

Multiple variations in the morphology of thyroid gland

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Abstract

Aim and Objective: This study is aimed to establish a preliminary data on the variation in the lobar pattern of thyroid gland **Study Design:** Descriptive type of study. **Place and period of study:** Department of Anatomy, Narayana Medical College, Chinthareddy palem, Nellore, from May 2011 to February 2014. **Materials:** Fifty embalmed formalin fixed cadavers were taken for the study from the anatomy dissection hall. **Method:** The samples were collected from the cadavers by “block dissection” and variations in the lobes and upper and lower limits of the lobes were observed and in situ and recorded. **Results:** The superior limit of the right and left lobes of the thyroid gland reached above the midpoint of the lamina of the thyroid cartilage in 12.8% and 15.4 % cases and was found at the level of that midpoint in 38.5% and 48.7% and 51.2% of cases in males and at the level of the midpoint in 54.5%, below the level of the midpoint in 36.4% and above the level of the midpoint in 9.1% and 18.2% , at the level of the midpoint in 54.5% and 54.5% and below the level of the midpoint in 36.4% and 27.3% of the cases in females respectively. 41.67% on the right and 48.33% on the left could not reach that midpoint of the thyroid cartilage. The inferior limit of the right and left lobes of the thyroid gland reached up to the 5th tracheal ring in 41% and 48.7%cases respectively and inferiorly up to the 6th tracheal ring in 59% and 51.3% of cases in males and up to the 5th tracheal ring in 36.4% and 45.5% and inferiorly up to 6th tracheal ring in 63.3% and 54.5% in female cases respectively. The isthmus was absent in 79.5% of cases in males and 72.7% of cases in females. The levator glandulae thyroidea was arising from the right lobe 11%, left lobe in 38% and isthmus in 38% of males. In females from the right lobe 0%,left lobe 1% and isthmus 1% of the cases respectively. The pyramidal lobe was arising from right lobe in 10%, left lobe in 36% and isthmus in 42% of the cases in males. In females the pyramidal lobe was arising from right lobe in 0%, left lobe in 5% and isthmus in 5% of the cases respectively. **Conclusion:** The present study is an approach to objective to increase the information pool and help the clinicians in their practice.

Key Word: Thyroid gland, levator glandulae thyroidea, pyramidal lobe and isthmus.

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INTRODUCTION

The thyroid gland is the first endocrine gland to start developing in the embryo. It is a highly vascular endocrine gland which is placed anteriorly in the neck, extending from fifth cervical to first thoracic vertebrae. The gland is composed of two lateral lobes which are

connected by a narrow median isthmus. The isthmus measures about 1.25 cm transversely as well as vertically and it is usually placed anterior to the second and the third Tracheal rings³. The anomalies of the development of the thyroid gland distort the morphology of the gland and they may cause clinical functional disorders and various thyroid illnesses⁴. The knowledge of the various developmental anomalies of the gland and the variations in the neurovascular relations will help the surgeons in the better planning of a safe and effective surgery⁵. A conical pyramidal lobe often ascends towards the hyoid bone from the isthmus or the adjacent part of the either lobe; it is occasionally detached or in two or more parts a fibrous or fibromuscular band. The levator of the thyroid gland- muscular levator glandulae throidae, sometime descends from the hyoid body to the isthmus or pyramidal lobe¹.

MATERIAL AND METHODS

Collection of specimen : 50 embalmed, formalin preserved cadavers aged between 40 to 75 years were collected over a period of 2011-2014 in the Department of anatomy, Narayana medical college, Chinthareddypalem, Nellore , Andhra Pradesh, INDIA. Measuring tape and vernier calliper were used for the study. Dissection method was employed for this study. The infrahyoid group of muscles were identified and reflected. The sternocleidomastoid muscle and superior belly of omohyoid were displaced laterally. After reflecting the sterno hyoid, sterno thyroid muscles the thyroid gland was exposed (Anitha T *et al* 2011). The fascia was removed from the lobes of the thyroid gland exposing its arteries and veins. During dissection of the specimen, observation notes were taken about the upper and lower limits of the lobes of the thyroid gland. The extensions of the thyroid gland i.e. superior and inferior limits were observed very carefully. The superior extension of each lobe of the thyroid gland was marked by a pin-marking on underlying thyroid cartilage and after removal of the whole of the thyroid gland, the distance between the points of junction of the cornua with the lamina of the thyroid cartilage above and below was measured with the help of a thread and then the thread was imposed on a measuring tape, on each side. Then the midpoint of that distance was determined. After that, the relative position of the pin-mark with that midpoint was noted on both sides. Then, at the inferior pole of lobes pin-mark was given and just after removal of whole of the thyroid gland, the inferior limit was noted by identifying the tracheal ring on which the pin-mark was given (Nurunnabi ASM *et al* 2011). The course of the levator glandulae thyroidea 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 (Zivic R *et al* 2011 august).

RESULTS

In the present study, the mean height of the right lobe of the thyroid gland was 4.3 ± 0.79 and the left lobe was 1.15 ± 0.45 . The mean height of the isthmus was 1.3 and its width was 1.6 respectively. The superior limit of the right and left lobes of the thyroid gland reached above the midpoint of the lamina of the thyroid cartilage in 12.8% and 15.4 % cases and was found at the level of that midpoint in 38.5% and 48.7% and 51.2% of cases in males and at the level of the midpoint in 54.5%, below the level of the midpoint in 36.4% and above the level of the midpoint in 9.1% and 18.2% , at the level of the midpoint in 54.5% and 54.5% and below the level of the midpoint in 36.4% and 27.3% of the cases in females

respectively. 41.67% on the right and 48.33% on the left could not reach that midpoint of the thyroid cartilage. The inferior limit of the right and left lobes of the thyroid gland reached up to the 5th tracheal ring in 41% and 48.7% cases respectively and inferiorly up to the 6th tracheal ring in 59% and 51.3% of cases in males and up to the 5th tracheal ring in 36.4% and 45.5% and inferiorly up to 6th tracheal ring in 63.3% and 54.5% in female cases respectively. The isthmus was absent in 79.5% of cases in males and 72.7% of cases in females. The levator glandulae thyroidea was arising from the right lobe 11%, left lobe in 38% and isthmus in 38% of males. In females from the right lobe 0%, left lobe 1% and isthmus 1% of the cases respectively. The pyramidal lobe was arising from right lobe in 10%, left lobe in 36% and isthmus in 42% of the cases in males. In females the pyramidal lobe was arising from right lobe in 0%, left lobe in 5% and isthmus in 5% of the cases respectively.

DISCUSSION

Berkovitz (2005) stated that the lateral lobes of the thyroid gland found to extend up to the lamina of the thyroid cartilage along an oblique line and their bases are level with the 4th or 5th tracheal ring. Sultana(2005) observed that among the left lobes, the superior limit was below the midpoint of the lamina of the thyroid cartilage in 83.3% of cases and 56.6% of the right lobes could reach the midpoint. 53.3% of the right lobes and 55% of the left lobes reached up to the 5th tracheal ring inferiorly. Begum, Begum and Naushaba (2006) found that among the right and left lobes, the superior limits were above the midpoint of the lamina of the thyroid cartilage in 35% and 31.67% cases, at the level of midpoint in 41.67% and 31.67%, below the midpoint in 6.7% and 36.67% respectively. In the present study the superior limit of the right and left lobes of the thyroid glands reached above the midpoint of the line joining the junctions of superior and inferior cornua with the lamina of the thyroid cartilage in 16.67% and 8.33% of cases respectively. In 41.67% of cases of the right lobe and 43.33% of cases of the left lobe, the superior limits were at the level of that midpoint. In 41.67% on the right and 48.33% on the left could not reach that midpoint of the thyroid cartilage respectively. The inferior limit of the right and left lobes of the thyroid gland reached up to the 5th tracheal ring in 63.33% and 60% cases respectively and reached up to the 6th tracheal ring in 36.67% and 40% cases 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. In the present study, Pyramidal lobe was

present in 36% in the present study and it was attached to the isthmus or lateral lobes. It was observed that the maximum number of lobes was attached to the isthmus (42%), as compared to the right or left lobe. In 11% and 3% of the cases, it was attached to the right and left lobes respectively. Marshall (1895) described the presence of isthmus in 43% of the cases respectively. Harjet *et al* (2004) observed in 28.9% of the specimens respectively. 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. Sobotta J (1915), Hunt PS *et al* (1968), Blumberg NA (1981), Braun EM *et al* (2000). The levator glandulae thyroideae was encountered in 49.5% of the dissections which were performed by Ranade *et al*, 2008. According to Gregory and Guse (2007) Soemmerring's levator glandulae thyroidea is an accessory muscle which runs from the hyoid bone to insert partly on the thyroid cartilage and partly on the isthmus of the thyroid gland. Merkel (1913) thought that

the levator glandulae was constant and glandular, though it was usually surrounded by muscle fibres. Huschke (1845) spoke of the structure only as glandular, while he mentioned nothing about the muscle. Bourgery (1831) described and illustrated a muscle which he called as "hyo-thyroïdien", which occupied the place of the pyramidal lobe. Finally, Godart (1847) reported a case in which the structure was indeed muscular, on the basis of the nitric acid test for the muscle. Soemmerring's muscle is the same as the hyo-thyro-glandulaire of Pointe, the levator glandulae thyroideae superficialis medius et longus of Krause (1879) and the musculus thyroideus of Merkel (1913) its usual full name in the literature being 'levator glandulae thyroideae of Soemmerring'. The isthmus was absent in 79.5% of cases in males and 72.7% of cases in females in the present study. Pastor *et al* (2006) defined the agenesis of the thyroid isthmus as the complete and congenital absence of the thyroid isthmus.

RESULTS

Absence of isthmus



Figure 1: Levator glandulae thyroideae and pyramidal lobe arising from left lobe of thyroid gland

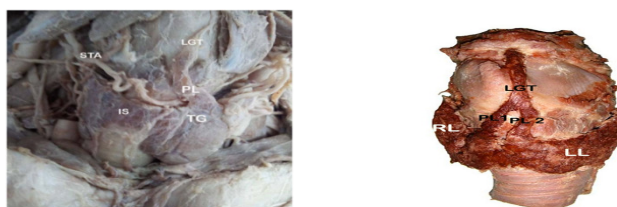


Figure 2: Double pyramidal lobe and double levator glandulae thyroideae.

Table 1: Extension of the lobes of thyroid gland

	Superior limit in relation to midpoint the lamina of thyroid cartilage			Inferior limit in relation to the tracheal ring						
	At	Below	Above	At	Below	Above	5 th	6 th	7 th	8 th
Male (39)	15 (38.5%)	19 (48.7%)	5 (12.8%)	13 (33.3%)	20 (51.2%)	6 (15.4%)	16 (41%)	23 (59%)	19 (48.7%)	20 (51.3%)
Female (11)	6 (54.5%)	4 (36.4%)	1 (9.1%)	6 (54.5%)	3 (27.3%)	2 (18.2%)	4 (36.4%)	7 (63.6%)	5(45.5%)	6 (54.5%)

Table 2: Incidence of isthmus in different sex

Sex	Present		Absent	
	Number	Percent	Number	Percent
Male (39)	31	79.5%	8	20.5%
Female (11)	8	72.7%	3	27.3%

Table 3: Posterior relations of the isthmus

Related structure	Frequency	Percentage
1 st and 2 nd rings	4	10%
1 st 2 nd and 3 rd rings	10	25.6%
2 nd 3 rd and 4 th rings	15	38.5%
2 nd and 3 rd rings	5	12.8%
3 rd and 4 th rings	5	12.8%
Present in total	39	78%

Table 4: Mean height and thickness of lobes and isthmus

Lobe	Height (+_SD)	Thickness (+_SD)	Width
Right lobe	4.3+_0.79	1.15+_0.45	-
Left lobe	4.2+_0.72	1.15+_0.32	-
Isthmus	1.3	-	1.3

Table 5: The number of male and female cadavers with gross anatomical variations

Variant Lobes	Male Cadavers						Female Cadavers					
	Right	%	Left	%	Isthmus	%	Right	%	Left	%	Isthmus	%
Pyramidal lobe (19)	2	10	7	36	8	42	0	0	1	5	1	5
Levator glandulae thyroidea (18)	2	11	7	38	7	38	0	0	1	5	1	5

CONCLUSION

The agenesis of the isthmus can be associated with other types of dysorganogenesis, such as the absence of a lobe or the presence of ectopic thyroid tissue and hence, in clinical practice, when such a condition is diagnosed, it is necessary to perform a differential diagnosis against other pathologies such as autonomous thyroid nodule, thyroiditis, etc. 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 thyroidectomy. Understanding of thyroid anatomy and associated anatomical variations are very important so that these variations are not overlooked in the differential diagnosis.

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