dissections. Type IIa nerves were slightly more frequent on the right side, whereas Type I and Type IIb nerves showed similar bilateral distribution.

Table 2. Intraoperative identification and anatomical distribution of the external branch of the superior laryngeal nerve

Variable	n (%)
EBSLN identification (n = 40)	
Identified	34 (85.0)
Not identified	6 (15.0)
Cernea classification (n = 34)	
Type I	12 (35.3)
Type IIa	14 (41.2)
Type IIb	8 (23.5)

Table 3. Side-wise distribution of Cernea classification (n = 34)

Cernea classification	Right	Left	Total
Type I	6	6	12
Type IIa	8	6	14
Type IIb	4	4	8
Total	18	16	34

Histopathological Findings

Histopathological examination revealed that benign thyroid lesions constituted the majority of thyroidectomy specimens (82.5%). Colloid goitre was the most common diagnosis (45%), followed by multinodular goitre (22.5%) and follicular adenoma (15%). Malignant lesions accounted for 17.5%, comprising papillary carcinoma (12.5%) and follicular carcinoma (5%).

Table 4. Histopathological diagnosis of thyroidectomy specimens (n = 40)

Histopathological diagnosis	n (%)
Colloid goitre	18 (45.0)
Multinodular goitre	9 (22.5)
Follicular adenoma	6 (15.0)
Papillary carcinoma	5 (12.5)

Follicular carcinoma	2 (5.0)

Postoperative Voice Outcomes

Postoperative voice changes were observed in 6 patients (15%), whereas 34 patients (85%) reported no postoperative voice-related complaints.

Table 5. Postoperative voice outcomes following thyroidectomy (n = 40)

Postoperative voice changes	n (%)
Present	6 (15.0)
Absent	34 (85.0)

Association Between Cernea Classification and Postoperative Voice Changes

Among the 34 patients in whom the EBSLN was identified, postoperative voice changes demonstrated a progressive increase across Cernea classifications. No patient with Cernea Type I anatomy developed postoperative voice changes. In contrast, voice changes occurred in 2 of 14 patients (14.3%) with Type IIa anatomy and 4 of 8 patients (50.0%) with Type IIb anatomy.

Notably, Type IIb nerves accounted for 66.7% of all postoperative voice changes despite representing only 23.5% of identified nerves, suggesting that this anatomical variant carries a substantially greater risk of postoperative functional impairment.

Table 6. Association between Cernea classification and postoperative voice changes (n = 34)

Cernea classification	Voice changes Present	Voice changes Absent	Total	Voice changes (%)
Type I	0	12	12	0
Type IIa	2	12	14	14.3
Type IIb	4	4	8	50
Total	6	28	34	17.6

Statistical analysis

The association between Cernea classification and postoperative voice changes should be analysed using Fisher's exact test because of the small sample size and the presence of expected cell counts less than five. In addition, a secondary analysis comparing Type I with combined Type II (Type IIa + Type IIb) nerves may be performed to estimate the risk of postoperative voice dysfunction associated with anatomically vulnerable nerve variants.

Figures

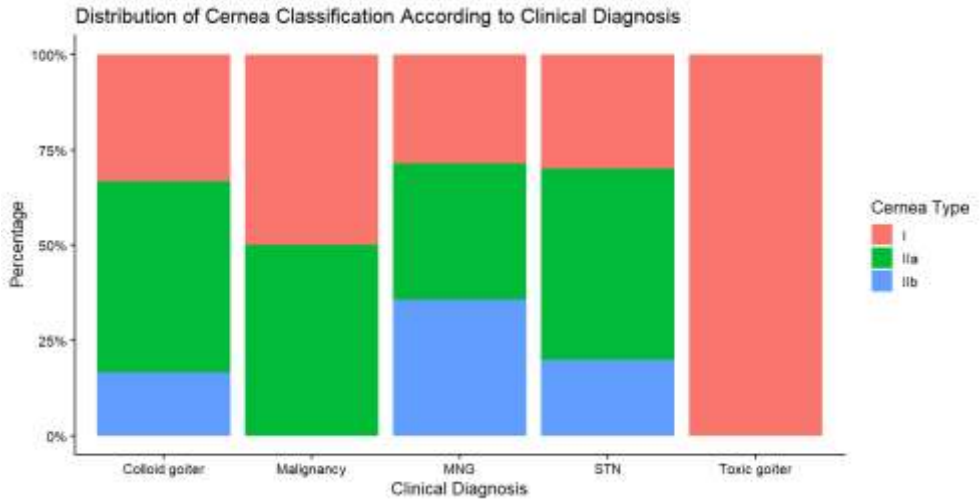

Figure 1. Distribution of Cernea classification

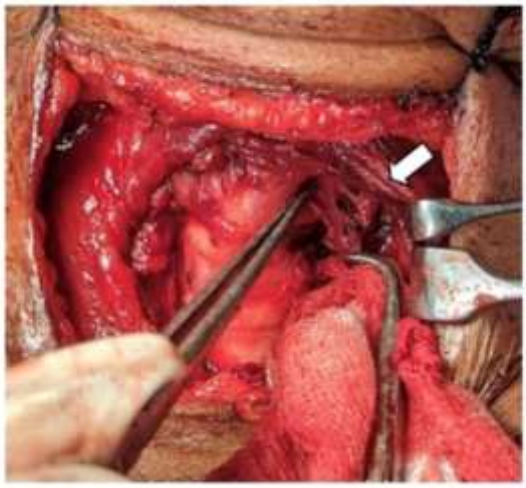

Figure 2. Intraoperative appearance of Cernea Type I EBSLN.

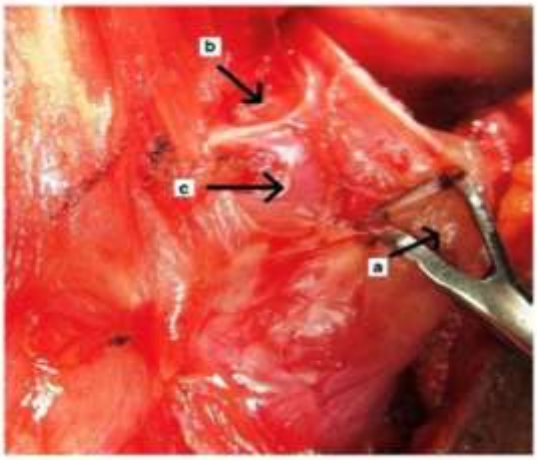

Figure 3. Intraoperative appearance of Cernea Type IIa EBSLN.

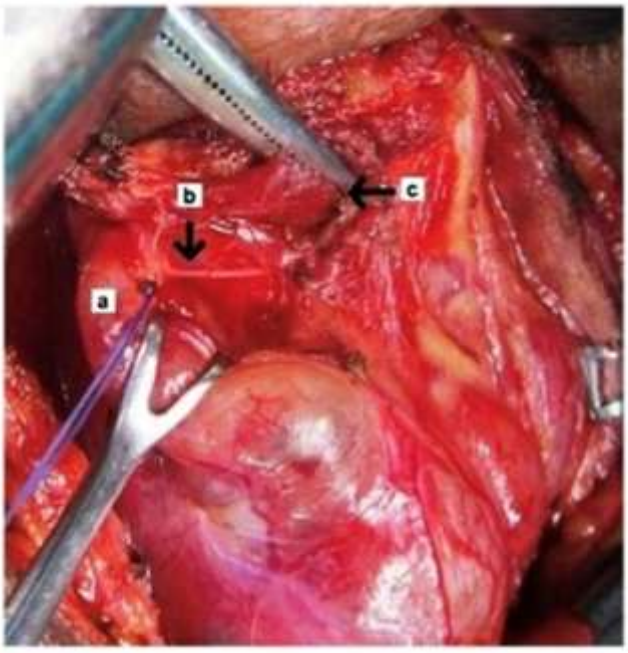

Figure 4. Intraoperative appearance of Cernea Type IIb EBSLN.

DISCUSSION

The present study evaluated the clinical utility of the Cernea classification by assessing the intraoperative identification of the external branch of the superior laryngeal nerve (EBSLN), documenting its anatomical variations, and determining its association with postoperative voice changes in patients undergoing thyroidectomy. Preservation of the EBSLN remains an important component of safe thyroid surgery because injury to this nerve may result in subtle yet clinically significant voice dysfunction despite preservation of the recurrent laryngeal nerve. Although the anatomical characteristics of the EBSLN have been extensively described, relatively few clinical studies have correlated Cernea classification with postoperative functional outcomes. The present study therefore provides additional evidence supporting the importance of careful superior pole dissection and routine consideration of EBSLN anatomy during thyroidectomy.

The mean age of patients in the present study was **40.5 ± 11.4 years**, with most patients belonging to the **31–40-year** age group, followed by the **41–50-year** age group. This demographic profile is consistent with the epidemiology of thyroid disorders requiring operative management. Bergamaschi et al. reported that thyroidectomy is performed predominantly in middle-aged adults because benign nodular thyroid disease and differentiated thyroid carcinoma become clinically significant during this period **[10]**. Similarly, Rosato et al., in a multicentre study involving more than 14,000 thyroidectomies, observed that the majority of patients undergoing surgery were between the third and fifth decades of life **[16]**. The predominance of patients within the economically productive age group highlights the importance of preserving postoperative voice quality, as even minor functional impairment may adversely affect communication, employment, and overall quality of life.

Female patients constituted **75%** of the study population, resulting in a female-to-male ratio of approximately 3:1. This observation is consistent with previous reports demonstrating a higher prevalence of thyroid disorders among women. Bergamaschi et al. also reported a marked female predominance in patients undergoing thyroid surgery **[10]**, while Rosato et al. found that women accounted for nearly three-quarters of patients in their multicentric series **[16]**. The higher incidence of thyroid disease among women has been attributed to hormonal influences, autoimmune predisposition, and reproductive factors that promote thyroid enlargement and nodular disease. Although sex itself is unlikely to influence the anatomical course of the EBSLN, the demographic characteristics observed in the present study indicate that the study population is representative of routine endocrine surgical practice.

Multinodular goitre was the most common clinical diagnosis, accounting for **45%** of all patients, followed by solitary thyroid nodules and colloid goitre. These findings agree with contemporary endocrine surgical practice, where benign multinodular disease remains the principal indication for thyroidectomy. Delbridge emphasized that multinodular goitre frequently progresses over time, leading to compressive symptoms, cosmetic deformity, or suspicion of malignancy that necessitates definitive surgical management **[7]**. Similarly, Rosato et al. reported that benign thyroid disease accounted for most thyroidectomies performed across multiple institutions **[16]**. The predominance of benign disease in the present study therefore reflects the typical spectrum of patients encountered in endocrine surgery.

Pressure symptoms represented the most frequent indication for surgery, followed by cosmetic concerns and suspicion of malignancy. These findings are consistent with accepted indications for thyroidectomy. Delbridge described progressive compressive symptoms, including dysphagia, dyspnoea, and neck discomfort, as major indications for surgical intervention in multinodular goitre **[7]**. Cosmetic deformity also remains an important consideration, particularly among younger patients with visibly enlarged thyroid glands. In addition, patients presenting with suspicious cytological findings or indeterminate thyroid nodules often require surgery to establish a definitive diagnosis and exclude malignancy.

Total thyroidectomy was performed in **87.5%** of patients and was the preferred operative procedure in the present study. This reflects the current shift towards definitive surgical management of bilateral benign thyroid disease and differentiated thyroid carcinoma. Delbridge advocated total thyroidectomy because it eliminates residual disease, reduces recurrence, and avoids the need for completion thyroidectomy **[7]**. Rosato et al. similarly concluded that total thyroidectomy can be performed safely with low complication rates when undertaken by experienced surgeons **[16]**. However, complete mobilisation of the superior pole during total thyroidectomy places the EBSLN at greater risk of injury, thereby reinforcing the importance of careful identification of the nerve and meticulous ligation of the superior thyroid vessels.

Histopathological examination demonstrated that benign lesions constituted the majority of thyroidectomy specimens, with colloid goitre being the most frequent diagnosis. Malignant lesions accounted for **17.5%** of cases, predominantly papillary carcinoma. These findings are consistent with the clinical indications for surgery observed in the present study, where most patients underwent thyroidectomy for benign multinodular disease, while a smaller proportion required surgery because of suspected malignancy. The histopathological profile therefore reflects the expected disease spectrum in a tertiary endocrine surgical practice and provides an appropriate clinical context for evaluating the anatomical characteristics of the EBSLN.

The principal finding of the present study was the successful intraoperative identification of the external branch of the superior laryngeal nerve (EBSLN) in **85%** of patients undergoing thyroidectomy. Routine identification of

the EBSLN remains a subject of considerable interest in endocrine surgery because of its variable anatomical course and its close relationship to the superior thyroid vascular pedicle. Failure to recognize the nerve during superior pole dissection may result in traction, thermal, or ligature injury, leading to postoperative voice dysfunction despite preservation of the recurrent laryngeal nerve. Cernea et al. first highlighted the surgical importance of identifying the EBSLN during thyroidectomy and demonstrated that its anatomical relationship with the superior thyroid vessels determines its susceptibility to operative injury **[1]**. In a subsequent study, Cernea et al. further emphasized that meticulous dissection of the superior pole and individual ligation of the superior thyroid vessels close to the thyroid capsule remain the most effective strategies for preventing nerve injury **[2]**.

The identification rate of **85%** observed in the present study is comparable with those reported in previous anatomical and surgical series. Friedman et al. demonstrated that deliberate intraoperative identification of the EBSLN substantially improves preservation rates and facilitates safer superior pole dissection **[11]**. Similarly, Hurtado-López et al. reported that selective identification of the EBSLN is feasible in routine thyroid surgery without increasing operative difficulty or morbidity **[12]**. These findings support the concept that careful anatomical dissection, even in the absence of intraoperative neuromonitoring, enables successful visualization of the nerve in most patients. The inability to identify the EBSLN in a small proportion of patients in the present study may be explained by individual anatomical variation, large goitres obscuring the operative field, or the close adherence of the nerve to the superior thyroid vessels.

Among the identified nerves, Cernea Type IIa was the most common anatomical variant, followed by Type I and Type IIb. Importantly, Type II variants collectively accounted for nearly two-thirds of all identified nerves, indicating that anatomically vulnerable nerve patterns were encountered more frequently than the relatively safer Type I configuration. This observation is consistent with the original description by Cernea et al., who demonstrated that Type II variants are common and remain at greater risk of injury because of their close relationship to the superior thyroid vascular pedicle **[1]**. Dionigi et al. similarly reported that Type II nerves predominate during thyroid surgery and emphasized that surgeons should routinely anticipate these higher-risk anatomical variants during superior pole dissection rather than assuming a uniformly safe anatomical course **[5]**. Comparable findings were reported by Selvan et al. in an Indian population, further supporting the applicability of the Cernea classification across different populations **[6]**.

The predominance of Type II anatomy has important surgical implications. During superior pole mobilisation, the EBSLN may traverse immediately adjacent to or below the upper border of the superior thyroid vessels, particularly in Type IIb anatomy. Consequently, mass ligation of the superior thyroid pedicle or excessive traction during superior pole dissection may place the nerve at considerable risk of injury. These observations reinforce the importance of capsular dissection and individual ligation of the superior thyroid vessels close to the thyroid capsule, as originally recommended by Cernea et al. **[2]**. Such an approach minimizes the likelihood of inadvertent nerve injury while facilitating complete thyroid resection.

Side-wise assessment demonstrated a comparable distribution of Cernea types between the right and left thyroid lobes, with only minor differences in the frequency of individual anatomical variants. This finding suggests that EBSLN anatomy is relatively symmetrical and that surgeons should exercise equal caution during superior pole dissection on both sides of the neck. Although side-specific anatomical differences have been inconsistently reported in the literature, Dionigi et al. observed no clinically significant asymmetry in the distribution of EBSLN variants during thyroidectomy **[5]**. The bilateral similarity observed in the present study therefore supports the routine application of meticulous superior pole dissection irrespective of the side of operation.

The most clinically relevant finding of the present study was the relationship between Cernea classification and postoperative voice changes. Overall, postoperative voice changes were observed in **15%** of patients; however, the frequency of voice dysfunction varied considerably according to the anatomical course of the EBSLN. No patient with **Cernea Type I** anatomy developed postoperative voice changes, whereas voice alterations occurred in **14.3%** of patients with **Type IIa** anatomy and **50%** of those with **Type IIb** anatomy. Furthermore, although Type IIb nerves represented less than one-quarter of all identified nerves, they accounted for two-thirds of all postoperative voice changes. This progressive increase in voice dysfunction from Type I to Type IIb strongly suggests that lower-lying anatomical variants are associated with greater vulnerability during superior pole dissection.

These findings agree with the anatomical observations originally described by Cernea et al., who proposed that Type II nerves are intrinsically more susceptible to operative injury because of their intimate relationship with the superior thyroid vessels **[1]**. Dionigi et al. similarly highlighted the increased vulnerability of Type IIb nerves during thyroidectomy and recommended meticulous dissection whenever these variants are encountered **[5]**. Friedman et al. further demonstrated that preservation of the EBSLN through deliberate intraoperative identification contributes to improved postoperative voice outcomes **[11]**. Although previous studies have primarily focused on anatomical descriptions or nerve identification, the present study extends these observations by demonstrating a clinically meaningful relationship between Cernea classification and postoperative voice function.

The planned application of Fisher's exact test to evaluate the association between Cernea classification and postoperative voice changes further strengthens the analytical component of the study. Demonstrating a statistically significant association would support the use of the Cernea classification not only as an anatomical descriptor but also as a clinically useful predictor of postoperative functional outcomes. Such evidence would reinforce the value of routine EBSLN identification during thyroidectomy, particularly in patients with Type II anatomy.

The findings of the present study have important implications for endocrine surgical practice. Routine consideration of the Cernea classification during superior pole dissection may assist surgeons in identifying patients at increased risk of EBSLN injury and facilitate appropriate modification of operative technique. Individual ligation of the superior thyroid vessels close to the thyroid capsule, avoidance of excessive traction, and careful dissection within the capsular plane remain fundamental principles for preserving the EBSLN and minimizing postoperative voice morbidity. Where available, intraoperative neuromonitoring may provide additional functional confirmation of nerve integrity; however, meticulous anatomical dissection continues to represent the cornerstone of safe thyroid surgery, particularly in resource-limited settings.

The present study has several strengths. It prospectively evaluated intraoperative EBSLN identification, applied the Cernea classification in a uniform manner, and correlated anatomical findings with postoperative voice outcomes, thereby providing clinically relevant evidence regarding the functional significance of EBSLN preservation. Nevertheless, certain limitations should be acknowledged. The study was conducted at a single centre with a relatively small sample size, which may limit the generalisability of the findings. Postoperative voice assessment was based on clinical evaluation rather than validated objective voice analysis or laryngeal electromyography, and intraoperative neuromonitoring was not routinely available. Larger multicentre studies incorporating standardized voice assessment tools and objective electrophysiological evaluation would further clarify the predictive value of the Cernea classification.

Overall, the present study demonstrates that routine intraoperative identification of the EBSLN is feasible in many thyroidectomy procedures and that Cernea Type II anatomy, particularly Type IIb, is associated with a greater frequency of postoperative voice changes. These findings support the continued use of the Cernea classification as a practical intraoperative guide during superior pole dissection and reinforce the importance of meticulous EBSLN preservation to optimize functional outcomes following thyroidectomy.

CONCLUSION

The present study demonstrated that routine intraoperative identification of the external branch of the superior laryngeal nerve (EBSLN) is feasible in the majority of patients undergoing thyroidectomy when meticulous superior pole dissection is employed. The Cernea classification proved to be a practical anatomical tool for identifying variations in the course of the EBSLN and for recognizing nerve configurations that are more susceptible to operative injury. Type IIa was the most frequently encountered anatomical variant, while Type IIb demonstrated the highest incidence of postoperative voice changes, suggesting an increased risk of functional impairment associated with this anatomical pattern.

The observed association between Cernea classification and postoperative voice changes highlights the clinical relevance of careful anatomical identification of the EBSLN during thyroidectomy. Routine application of the Cernea classification may assist surgeons in anticipating high-risk anatomical variants, facilitating safer superior pole dissection and potentially reducing postoperative voice morbidity. Although larger multicentre studies incorporating objective voice assessment and intraoperative neuromonitoring are required to further validate these findings, the present study supports the incorporation of the Cernea classification into routine thyroid surgical practice as a simple and effective guide for EBSLN preservation and improved functional outcomes.

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Conflicts of Interest

The authors declare that they have no competing interests.

Author Contributions
All authors contributed to the conception and design of the study. The authors performed data collection, analysis, and interpretation. The manuscript was drafted and critically revised by all authors. All authors read and approved the final manuscript and agree to be accountable for all aspects of the work.

Data Availability
The datasets generated and analysed during the current study are available from the corresponding author on reasonable request.

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