

The use of superior parathyroid gland as an anatomical landmark in identifying recurrent laryngeal nerve during total thyroidectomy: a prospective single-surgeon study

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Purpose: This study was performed to determine the anatomical position of recurrent laryngeal nerve (RLN) relative to superior parathyroid gland (SPG) in a consecutive total thyroidectomy series.

Methods: A total of 421 patients (mean age, 45.6 years; female, 76.0%) who had total thyroidectomy accompanied with intraoperative exposure of RLN in relation to SPG were included in this prospective single-surgeon thyroidectomy series study. The relation of RLN to SPG was assessed based on the measurement of the natural distance between the RLN and SPG, which was categorized as 0–5 mm, 6–10 mm, and ≥ 11 mm.

Results: Most of the thyroidectomy indications (69.1%) were related to malignant disease including papillary carcinoma in 54.9% of cases. Overall, in 90.7% of patients RLN was identified within 5 mm of the SPG, and in 65.1% of cases, it was found within 1 mm of the SPG. The RLN was found between 6 and 10 mm from the SPG in 8.5% of cases, while it was at least 11 mm away from the SPG in 0.7% of cases.

Conclusion: In conclusion, this prospective single-surgeon thyroidectomy series study indicates the likelihood of localizing the RLN in close proximity to SPG during total thyroidectomy operations. Hence, the SPG can be used as a landmark to identify RLN, and as part of routine parathyroid-sparing thyroidectomy, it may represent a convenient complementary approach to minimize the risk of iatrogenic injury to RLN in patients with an intact SPG.

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Key Words: Anatomic landmarks, Parathyroid glands, Peripheral nerve injury, Recurrent laryngeal nerve, Thyroidectomy

INTRODUCTION

Injury to a recurrent laryngeal nerve (RLN) is a serious complication after thyroid surgery leading to ipsilateral vocal fold paralysis, hoarseness of voice, and swallowing problems, and is a main cause of malpractice associated with thyroid surgery [1-4].

In this regard, the proper identification of RLN during thyroid surgery through sufficient knowledge of the surgical anatomy and the assistance of reliable anatomical landmarks along the

course of the nerve is considered of critical importance, given that it minimizes the risk of injury [3,5-8]. Hence, the direct inspection and complete exposure of RLN during thyroidectomy using crucial anatomical landmarks have become the gold standard method for the preservation of RLN and to prevent inadvertent injury to the nerve [2,5-7,9].

Besides injury to the RLN, thyroidectomy is also potentially associated with complications related to injury to the superior laryngeal nerve, or the parathyroid glands, and thus a surgeon must have an in-depth understanding of the anatomy of both

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the thyroid and parathyroid glands to minimize the morbidity of the operation [10].

The superior parathyroid gland (SPG) has a relatively constant location and a more consistent relationship with RLN compared to the inferior parathyroid gland while sparing the parathyroid gland is a routine procedure during thyroidectomy [7,10-12]. However, despite these advantages, the use of SPG as a potential landmark in localizing RLN during thyroidectomy has only been addressed by a few studies [11,12].

This prospective single-surgeon study aimed to determine the anatomical position of RLN relative to SPG in total thyroidectomy patients and thereby to evaluate the utility of SPG as a landmark to locate RLN during thyroid surgery.

METHODS

This study was conducted in accordance with the ethical principles stated in the Declaration of Helsinki and approved by the Clinical Research Ethics Committee of Uludag University (No. 2019-15/1). Written informed consent was obtained from all patients.

Study population

A total of 421 patients (mean age, 45.6 years [range, 18–78 years]; female, 76.0%) who had total thyroidectomy accompanied with intraoperative exposure of RLN in relation to SPG were included in this prospective single-surgeon thyroidectomy series study conducted at a tertiary care general surgery clinic between June 2020 and June 2023. Patients who underwent thyroidectomy operations other than total thyroidectomy and those with inability to identify RLN and/or SPG intraoperatively

were excluded from the study. Although 421 patients were initially enrolled, the final study population was composed of 410 thyroidectomy patients with exclusion of 11 patients due to the inability to identify SPG intraoperatively.

Assessments

Patient demographics (age, sex) and thyroidectomy indications (benign and malignant) were recorded in each patient. All thyroidectomy operations were carried out by the same surgeon (EG). Following the identification of the SPG, the RLN was exposed in the vicinity of the gland via careful dissection until its visualization, and then the natural distance between the RLN and SPG was preserved. Technically, the SPG was identified prior to the RLN. After SPG was identified, the RLN was carefully exposed in its vicinity and dissection was ceased to preserve the natural distance between the RLN and SPG. The relation of RLN to SPG was assessed based on the measurement of the natural distance (in millimeters) between the 2 structures (inferior border of the SPG and the intersection point of inferior thyroid artery and RLN) in a state of medial traction of the thyroid. The distance was categorized as 0–5 mm (category A), 6–10 mm (category B), and ≥ 11 mm (category C) (Fig. 1).

Statistical analysis

Statistical analysis was performed using IBM SPSS Statistics ver. 22.0 (IBM Corp.). Descriptive statistics were reported including means and ranges for continuous variables and percentages for categorical variables. Data were expressed as means with ranges and frequencies with percentages where appropriate.

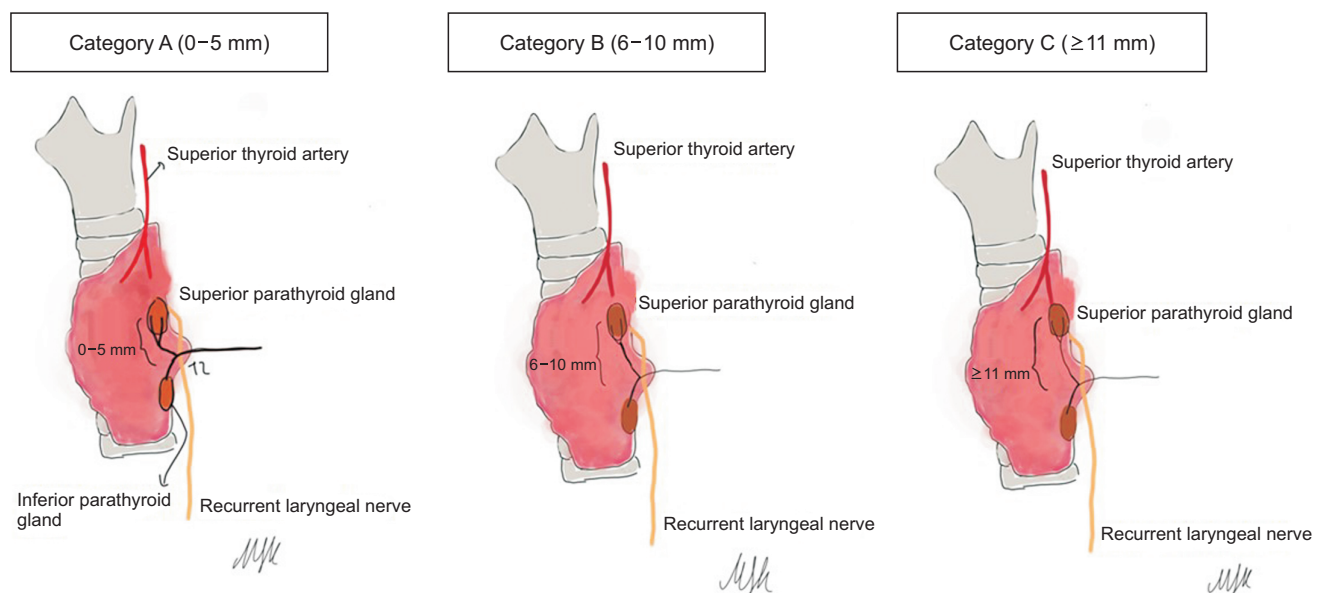


Fig. 1. The categories used for the assessment of the distance recorded between the recurrent laryngeal nerve and superior parathyroid gland.

Table 1. Patient demographics and thyroidectomy indications

Characteristic	Data
No. of patients	421
Age (yr)	45.6 (18–78)
Sex	
Female	320 (76.0)
Male	101 (24.0)
Thyroidectomy indications	
Benign	130 (30.9)
Colloid goiter	27 (6.4)
Multinodular goiter	75 (17.8)
Adenoma	28 (6.7)
Malignant	291 (69.1)
Papillary carcinoma	231 (54.9)
Follicular neoplasia	35 (8.3)
Hurtle cell carcinoma	18 (4.3)
Medullary carcinoma	7 (1.7)

Values are presented as number only, mean (range), or number (%).

Table 2. Distance between the RLN and the SPG (n = 410)

Distance category (mm)	No. of patients (%)	Recorded distance between RLN and SPG (mm)	No. of patients (%)
Category A (0–5)	372 (90.7)	0	191 (46.6)
		1	76 (18.5)
		2	32 (7.8)
		3	32 (7.8)
		4	24 (5.9)
		5	17 (4.1)
Category B (6–10)	35 (8.5)	6	21 (5.1)
		7	8 (2.0)
		8	1 (0.2)
		9	1 (0.2)
		10	4 (1.0)
Category C (≥11)	3 (0.7)	≥11	3 (0.7)

RLN, recurrent laryngeal nerve; SPG, superior parathyroid gland.

RESULTS

Patient demographics and thyroidectomy indications

The mean age of patients was 45.6 years (range, 18–78 years), and 320 of 421 patients (76.0%) were females. Most of the thyroidectomy indications (69.1%) were related to malignant disease including papillary carcinoma in 54.9% of cases (Table 1).

Distance between recurrent laryngeal nerve and superior parathyroid gland

Overall, in 90.7% of patients, RLN was identified within 5 mm of the SPG (category A), and in 65.1% of cases, it was found within 1 mm of the SPG. The RLN was found between 6 and 10

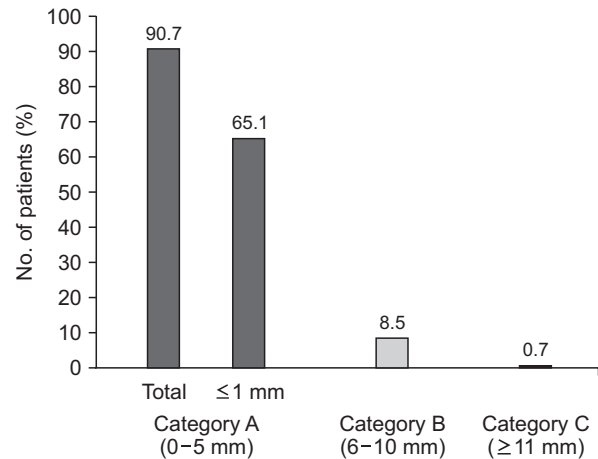


Fig. 2. The recorded distance between recurrent laryngeal nerve and superior parathyroid gland in total thyroidectomy patients.

mm from the SPG (category B) in 8.5% of cases, while it was at least 11 mm away from the SPG in 0.7% of cases (Table 2, Fig. 2).

DISCUSSION

This prospective series of total thyroidectomies revealed the identification of RLN in close proximity to SPG in the majority of patients. The RLN was identified within 5 mm of the SPG in 90.7% of cases, and within 1 mm of the SPG in 65.1% of cases. The RLN-to-SPG distance was 6–10 mm in 8.5% of patients, and ≥11 mm in 0.7% of cases.

Similarly, in a prospective thyroidectomy series in 59 patients, the average distance between the RLN and SPG during thyroid surgery was found to be 5.03 mm (standard deviation, 1.79 mm), while the RLN was reported to lie within 5 mm of SPG in 83.1% of cases and within 6–10 mm in 15.3% of cases [12].

Also, in a study assessing 103 consecutive thyroid lobectomies in 73 patients, the RLN was found in close proximity to the SPG, within 5 mm and 1 mm of the gland in 88.9% and 62.6% of cases, respectively [11]. The rates of permanent postoperative vocal fold paralysis were 2.5%, 12.5%, and 14.3% for the distance categories of 0–5 mm, 6–10 mm, and ≥11 mm, respectively [11].

Additionally, the height of the thyroid lobe and the presence of thyroid malignancy were reported to be positively associated with the distance between the 2 structures, with greater distance between RLN and SPG in cases of longer lobes (in the superior–inferior dimension) and cancerous lobes [11]. Hence, the preoperative assessment of lobe size and pathology is considered likely to provide patient-specific information to the surgeon regarding the appropriateness of using this approach in RLN identification [11].

In fact, in an analysis of a thyroidectomy-specific database involving 11,370 patients, the risk of RLN injury was found

to be independently associated with total thyroidectomy (vs. lobectomy) and diagnosis of thyroid malignancy (vs. benign indications) [13].

In our series, all patients had total thyroidectomy which was performed due to diagnosis of malignancy in majority of cases, emphasizing the potentially increased risk of RLN injury and thus the further importance of accurate intraoperative RLN identification through reliable anatomical landmarks. The identification of RLN in close proximity to SPG in the majority of our patients, despite the presence of thyroid malignancy in almost 70%, seems notable in this regard, emphasizing the potential utility of SPG as a reliable landmark for RLN identification even in thyroidectomies due to malignant indications.

Given the likelihood of permanent injury to the nerve in up to 1.4% of thyroidectomies, even in expert hands, along with temporary paralysis occurring in up to 5.4% of cases, the proper identification of the nerve during surgery is considered to be of critical importance regarding its association with at least a fivefold decreased risk of RLN injury [13-20]. Hence, our findings support that a consistent relationship exists between the RLN and the SPG, increasing the reliability of using SPG as a landmark to visualize and preserve RLN during thyroidectomy operations [11,12]. This approach, which is already part of routine procedures for sparing the parathyroid gland in thyroidectomies, enables RLN identification without increasing operation time or morbidity risk [11]. Nonetheless, identification of the SPG is a prerequisite for this approach, which can be challenging in some cases and is possible only when the patient has an intact SPG [11].

In conclusion, this prospective single-surgeon thyroidectomy series study indicates the likelihood of localizing the RLN in close proximity to SPG during total thyroidectomy operations. Hence, the SPG can be used as a landmark to identify RLN, and as part of routine parathyroid-sparing thyroidectomy operations, it may represent a convenient complementary approach to minimize the risk of iatrogenic injury to RLN in patients with an intact SPG. The relevance of this approach in reducing the risk of RLN injury should be further investigated in large-scale prospective studies in the setting of thyroidectomy, particularly for malignant indications.

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Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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All work was done by EG.

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