

# Surgical anatomy of the pyramidal lobe and its significance in thyroid surgery

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## Summary

**Aim.** The purpose of this prospective study was to highlight some new findings about anatomical and morphological variations of the thyroid pyramidal lobe and to emphasise the necessity and importance of exploration of the visceral compartment of the neck and resection of this structure in primary thyroid operations.

**Method.** We analysed 100 consecutive primary thyroid operations with additional pathological examination of the specimens.

**Results.** A pyramidal lobe was found in 61% of the cases. The lobe of Lalouette was found more often in women (61.96%) than in men (50%) and more often (67.3%) in patients less than 50 years old than in those older than 50 (54.2%). The lobe branched off more frequently from the midline (49.18%) than from other parts of the isthmus; its length ranged from 8 to 40 mm, with a median length of 20.13 mm. In diffuse thyroid diseases, the lobes were always pathologically involved and significantly longer.

**Conclusion.** Since the pyramidal lobe is a normal component of the thyroid gland, of varying position and size, with pathological changes in benign and malignant diseases, it should always be examined during thyroid surgery and mandatorily removed in total and subtotal thyroidectomies.

The pyramidal lobe is a not-always prominent feature of the thyroid gland, and develops from the distal part of the thyroglossal duct. Its course can be from the isthmus, the left or right lobe, upwards in the form of a short stump or a long process that can reach the upper border of the thyroid cartilage or even the hyoid bone. Since Lalouette gave this entity its name in 1749, 1 statements about the variations and frequencies of the pyramidal lobe, in old and current literature, have varied (Table I). Considering the fact that this structure can be a potential place of recurrent thyroid disease after subtotal or 'total' thyroidectomy or a primary localisation of a solitary or multifocal malignant disease, knowledge about its anatomy, morphology, variations and frequency is necessary in thyroid surgery.

The purpose of this study was to add new facts about variations of the pyramidal lobe and to emphasise the necessity and importance of exploration of the visceral compartment of the neck

and resection of this structure during primary operations on the thyroid.

## Methods

In this prospective study, we analysed 100 consecutive thyroid operations (lobectomies, subtotal and total thyroidectomies with resection of the pyramidal lobe if present) with additional pathological examination of the specimens. The 100 primary operations were chosen independently of sex, age or pathological substrate. Patients included in this research were surgically treated in the Institute of Oncology and Radiology of Serbia as well as in the Surgical Clinic of the Dr Dragisa Misovic Clinical Centre in Belgrade during 2007.

All patients were operated on by a standardised surgical technique. The surgical extent depended on the type of disease, on gross intra-operative findings, sentinel lymph node biopsies (14) and frozen section. In 78 cases, we performed total thyroidectomies (in 8 with central or lateral neck dissection); in 4 subtotal resections; and in 18 lobectomies. During operation, the anatomy of the pyramidal lobe was analysed with special attention to the position of its origin on the upper border of the isthmus. In all cases, pyramidal lobes were removed if present. The lobes were transected at the branching level from the isthmus and dissected in a cranial direction until all visible thyroid tissue was removed. Additional pathological examination of the pyramidal specimen included measuring with a standard ruler, and macro- and microscopic analysis.

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. Eight men (age 25 - 71, median 47) and 92 women (age 17 - 74, median 50) were operated on and examined. Frequencies of all types of thyroid disease in this series are shown in Table II. A variety of statistical methods was used: chi-square test, Spearman's test, *t*-test, and ANOVA test.

## Results

A pyramidal lobe occurred in 61% of the subjects. It was more frequent in women (62%) than in men (50%) and more frequent in patients <50 years (67%) than those >50 (54%) ( $p < 0.05$ ). The pres-

**TABLE I. PREVALENCE OF THE PYRAMIDAL LOBE IN THE LITERATURE**

Author	Frequency (%)	Examination method	Examination year
Marshall <sup>2</sup>	43	On cadavers	1895
Sobotta <sup>1</sup>	45	On cadavers	1915
Gardner <sup>3</sup>	40	On cadavers	1966
Hunt <sup>4</sup>	41	Surgical	1968
Blumberg <sup>5</sup>	60 – 65	Surgical	1981
Kitagawa <sup>6</sup>	48.6	On cadavers	1993
Foster <sup>7</sup>	80	Unknown	1995
Henry <sup>8</sup>	30	Unknown	1997
Filho <sup>9</sup>	50.7	Surgical	2004
Harjeet <sup>10</sup>	28.9	On cadavers	2004
Braun <sup>11</sup>	55	On cadavers	2007
Sturniolo <sup>12</sup>	25.5	Surgical	2008
Geraci <sup>13</sup>	12	Surgical	2008

**TABLE II. PRESENCE OF THE PYRAMIDAL LOBE IN VARIOUS THYROID DISEASES**

Thyroid disease	Presence of the pyramidal lobe		Total
	Yes	No	
<b>Solitary benign tumours</b>	<b>5 (26.32%)</b>	<b>14 (73.68%)</b>	<b>19</b>
<b>Malignant tumours</b>	<b>10 (62.5%)</b>	<b>6 (37.5%)</b>	<b>16</b>
<b>Multinodular goitre</b>	<b>37 (71.15%)</b>	<b>15 (28.85%)</b>	<b>52</b>
<b>Hashimoto's thyroiditis</b>	<b>7 (77.78%)</b>	<b>2 (22.22%)</b>	<b>9</b>
<b>Graves' disease</b>	<b>2 (50%)</b>	<b>2 (50%)</b>	<b>4</b>
<b>Total</b>	<b>61</b>	<b>39</b>	<b>100</b>

ence of the pyramidal lobe was most often associated with multinodular goitres (71%) and Hashimoto thyroiditis (78%), while it was mostly absent in thyroid glands with benign tumours (Table II). It branched off more often from the midline (49%) than from the right (36%) or the left (15%) part of the isthmus.

A statistically significant percentage of all pyramidal lobes was affected by the primary thyroid disease (59%,  $p < 0.01$ ). In glands with benign tumours, the pyramidal lobe was never affected, while in diffuse diseases (Hashimoto's thyroiditis, Graves' disease) the lobe of Lalouette was always involved. The majority (73%) of pyramidal lobes in benign multinodular goitres showed similar changes to the main parts of the gland. In 2 cases, we even found malignant foci in this structure. In 1 case, it was the only site of a papillary carcinoma, while in the other case the pyramidal localisation was a part of a multicentric papillary cancer (Table III).

The length of the pyramidal lobes ranged from 8 to 40 mm with a median size of 20.13 mm. Men had a median length of 16.25 mm while women had a median length of 20.4 mm ( $p < 0.05$ ). No significant difference was found between the length of the pyramidal lobes in patients younger or older than 50. The involved pyramidal tracts (average length 21.03 mm) were longer than those which were not involved (average length 18.84 mm), especially in diffuse thyroid disease (average length 23.22 mm) with a high statistic significance ( $p < 0.01$ ).

## Discussion

The pyramidal lobe varies in shape and position as well as appearance and size. Highly variable forms have been described: pyramidal, triangular, string or flat. Its direction is upwards in the midline or slightly to the left or the right, depending on the position of origin on the upper border of the isthmus. It may be attached to the thyroid cartilage by fibrous tissue. The origin can be on the upper border of the isthmus, the medial border of the lateral lobes or the upper poles.<sup>10</sup> Most authors claim that the most frequent position (40 - 60%) of the pyramidal lobe origin is the left side of the isthmus or the left thyroid lobe.<sup>1,4,5,10,11</sup> These statements do not agree with data from our study, where the pyramidal lobe arose most often from the midline (49%) and the right side (36%) and seldom from the left (15%) of the isthmus, without a single case of lobar origin.

The 61% of pyramidal appearances in our series falls into the middle of the range of frequencies mentioned in the literature (Table I). While Braun *et al.*<sup>11</sup> claim that the appearance of pyramidal lobes is more prevalent in male (62%) than in female (50%) patients, which coincides with the observations of bygone anatomists,<sup>1</sup> in our study – as in those of Filho and Sturniolo<sup>9,12</sup> – pyramidal tracts more frequently appear in female (61%) than in male (50%) patients. Since there were only 8 men in our survey, these data may need to be revised by means of larger series. Our study

**TABLE III. INVOLVEMENT OF THE PYRAMIDAL LOBE IN VARIOUS THYROID DISEASES**

Thyroid disease	Involvement of the pyramidal lobe		
	Yes	No	Total
<b>Solitary benign tumours</b>	-	<b>5 (100%)</b>	<b>5</b>
<b>Malignant tumours</b>	<b>2 (20%)</b>	<b>8 (80%)</b>	<b>10</b>
<b>Multinodular goitre</b>	<b>27 (72.97%)</b>	<b>10 (27.03%)</b>	<b>37</b>
<b>Hashimoto's thyroiditis</b>	<b>7 (100%)</b>	-	<b>7</b>
<b>Graves' disease</b>	<b>2 (100%)</b>	-	<b>2</b>
<b>Total</b>	<b>36 (59.02%)</b>	<b>25 (40.98%)</b>	<b>61</b>

also showed that these lobes are more frequent in patients <50 (67%) than >50 (54%), which could be a result of the physiological atrophy mentioned by Tenchini and Cavatorti.<sup>1</sup>

Data concerning the involvement of the pyramidal lobe in benign diseases were seldom found.<sup>12,13</sup> The fact that the pyramidal lobe was affected by the primary disease of the thyroid gland in all patients with diffuse diseases (Graves' disease, Hashimoto's thyroiditis) and in the majority of patients with multinodular goitres (73%) shows that this lobe is a normal component of the thyroid. Pyramidal tracts in diffuse conditions were significantly longer than those which were affected by other thyroid diseases or than those which were not affected at all, which could be explained by their hypertrophy. In our survey, we also found 2 cases with papillary carcinoma foci in the pyramidal lobe – one as a unifocal disease and the other as a part of a multifocal process. Involvement of the pyramidal lobe in unifocal and multifocal malignant diseases is well described.<sup>13,15-17</sup>

Information on the length of the pyramidal lobe varies considerably. In a study by Filho *et al.*,<sup>9</sup> the length of the lobe ranged from 10 to 50 mm, while Braun *et al.*<sup>11</sup> noted a median length of 24.1 mm with a range of 3 - 63 mm, and with longer lobes in females. Geraci *et al.*<sup>13</sup> found that no pyramidal lobe exceeded 20 mm. We found a length range from 8 to 40 mm with a median length of 20.13 mm, which fits the range found in present literature, and also with longer lobes in females. Most authors describe the extent of the pyramidal lobe according to surrounding structures: Harjeet *et al.*<sup>10</sup> claim that the structure reaches the hyoid bone in 5% of cases, Marshall<sup>2</sup> claimed such length in over 50%, while Braun<sup>11</sup> noted such an extent in 25%.

Besides the fact that the pyramidal lobe is a normal component of the thyroid gland, with various positions and sizes and with possible pathological changes in all thyroid diseases, it is still referred to in recent literature as a frequent site for recurrence of benign diseases after total and subtotal resection of the gland.<sup>18-22</sup> It is also the most frequent site for radio-iodine uptake on postoperative scintiscan after surgical resection of differentiated thyroid cancer.<sup>23</sup>

The pyramidal tract of the thyroid gland should always be examined during thyroid surgery; its removal is mandatory in total thyroidectomy for several reasons:

- to decrease the possibility of local recurrence of benign diseases
- to probably render about 90% of patients with differentiated thyroid carcinoma permanently free of disease, considering the high percentage of multifocality of these tumours<sup>24</sup>

- to improve adjuvant radio-iodine treatment in differentiated thyroid cancer<sup>25</sup>
- to increase the sensitivity of serum thyroglobulin in patients with differentiated thyroid cancer.<sup>24</sup>

Preservation of the pyramidal lobe, as a useful remnant of thyroid tissue, can also be of great importance in thyroid surgery. The fact that the pyramidal lobe as well as the isthmus of the thyroid gland does not contain C-cells was used by a group of German authors for an operation named 'Isthmus-preserving total bilobectomy' in patients with C-cell hyperplasia.<sup>26</sup>

## Conclusions

The pyramidal tract was found in 61% of all operated patients, so it can be considered as a normal component of the thyroid gland and not as ectopic tissue. The lobe of Lalouette was found more often in women than in men and more often in patients younger than 50 than older. It branched off more frequently from the midline than from other parts of the isthmus. In diffuse thyroid diseases (Graves' disease, Hashimoto's thyroiditis), the lobes were always pathologically involved as they were very often in other benign and malignant diseases. Pyramidal lobes were significantly longer in female than in male patients, and also significantly longer if they were pathologically affected, especially in diffuse thyroid diseases. Since the pyramidal lobe is a normal component of the thyroid gland, in various positions and sizes, and with pathological changes in benign and malignant diseases, it should always be examined during thyroid surgery and always removed in total and subtotal thyroidectomies.

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## News

### Hat trick for Surgical Gastroenterology at UCT

The recent combined Association of Surgeons of Southern Africa (ASSA) and South African Gastroenterology Congress held at the Cape Town International Convention Centre was attended by 1 800 delegates. Also present were 800 visiting surgeons from the European Hepatopancreatobiliary Association. Members of the Surgical Gastroenterology unit in the Department of Surgery at the University of Cape Town and Groote Schuur Hospital made a clean sweep at the ASSA academic presentations, being awarded all the prizes on offer.

Dr Marc Bernon received the 1st prize for his paper entitled 'Prospective randomised trial comparing self-expanding metal Wall stents with plastic stents in the palliation of malignant obstructive jaundice'. Dr Christopher Price was awarded the 2nd prize for his paper 'Combined palliative stenting for malignant biliary and duodenal obstruction', and Dr Galya



(From left to right) Professor Jake Krige (Head, Surgical Gastroenterology), Galya Chinnery, Marc Bernon and Christopher Price.

Chinnery 3rd prize for her paper 'Civilian low-velocity gunshot wounds of the pan-

creas. Analysis of 219 patients treated at a level 1 trauma centre'.