Case Report

Multiple Anomalies in the Morphology and the Blood Supply of the Thyroid Gland: A Case Report

Anatomy Section

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ABSTRACT

During the routine undergraduate dissection of the thyroid gland of a 50 year old male cadaver, multiple anomalies in the morphology and the blood supply of the thyroid gland were encountered. These were in the form of the absence of the thyroid isthmus, the presence of the pyramidal lobe and levator glandulae thyroidae on the right side and the bilateral absence of the superior thyroid artery, the gland being supplied solely by the inferior thyroid arteries which came out as the branches of the thyrocervical trunk. 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. The knowledge of various developmental anomalies of the gland and the variations in the neurovascular relations helps the surgeon in the better planning of a safe and effective surgery.

Key Words: Anatomy, Isthmus, Pyramidal lobe, Levator glandulae thyroidae, Superior thyroid artery

KEY MESSAGE

- The thyroid gland is a highly vascular gland which is composed of two lateral lobes which are connected by a narrow median isthmus. 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 illnesses.

INTRODUCTION

The thyroid gland is the first endocrine gland to start developing in the embryo. It is well known for its developmental anomalies which include persistence of the pyramidal lobe, thyroglossal cysts, agenesis of the thyroid gland, agenesis of the isthmus alone or of the aberrant thyroid gland, etc [1,2]. It is a highly vascular endocrine gland which is placed anteriorly in the neck, extending from the fifth cervical to the 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 rings [3]. 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 illnesses [4]. 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 surgery [5].

CASE REPORT

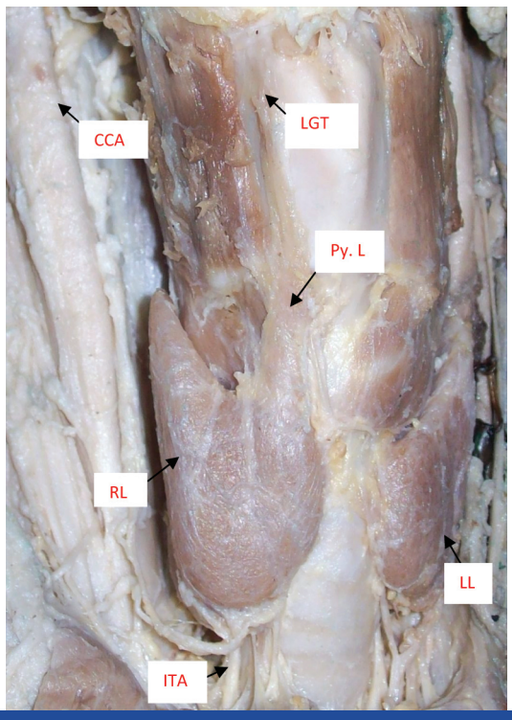
During the routine undergraduate dissection of the thyroid gland of a 50 year old male cadaver in the Department of Anatomy, Govt. Medical college, Amritsar, India, the following anomalies were found:

- Absence of the thyroid isthmus
- Presence of the right pyramidal lobe
- Presence of levator glandulae thyroidae on the right side.
- Bilateral absence of the superior thyroid artery, the gland being supplied solely by the inferior thyroid artery.

The right and the left lobes were lying independently on either side of the trachea. The right lobe measured 3.5cms along its anterior border and 2.2cms transversely, its apex being at the level of the lower border of the thyroid cartilage and its base being at the level of the third tracheal ring. The left lobe measured 3.0cms along its anterior border and 2.0cms transversely, its apex being at the level of the middle of the cricoid cartilage and its base being at the level of the fourth tracheal ring. The pyramidal lobe was 2.3cms long and 1.5cms wide. The length and breadth of the levator glandulae thyroidae were 3.5cms and 0.3-0.4cms respectively. It extended from the pyramidal lobe to the hyoid bone. The superior thyroid arteries were absent on both the sides. Instead, the two lobes were supplied by the inferior thyroid arteries which came out as the branches of the thyrocervical trunk on both the sides. There was no anastomosis between the two inferior thyroid arteries (See [Table/Fig-1]). There was no scar on the neck which suggested that the subject had not undergone any surgery. There was no ectopic thyroid tissue between the root of the tongue and the gland's position.

DISCUSSION

Pastor et al (2006) [6] defined the agenesis of the thyroid isthmus as the complete and congenital absence of the thyroid isthmus. Its incidence varies between 3%–33%, as has been reported by various authors (See [Table/Fig-2]).



[Table/Fig-1]: Showing the anomalies in the morphology and blood supply of thyroid gland.
(CCA: Common carotid artery; ITA: Inferior thyroid artery; LGT: Levator glandulae thyroidae; LL: left lobe; Py L: Pyramidal lobe; RL: Right lobe)

Sr. No.	Author & Year	Incidence
1	Marshall, 1895 [1]	10%
2	Kukarni & Kadam, 2001 [7]	1 case
3	Won & Chung,2002 [8]	3%
4	Harjeet et al, 2004 [9]	7.9%
5	Pastor et al, 2006 [6]	1 case
6	Braun et al, 2007 [10]	6.9%
7	Ranade et al,2008 [11]	33%
8	Dixit et al, 2009 [5]	14.6%
9	Shankar et al, 2009 [12]	1 case

[Table/Fig-2]: Showing the incidence of the agenesis of the thyroid isthmus

The incidence of the pyramidal lobe ranges between 7%–76.8% (See [Table/Fig-3]).

Sr. No.	Author & Year	Incidence
1	Braun et al, 2007 [10]	55%
2	Ranade et al, 2008 [11]	58%
3	Dixit et al, 2009 [5]	7.31%
4	Won & Chung, 2002 [8]	76.8%

[Table/ Fig-3]: Showing the incidence of the pyramidal lobe

The levator glandulae thyroidae was encountered in 49.5% of the dissections which were performed by Ranade et al, 2008 [11]. According to Gregory and Guse (2007) [13], Soemmerring's levator glandulae thyroidae 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) [14] thought that the levator glandulae was constant and glandular, though it was usually surrounded by muscle fibres. Huschke (1845) [15] spoke of the structure only as glandular, while he mentioned nothing about the muscle. Bourgery (1831) [16] described and illustrated a muscle which he called as "hyo-thyroïdien", which occupied the place of the pyramidal lobe. Finally, Godart (1847) [17] 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) [18] and the musculus thyroideus of Merkel (1913) [14]; its usual full name in the literature being 'levator glandulae thyroideae of Soemmerring'.

Morrigyl and Sturm (1996) [19] reported a rare case in which both the inferior thyroid arteries and the left superior thyroid artery were absent.

All the previous researchers mentioned the individual incidence of these anomalies, but all were silent about all the variations which occurred in the same cadaver. Probably none had encountered a case with so many anomalies as was found in the present cadaver.

Ontogeny

The agenesis of the isthmus can be explained as an anomaly of the embryological development. The adult thyroid gland has two types of endocrine cells, the follicular and the parafollicular cells, which are derived from two different embryological cell families. The follicular cells come from the endodermic cells of the primitive pharynx and the parafollicular cells come from the neural crest [20]. The thyroid gland begins to develop as a median thickening of the endoderm on the floor of the pharynx, between the first and the second pharyngeal pouches. This area later invaginates to form the median diverticulum, which appears in the latter half of the fourth week. This thyroid diverticulum grows in allometric proliferation, becoming a solid cellular cord which is called the thyroglossal duct. The duct grows caudally and bifurcates to give rise to the thyroid lobes and the isthmus. At the same time when its caudal growth is taking place, the cephalic end of the thyroglossal duct degenerates [21]. A high division of the thyroglossal duct can generate two independent thyroid lobes with the absence of the isthmus. The absence of the isthmus can be associated with other types of dysorganogenesis, such as the absence of either lobe or the presence of ectopic thyroid tissue [22].

Phylogeny

When we trace the phylogeny, it is seen that the isthmus may be missing in amphibians, birds and among mammals- monotremes, certain marsupials, cetaceans, carnivores and rodents. In rhesus monkeys (Macacus rhesus) also, there is no isthmus [6].

CLINICAL SIGNIFICANCE

Clinically, the diagnosis of the agenesis of the isthmus can be made with scintigraphy, which can also be performed with an overload of TSH. The diagnosis can also be made with the aid of ultrasonography, computerized tomography (C.T.) and magnetic resonance imaging (M.R.I.) or during a surgical procedure. In asymptomatic patients with nodular goitres, fine-needle aspiration biopsies and eventually, immunohistochemistry tests are useful in supporting the medical decision, but when agenesis is present, the importance of the pre-operative differentiation between the benign and the malignant lesions is critical, considering the surgical procedure and the possibility of the impairment of the thyroid function [23]. When an image of the absence of the isthmus is observed, a differential diagnosis against autonomous thyroid nodule, thyroiditis, primary carcinoma, neoplastic metastasis and infiltrative diseases such as amyloidosis should be considered [6].

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. The surgeon who plans a thyroidectomy must be prepared to find variations like ectopic thyroid nodules around the normally-located thyroid gland. Proper identification of the vessels is very important in order to avoid major complications. Hence, a thorough knowledge of the thyroid anatomy and its associated anatomical variations is very much essential, so that these anomalies may not be overlooked in the differential diagnosis.

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