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Occurrence of the Pyramidal Lobe of the Thyroid Gland in Human Fetuses

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ABSTRACT

Introduction: the pyramidal lobe of the thyroid (PL) is an embryological remnant of the thyroglossal duct, established as a normal component of the thyroid gland, which can vary greatly in shape, position, appearance and size, and is not present in all individuals. Its prevalence can vary from 12% to 80% according to the type of study. Sua prevalência pode varia de 12% a 80% de acordo o tipo de estudo.

Objective: to determine the frequency of occurrence and morphometry of the PL in human fetuses.

Material and method: 24 thyroid glands of human fetus cadavers were dissected without the aid of optical instruments, 12 males and 12 females, whose general age ranged from 20.3 to 36.8 weeks, with an average of 26, 3 weeks. The fetuses were preserved in a 10% formaldehyde solution, and all measurements were performed using a 0.01 mm precision digital caliper.

Results: the PL was found in 12.5% of the 24 thyroid glands studied, all females. The pyramidal lobes (PLs) originated from the upper margin of the isthmus of the thyroid gland, with 66.66% of the PLs located more to the left of the midline and 33.33% to the right. The length of the PLs ranged from 10.47 mm to 13.90 mm, with an average of 12.56 mm, and the width ranged from 3.04 mm to 3.39 mm, with an average of 3.25 mm.

Conclusion: the knowledge of the normal anatomy and PL variations of the thyroid gland are essential for head and neck surgeons, especially in total thyroidectomy surgeries, as it can be affected by diseases that affect the rest of the thyroid parenchyma.

Keywords: Pyramidal lobe; Anatomy; Thyroid imaging; Thyroid surgery.

Introduction

The thyroid gland, considered the largest endocrine gland in the human body, is formed by two lateral lobes (right and left) joined by an isthmus along the midline.[1,2] It is located in the lower and anterior part of the neck, at the level of vertebrae C5 to T1.[3] A third lobe, conical in shape, called the pyramidal lobe (PL), almost always extends to the left of the upper border of the isthmus or the adjacent portion of each lobe cranially to the hyoid bone.[4]

The PL is embryologically derived from remnant thyroid tissue located in the pretracheal region between the isthmus and the hyoid bone, during the intrauterine descent of the fetal lingual thyroid to its normal anatomical location and varies in shape and position, as well as in appearance and size.[5,6]

The PL, despite being an anatomical variation, consists of normal thyroid tissue. Therefore, all types of diseases that occur in the thyroid are likely to also occur in the PL.[7] Recognition of the presence of a PL within a preoperative setting may be considered relevant to help ensure a complete resection while performing a thyroidectomy.[8] Identification and removal of the PL are of great importance for the success of postoperative treatment with radioactive iodine in patients with differentiated thyroid carcinoma.[9,10] Because if it is not removed, it will reduce the therapeutic benefit by absorbing most of the radioactive agent in patients who receive radioactive iodine in the postoperative period.[11]

Although the thyroid gland has been extensively studied, the anatomy of the PL still remains a subject to be better studied, especially in human fetuses. The frequency of occurrence of the PL has been reported in percentages ranging from 12% to 80% of cases.[2,10,12] Despite being a topic of great importance, considering the possibilities for the occurrence of pathologies and the implication of their presence in some thyroid treatments, there is a wide variation in the results reported in the literature, and studies that use

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human fetuses in the identification of the PL are not frequent. Therefore, our objective was to determine the occurrence and morphometry of the PL in human fetuses.

Material and Method

Twenty-four thyroid glands from human fetus cadavers were dissected without the aid of optical instruments, 12 male and 12 female. The fetuses were preserved in a 10% formaldehyde solution and belonged to the Human Anatomy Laboratory of the Morphology Department of the Federal University of Sergipe, obtained in accordance with Law No. 8501, of November 30, 1992, which provides for the use of unclaimed cadavers for use in research. Fetal age was estimated from the length of the hallux-calcaneus and according to the equation GA=8.2982 + (0.38764 × F), where GA is the gestational age and F is the measurement of the length of the hallux-calcaneus.[13] All measurements were performed using a digital pachymeter with a precision of 0.01 mm. The ages ranged from 20.3 to 36.8 weeks, with an average of 26.3 weeks, and in males this age ranged from 22 to 36.8 weeks with an average of 27.3 weeks and in females this average was 25.3 weeks ranging from 20.3 to 31.7 weeks. All fetuses included in the study were normal and free of any macroscopically detected thyroid pathology, or thyroid glands that presented anatomical variations and developmental anomalies, such as: agenesis of the thyroid gland, partial or complete absence of isthmus, were excluded from the study.

Results

The PL was found in 12.5% (3) of the 24 thyroid glands studied, all females. All pyramidal lobes (PLs) originated from the upper margin of the isthmus of the thyroid gland, with 66.66% (2) of the LPs located more to the left of the midline and 33.33% (1) to the right (Figure 1).

The length of the PLs ranged from 10.47 mm to 13.90 mm, with a mean of 12.56 mm, and the width ranged from 3.04 mm to 3.39 mm, with a mean of 3.25 mm (Table 1).

Table 1. Morphometry of the pyramidal lobes.

Fetus	Sex	Age (weeks)	Length (mm)	Width (mm)
1	F	32	13.90	3.04
2	F	28	10.47	3.39
3	F	21	13.32	3.32

Discussion

The thyroid is the first endocrine gland to develop, with its initial precursor appearing as early as the third week of gestation, which progresses to form a bilobed structure united by an isthmus. During the descent to its anatomical position, it remains connected to the base of the tongue by the thyroglossal duct, which in most cases becomes fibrous and is completely obliterated, however if there is persistence, it results in the formation of the PL.[8]

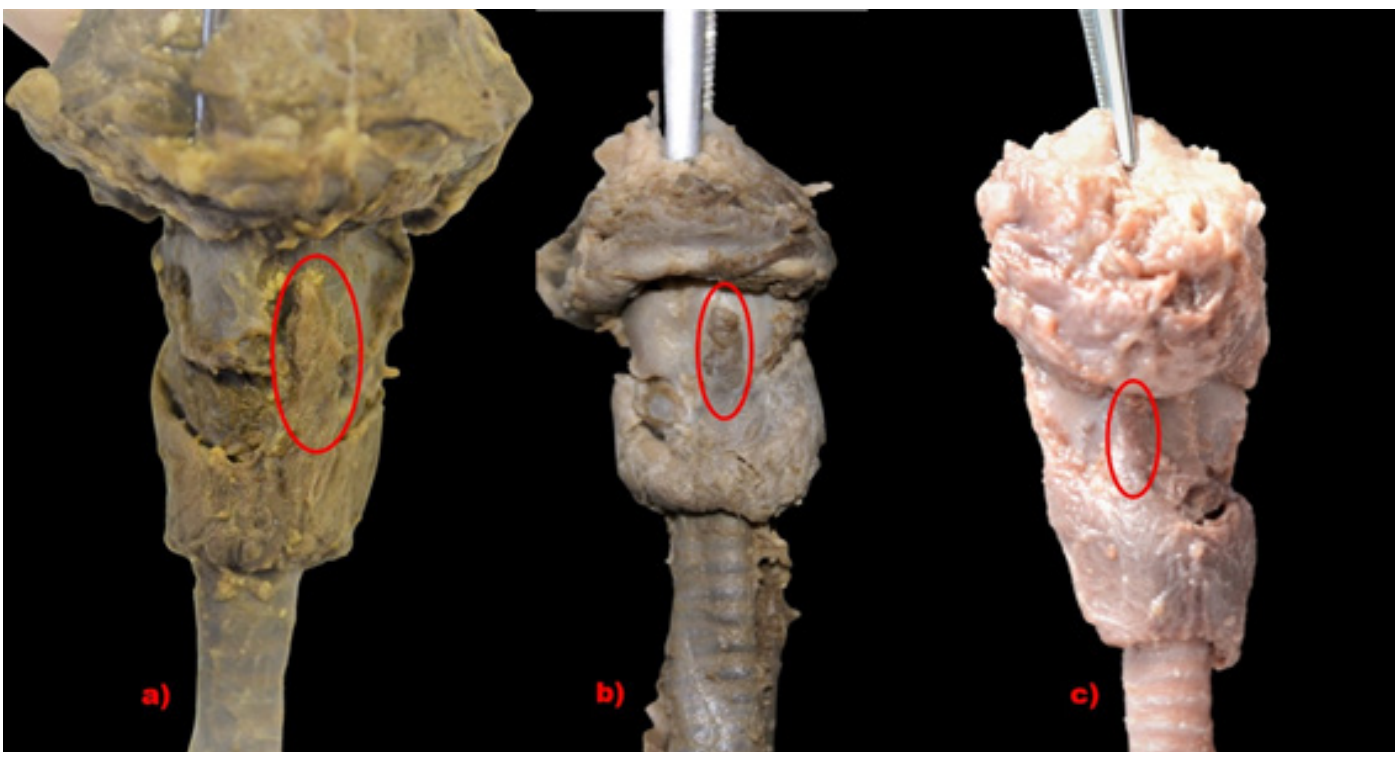

Figure 1. Origin of the pyramidal lobes
Circle – pyramidal lobe a and b – PL originating to the left of the midline of the upper margin of the isthmus
c - PL originating to the right of the midline of the upper margin of the isthmus

Anatomical studies indicate that the occurrence of the PL has varied from 12% to 80% of cases.[2,5,6,8,10-12,14] In the present study, the presence of the PL was found in 12.5% of the cases, which corroborates Geraci *et al.*,[10] who also found an occurrence of 12% of LPs in a sample of 604 patients undergoing thyroidectomy. Table 2 shows the divergence found by several authors regarding the PL frequency variation according to the type of study, location and sample.

In the present study, all PLs were present in females. This type of finding was also described by Ayandipo *et al.*,[14] Gurleyik *et al.*,[6] Mortensen *et al.*,[8] Cengiz *et al.*,[5] and Zivic *et al.*,[16] with a frequency that ranged from 62% to 86, 8%. For Sultana *et al.*,[20] Nurunnabi *et al.*,[15] Gurleyik *et al.*,[6] Milojevic *et al.*,[11] Braun *et al.*,[2] this occurrence was higher in males and ranged from 52.1% to 84%.

With regard to the length and width of PLs in the thyroid gland in adults, Ayandipo *et al.*,[14] Gurleyik *et al.*,[6] Milojevic *et al.*,[11] Mortensen *et al.*,[8] Zivic *et al.*,[16] found a length which ranged from 5 to 80 mm, while for Milojevic *et al.*,[11] Mortensen *et al.*,[8] Ayandipo *et al.*,[14] Nurunnabi *et al.*,[15] the width ranged from 4 mm to 27 mm. In our study, as it has been carried out in fetuses, the length of the LP ranged from 10.47 mm to 13.90 mm, with a mean of 12.56 mm. The width ranged from 3.04 mm to 3.39 mm, with an average of 3.25 mm. Taking as a basis the largest length and width of the PLs of adults and comparing them with the largest PLs among the fetuses in the present study, we obtained a proportion between these measurements of 17.37% for length and 12.55% for width.

Most authors state that the most frequent position (50 – 92.6%) of the origin of the pyramidal lobe of the thyroid gland is on the upper margin and more to the left of the midline of the isthmus.[4,10,15,21] In the present study, we found the PLs located more to the left of the midline (66.6%) than to the right (33.3%) and none of them in the midline of the isthmus or the lobes of the thyroid gland. For Mortensen *et al.*,[8] in 51% of the cases the origin of the PL was to the right of the midline. This finding differs from those described by Ayandipo *et al.*,[14] Gurleyik *et al.*,[6] Milojevic *et al.*,[11] and Zivic *et al.*,[16] who reported that the PL originated from the midline of the isthmus and varied from 28.1% to 52.3%.

It is important to highlight that the divergences found can be justified by the fact that the current work uses a sample composed of human fetuses, unlike other studies in which the authors studied the occurrence of PL in adults.

Conclusion

The PL is one of the most common anatomical variations of the thyroid gland. In our study, the frequency of occurrence of the PL was 12%. All PLs were present in female fetuses and had an anatomical location more frequent on the upper margin of the isthmus to the left of the midline. Therefore, detailed knowledge of the anatomy, morphology and morphometry of the PL is of paramount importance for several areas of health, especially in surgical procedures of the thyroid gland, as well as in the postoperative treatment of patients with thyroid carcinoma. Despite being a recurrent theme in adults, it needs further research in human fetuses, due to its scarcity in the literature.

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Table 2. The PL occurrence frequency.

Author	Type of study	Location	Sample	Frequency
Blumberg,[3]	Thyroidectomy surgery	U.S.	70	59%
Nurunnabi *et al.*,[15]	Cadaver	Bangladesh	60	25%
Zivic *et al.*,[16]	Thyroidectomy surgery	Republic of Serbia	100	61%
Tanriover *et al.*,[17]	Cadaver	Turkey	90	57,8%
Milojevic *et al.*,[11]	Cadaver	Republic of Serbia	58	55,2%
Mortensen *et al.*,[8]	Ultrasound	England	416	21%
Ryu *et al.*,[18]	Ultrasound	South Korea	135	58,1%
Kim *et al.*,[19]	Computed tomography	South Korea	160	59,3
Gurleyik *et al.*,[6]	Thyroidectomy surgery	Turkey	166	65,7%
Ayandipo *et al.*,[14]	Thyroidectomy surgery	Nigeria	160	44%
Freilinger .,[12]	Ultrasound	Austria	50	80%

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