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The Surgical Anatomy of the Pyramidal Lobe and Its Significance in Thyroid Surgery

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ABSTRACT

Background: The embryological remnant known as the pyramidal lobe (PL) is frequently discovered during thyroidectomy, and its excision is crucial in lowering the risk of recurrence. The existence of the PL and other anatomic abnormalities may affect the effectiveness of surgical intervention and the overall accuracy of thyroidectomy.

Method: There were sixteen individuals in this research who had thyroidectomies. During thyroid surgery, the anterior cervical region—which lies between the hyoid bone and the thyroid isthmus—was dissected. In these individuals, the incidence, size, and anatomical characteristics of the PL were determined.

Results: The incidence of pyramidal lobe (PL) was 87.5%. No gender difference was found for PL incidence. The base of the PL was located at the isthmus in 78.5% and the left lobe in 21.4%. There was no correlation of pyramidal lobe with right lobe of thyroid. The meanlength of the PL was 24.1 (range, 5–49) mm. The PL was longer than 30mm in 50% of patients. One-third of the patients with short PL were men whereas women accounted for 80% of patients with long PL.

Conclusion: A prevalent component of the thyroid is the PL, as evidenced by the high occurrence. With a varied length, the PL typically starts at the isthmus close to the midline and extends to the hyoid bone. The pre-laryngeal area should be dissected in order to accomplish a complete thyroidectomy, as the PL is a common structure. It should always be checked during thyroid surgery and removed mandatory in cases of total and hemi thyroidectomies since the pyramidal lobe is a typical component of the thyroid gland that varies in location and size and can undergo pathological alterations in both benign and malignant disorders.

Keywords: Pyramidal Lobe; Thyroidectomy; Pre-Laryngeal Area; Thyroid Gland; Benign; Malignant

Introduction

Currently, the preferred surgical techniques for thyroid gland problems are hemithyroidectomies or complete thyroidectomies. When it comes to autoimmune and malignant conditions in particular, the extent of resection is crucial. Following surgical resection, leftover tissue may make it more difficult to treat specific ailments and to follow up following surgery. Incomplete thyroid tissue removal due to differences in the gland's anatomy might occasionally lead to a recurrence of the condition [1,2]. One classic example of anatomical difference impacting the completion of thyroidectomy is the existence of the Pyramidal Lobe(PL). A thyroid surgeon has to be completely knowledgeable about the architecture of the thyroid gland, including any changes that may be acquired, congenital, or embryological. The PL is characterized as an embryologically derived thyroid tissue remnant situated in the pretracheal area, between the hyoid bone and the isthmus, during the intrauterine descent of the fetal lingual thyroid to its anatomically proper position. According to published reports, its prevalence might range from 12% to 80% [3,4]. Failure to remove the PL completely, if it is present, usually precludes a thyroidectomy from being successful and increases the risk of disease recurrence.

Finding out the frequency and anatomical characteristics of the PL in our patients who had thyroid surgery was the goal of this prospective investigation.

An endocrine organ located in the anterior neck, within the pretracheal fascia, is the thyroid gland [5]. It consists of two lobes (left and right), an isthmus that connects them, and a pyramidal lobe (PL), which is present in up to 65% of instances [6]. During fetal development, it marks the distal end of the thyroglossal duct, which forms along the thyroid gland's migration path [7]. In the third week of pregnancy, the thyroid gland near the base of the tongue starts to grow. The thyroid diverticulum migrates in the midline downward ahead of the laryngeal cartilage and hyoid bone, and settles at the level of the C5–T1 vertebrae in the anterior neck. The thyroglossal duct joins the gland to the base of the tongue during its descend. Only the foramen cecum remains as a reminder of the thyroglossal duct's presence at the base of the tongue when it degenerates through apoptosis by the tenth week of intrauterine life. There are situations where the duct is not completely obliterated, leaving behind vestiges along its course, the most frequent of which is the pyramidal lobe [8]. Understanding this structure's anatomy, morphology, variations, and frequency is essential for thyroid surgery, as it may serve as the primary site for a single or multiple malignant diseases, or it may be the site of recurrent thyroid disease following hemi- or total thyroidectomy.

Materials and Methods

This prospective analysis included 16 patients (mean age 34.5; range 11–63) who had thyroid gland problems surgically treated between January 2022 and December 2023 with hemi and complete thyroidectomy. Surgical Technique: To accomplish complete excision of the gland, a typical procedure for dissecting the lateral lobes was followed. After total surgical dissection, the lateral lobe was medially mobilized. Prior to the gland's removal, the anterior cervical (pretracheal) region between the gland's isthmus and the hyoid bone was thoroughly examined, seen, and searched for thyroidal tissue. If thyroidal tissue was found, it was entirely dissected from the isthmus up to the hyoid bone. To guarantee that the thyroidectomy was performed completely, the lateral lobe, the isthmus, and the PL (if any) were all completely removed and sent for histopathological examination. The frequency of the PL was found in individuals who had either a partial or full thyroidectomy. It was determined which sexes made up the thyroidectomy patients with or without PL. It's worth mentioning that the PL base originates from the primary thyroid gland. We identified the origin of the PL on thyroidectomy tissues. Following the gland's removal, the size and length of the PL were measured on fresh tissue, and it was determined to be short (≤5 mm), medium (6–31 mm), or long (≥43 mm).

Results

Out of sixteen patients who underwent hemi or total thyroidectomy, fourteen (87.5%) showed pyramidal lobes. The prevalence of PLs was 66% in men and 92.3% in women (Table 1). Twelve of the sixteen (75%) individuals with PLs were female. In 78.5% of patients, the PL began in the isthmus, followed by the left side (Tables 1-3). The PL originated from the isthmus in 81.8% of female patients and 18.2% of male patients (Table 2). The mean length of the PL was 24.1mm (range 5–49) mm in our present series, and 50% of the PLs were longer than 30 mm. We found PLs of various lengths with origin at various sites on the thyroid gland (Figures 1- 4). The location of the pyramidal lobe's origin on the top border of the isthmus was carefully considered when analysing the anatomical structure of the structure during the procedure. Pyramidal lobes, if they existed, were eliminated in every instance. The lobes were dissected cranially until all discernible thyroid tissue was gone, starting at the branching level from the isthmus. The pyramidal specimen underwent further pathological analysis, which involved measuring using a standard ruler and doing both macro- and microscopic analyses (Figures 5 & 6). The incidence, position, size, and pathological involvement of the pyramidal lobe was compared with the sex, age, and type of thyroid disease of the patient. Three men (age 27 - 63, median 47.3) and thirteen women (age 11 - 54, median 50) were operated on and examined. Table 3 displays the frequencies of all thyroid diseases linked to the pyramidal lobe in this dataset. Numerous statistical techniques were applied, including the ANOVA test, t-test, chi-square test, and Spearman's test.

Table 1.

The length of the pyramidal lobe (mm)	Total	Women	Men
Short (1–15)	5	4	1
Middle (16–30)	3	2	1
Long (30<)	6	6	-

Table 2.

Origin of pyramidal lobe	Total	Men	Women
Isthmus	11	2	9
Left lobe of thyroid	3	1	2

Table 3.

Pathological involvement of pyramidal lobe	Number of patients
Goitre	9
Papillary carcinoma of thyroid	1
Follicular adenoma	4

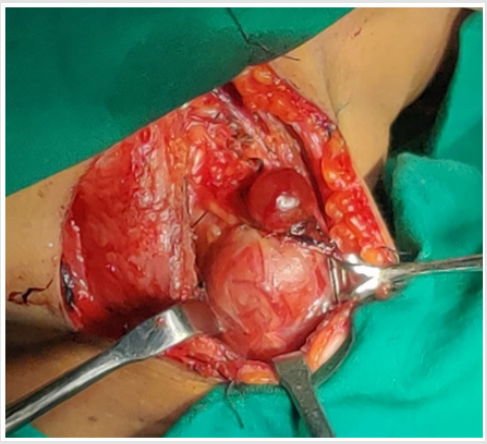

Figure 1: Upper pole of the thyroid gland showing the cystic and round shaped pyramidal lobe during surgery for hemithyroidectomys

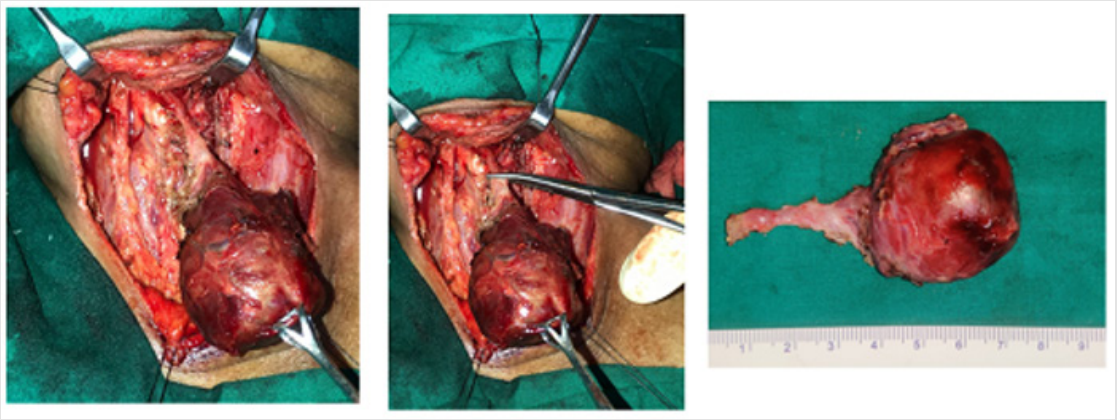

Figure 2: An intraoperative image of the long pyramidal tract, arising from left lobe of thyroid gland.

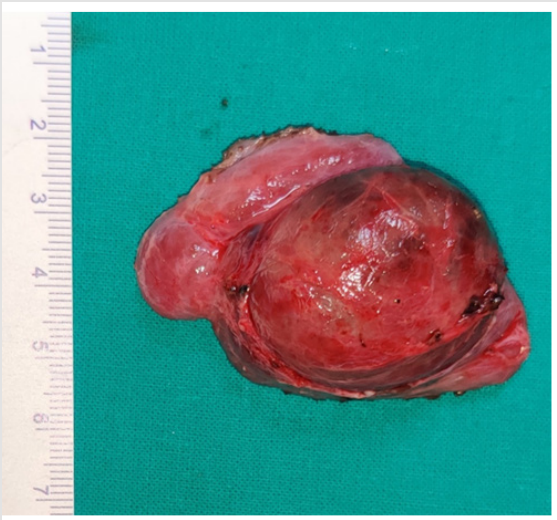

Figure 3: Lobulated appearance of pyramidal lobe (along with isthmus).

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Figure 4: Lobulated appearance of pyramidal lobe in papillary carcinoma of thyroid.

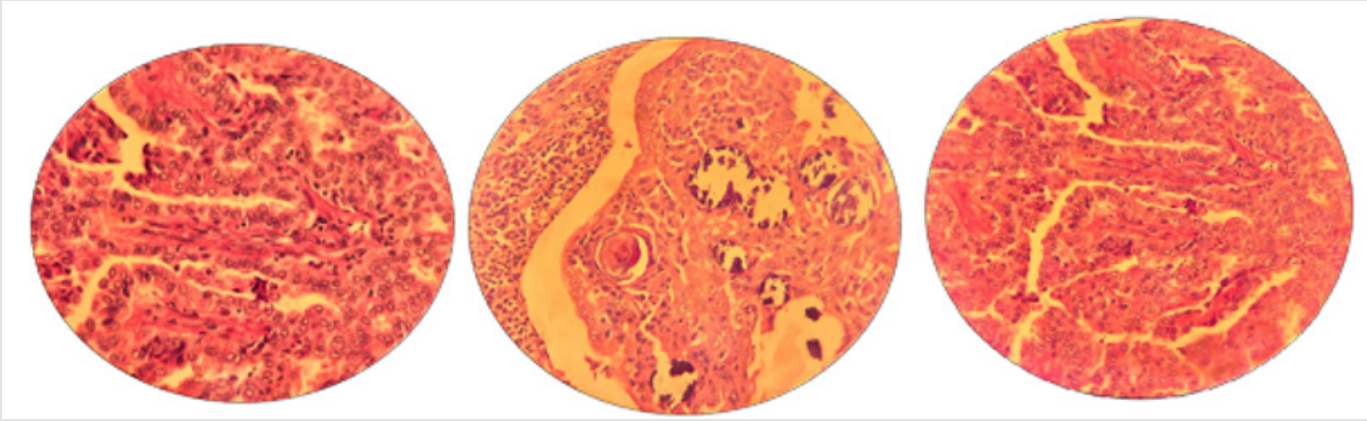

Figure 5: Histopathological slide from pyramidal lobe in a case of papillary carcinoma of thyroid.

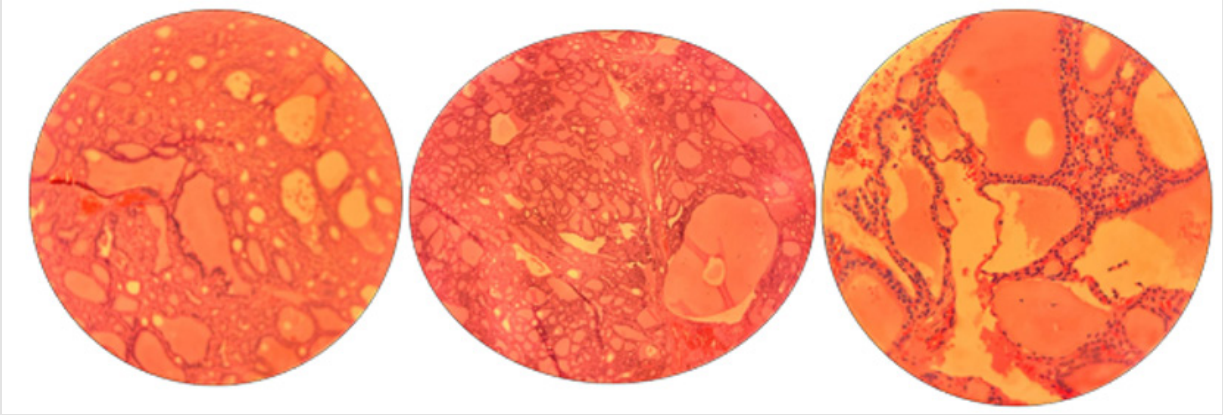

Figure 6: Slide picture from the pyramidal lobe showing a goiter histologically.

Discussion

The pyramidal lobe exhibits variations in size, shape, and location. Many shapes have been described, including string, flat, triangle, and pyramidal shapes. Depending on where it originated on the upper edge of the isthmus, it points upward in the midline or slightly to the left or right. It might have fibrous tissue securing it to the thyroid cartilage. The origin may be found on the upper poles, the medial border of the lateral lobes, or the upper border of the isthmus [9]. According to the majority of writers, the left thyroid lobe or the left side of the isthmus represent the most common location (40–60%) of the pyramidal lobe origin [1,10-12]. A pyramidal lobe's morphologic appearance can be used to categorize it as either bulge (with a rounded bulge at the end of the conical elongation), ectopic (when the lobe is not a continuation of the thyroid gland proper), broad (involving both lobes and having a broad originating base), or parallel (conical elongation arising from either or both lobes) [13] Its shape might be a nodule, a thread, or an inverted Y [14]. There is debate over whether gender matters when it comes to the pyramidal lobe's prevalence, however it has been demonstrated that women are more likely to have them since they have a higher frequency of thyroid diseases [15,16].There are wide differences in the information on the pyramidal lobe's length.

While Braun et al [1] reported a median length of 24.1 mm with a range of 3 - 63 mm and larger lobes in females, Filho et al [17]. found that lobe length varied from 10 to 50 mm. There were no pyramidal lobes larger than 20 mm, according to Geraci et al [3]. In addition to having longer lobes in females, we also identified a length range of 8 to 40 mm with a median length of 20.13 mm, which matches the range reported in the current literature. The majority of sources characterize the pyramidal lobe's extent in terms of surrounding structures: Marshall [18] asserts that the structure extends over 50% of the time, Braun [1] notes that it does so in 25% of cases, and Harjeet et al [19]. say that it reaches the hyoid bone in 5% of cases. Recent literature continues to refer to the pyramidal lobe as a common site for the recurrence of benign diseases following total and hemi-thyroidectomy, despite the fact that it is a normal component of the thyroid gland with varying positions and sizes and possible pathological modifications in all thyroid diseases [20-24] Additionally, following surgical excision of differentiated thyroid carcinoma, it is the most often detected location for radio-iodine uptake on postoperative scinti scans [25] (Figures 7-9). When performing thyroid surgery, the pyramidal tract of the thyroid gland should always be inspected; in the case of a complete thyroidectomy, its removal is required for a number of reasons:

- To lessen the chance that benign illnesses may reoccur locally
- Considering the high rate of multifocality of these tumors, it is likely to permanently cure 90% of patients with differentiated thyroid carcinoma [26].
- To enhance the use of adjuvant radioiodine therapy for differentiated thyroid carcinoma [27].
- In individuals with differentiated thyroid carcinoma, to raise the sensitivity of serum thyroglobulin [26].

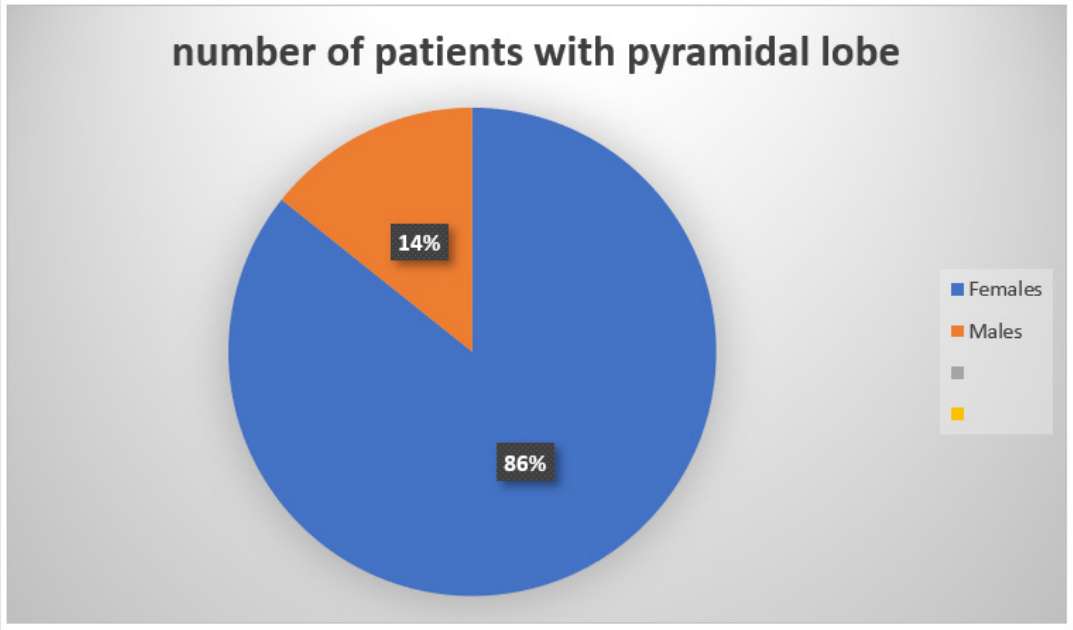

Figure 7.

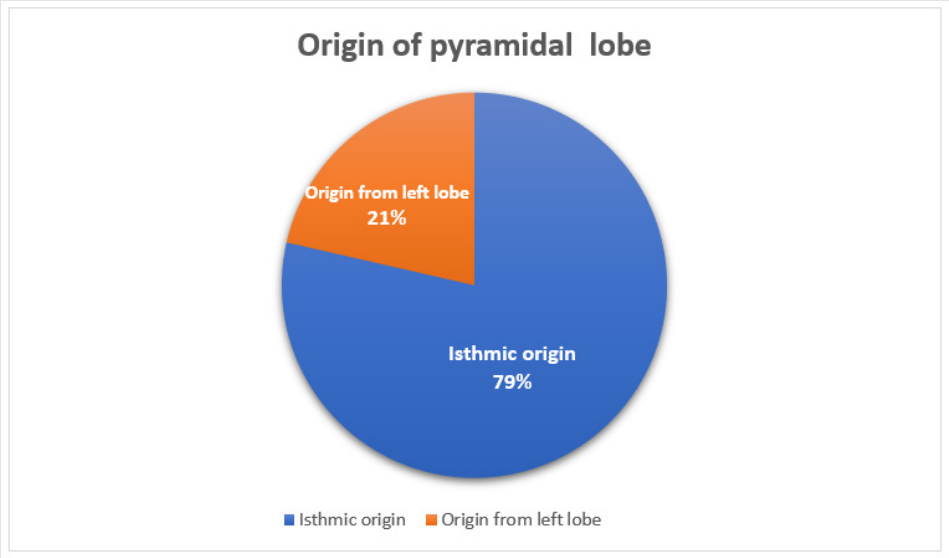

Figure 8.

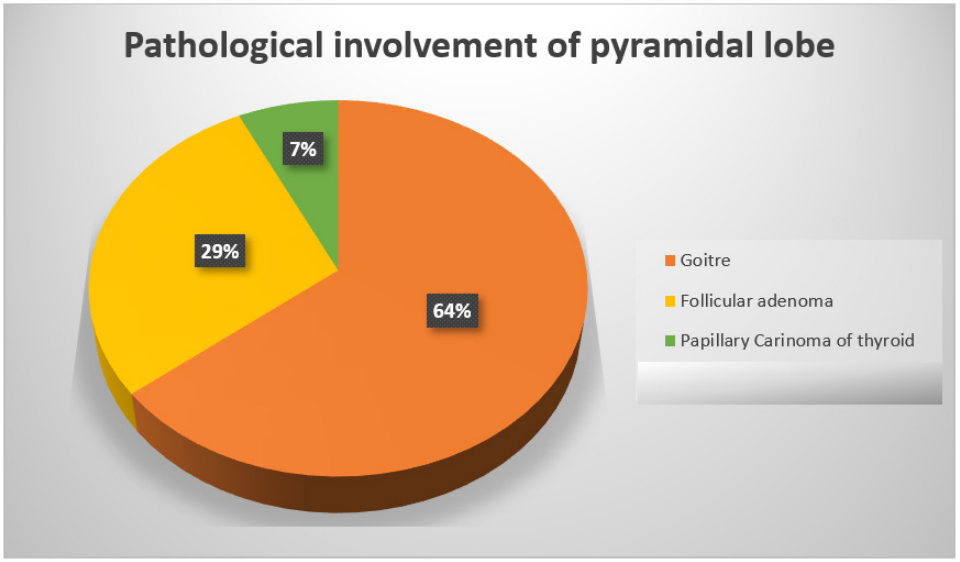

Figure 9.

Conclusion

The pyramidal lobe should always be checked during thyroid surgery and should always be removed in total and hemi thyroidectomies since it is an integral part of the thyroid gland that can occur in a variety of locations and sizes as well as exhibit pathological alterations in benign and malignant illnesses. The preferred surgical techniques for thyroid gland problems are hemi or total thyroidectomies. When it comes to autoimmune and malignant conditions in particular, the extent of resection is crucial. Following surgical resection, leftover tissue may make it more difficult to treat specific ailments and to follow up following surgery. Incomplete thyroid tissue removal due to differences in the gland's anatomy might occasionally lead to a recurrence of the condition.

Compliance with Ethical Standards

The procedure performed in this case report was in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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Conflict of Interest

The author (s) declares no potential conflicts of interest with respect to the research, authorship, and/or publication of this paper.

Ethical Approval

For the purpose of publishing this case report, the patient's written informed consent was obtained.

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