

Research Article

Morphological variations of the thyroid gland

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ABSTRACT

Background: The knowledge of various morphological & developmental anomalies of thyroid gland will help the surgeons in better planning of safe & effective surgery. Considering these facts we studied the variations of thyroid gland.

Methods: The material for the present study was collected from the department of forensic medicine, MMC & RI, Mysore, which includes 56 male and 33 female adult postmortem cadavers aged between 18 to 80 years. A dissection was carried out to expose thyroid glands & variations were observed in the morphology of thyroid gland.

Results: 1) 9% of specimens had agenesis of isthmus. 2) 46% of specimens had pyramidal lobe. 3) 41% of specimens had levator glanduli thyroideae. 4) 2.24 % of specimens had accessory thyroid tissue.

Conclusion: This study highlights the various morphological anomalies of the thyroid gland which forms cornerstone to safe & effective surgery.

Keywords: Thyroid gland, isthmus, Pyramidal lobe, Levator glanduli thyroideae

INTRODUCTION

Thyroid gland is situated low down in front of the neck. It consists of two symmetrical lobes united by an isthmus that lie in front of the second, third & fourth tracheal rings. In addition to its own capsule, the gland is enclosed by envelope of pretracheal fascia. Each lateral lobe is pear shaped with a narrow upper pole & a broader lower pole, and appears approximately triangular in cross-section with lateral, medial & posterior surfaces.

A small portion of gland substance often projects upwards from the isthmus, generally to the left side of the median plane, as the pyramidal lobe and represents a development of glandular tissue from the caudal end of the thyroglossal duct. It may be attached to the inferior border of the hyoid bone by fibrous band, which sometimes contains muscle fibers present in it are named Levator Glanduli Thyroideae (LGT) and are innervated by branch of external laryngeal nerve. Separate small masses of thyroid tissue (accessory thyroid glands) are

commonly found near the hyoid bone, in the tongue, in the superior mediastinum, or anywhere along the path of the descent of the thyroglossal duct, though their presence may only be revealed by histological study.¹

Levator glandulae thyroideae is said to represent the detached part of infrahyoid muscles and it may be innervated by a twig from Ansacervicalis.²

Thyroid disorder is a common health problem among large number of endocrinopathies. About 5% of the world population is affected from various Thyroid diseases. Most of the diseases affecting the Thyroid gland such as Goiter, Thyrotoxicosis, adenoma, carcinoma etc. are usually associated with enlargement of the gland and require medical and surgical intervention.³

Isthmus of Thyroid gland is constricted part which connects the Thyroid lobes in the median plane. The isthmus vary greatly & sometimes may be absent.¹ Agenesis of the thyroid isthmus can also be defined as the

complete and congenital absence of isthmus.⁴ The basic mechanism of agenesis of isthmus can be attributed to anomalous embryological development. Available literatures suggest that chromosome 22 plays a major role in the thyroid development.⁵

The thyroid gland appears as an epithelial proliferation in the floor of pharynx between tuberculum impar & foramen caecum. Subsequently thyroid gland descends in front of the pharynx as bilobed diverticulum. During the migration this thyroid remains connected to the tongue by a narrow canal the thyroglossal duct. This duct normally disappears. A high division of thyroglossal duct can lead to independent thyroid lobes and pyramidal lobe with absence of isthmus.⁶

METHODS

This study was done on 89 postmortem human thyroid glands collected from both sexes (Male 56, female 33) age ranging from 18 to 80 years. Fresh specimens containing thyroid gland were collected from November 2013 to July 2014 at the autopsy laboratory of Forensic medicine department of Mysore medical college & research institute.

The collected specimens were fixed in 10% formal saline solution. A dissection was carried out to expose the Thyroid glands. The thyroid glands were examined for the following variations such as,

1. Absence of isthmus
2. Presence of pyramidal lobe
3. Presence of levator glanduli thyroidae
4. Presence of accessory thyroid tissue

RESULTS

Our study included 56 male (62%) & 33 female (37%).

The morphological variations observed in the present study out of 89 specimens are;

- Absence of isthmus was seen in 8 specimens (9%) of which, 5 were male & 3 were female (Figure 1).
- Presence of pyramidal lobe was seen in 41 specimens (46%) of which, 29 were male & 12 were female (Figure 2).
- Presence of levator glanduli thyroidae was seen in 37 specimens (41%) of which, 26 were male & 11 were female (Figure 2).
- Two male specimens (2.24 %) of specimens had accessory thyroid tissue (Figure 3).

The incidence of thyroid gland variations are shown in Table 1.

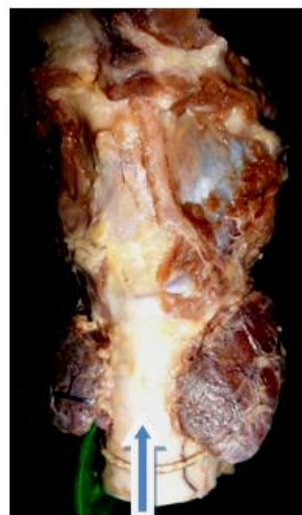


Figure 1: Showing absence of isthmus.

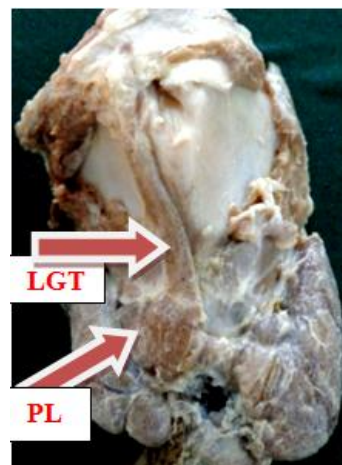


Figure 2: Showing PL - pyramidal lobe & LGT - levator glanduli thyroidae.



Figure 3: Showing accessory thyroid tissue.

Table 1: Percentage of thyroid gland variations out of 89 specimens.

Type of variation	No of cadavers	Percentage (%)
Absence of isthmus	08	9%
Presence of pyramidal lobe	41	46%
Presence of levator glanduli thyroidea	37	41%
Presence of accessory thyroid tissue	02	2.24%

DISCUSSION

Agenesis of isthmus of thyroid gland is rare in humans, the incidence varying from 5% to 10%.⁷ In our study incidence of absence of isthmus is in 9% (8 specimens), out of which 5 were male specimens & 3 were female specimens. This observation can be compared with studies done by Marshall et al., & Veena Kulkarni et al., Prakash et al, Daksha Dixit, Hussein Muktyaz, Abu Sadat Ahmed found 10%, 8.57%, 14%, 12.5%, 18.8% respectively. Incidence of absence of isthmus was higher in studies conducted by Saheli Zannath Sultana et al. & Ranade et al. where it was 31.66% & 33% respectively. This incidence was just 2.22% in the study done by O Tanriover in Bangladesh (Table 2).

Table 2: Percentage of absence of isthmus compared with other studies.

Authors & year of study	Sample size	% of absence of isthmus
C. F. Marshall (1891)	Total-60	10%
Ranade et al. (2008)	Total-105	33%
Abu Sadath Mohammed (2008)	Total-73	18.8%
Daksha Dixit et al. (2009)	Total-41	14%
Prakash et al. (2011)	Total-70	8.57%
O. Tanriover et al. (2011)	Total-90	2.22%
Veena Kulkarni et al. (2012)	Total-20	10%
Hussein Muktyaz et al. (2013)	Total-56	12.5%
Present study (2014)	Total-89	9%

The isthmus may be missing in the amphibians, birds and among mammals - monotremes, certain marsupials, cetaceans, carnivores and rodents. In rhesus monkey (Macacus rhesus) thyroid glands are normal in position but there is no isthmus.⁶

A comparative study of anatomy suggests that isthmus connecting the two lobes appeared during the course of evolution. The morphological difference in the evolutionary origin does not result in any changes in the thyroid function.⁴

In our study incidence of presence of pyramidal lobe is 46.06% (41 specimens), out of which 29 were male & 12 were female. This observation can be compared with the similar reports in the studies conducted by Marshall,

Hussein Muktyaz et al. found 43% & 41% respectively. This incidence was high in studies conducted by O. Tanriover et al. & Ranade et al. where it was 57.8 % & 58% respectively. This incidence was low i.e. 35.71% in a study done by Prakash et al., where as it was just 7.31% in a study done by Daksha Dixit et al. (Table 3).

Table 3: Percentage of presence of pyramidal lobe compared with other studies.

Authors & year of study	Sample size	% of presence of pyramidal lobe
C. F. Marshall (1891)	Total-60	43%
Ranade et al. (2008)	Total-105	58%
Daksha Dixit et al. (2009)	Total-41	7.31%
Prakash et al. (2011)	Total-70	35.71%
O. Tanriover et al. (2011)	Total-90	57.8%
Hussein Muktyaz et al. (2013)	Total-56	41.0%
Present study (2014)	Total-89	46.06%

Total, subtotal & partial thyroidectomy performed for different stages of carcinoma thyroid require precise and accurate knowledge of variations associated with thyroid gland. During thyroidectomy the pyramidal lobe also called Lolouett’s lobe - should be looked for & removed otherwise it can result in incomplete resection of the thyroid gland.⁸

All thyroid diseases are described in the pyramidal lobe which is formed from normal thyroid tissue. Residual thyroid tissue in the pyramidal lobe can lead to serious complications in diseases like carcinoma & Grave’s disease where complete removal of thyroid gland is indicated.⁹

In our study incidence of presence of levator glanduli thyroidea is 41.57% (37 specimens) out of which 26 were male & 11 were female specimens. This observation can be compared with the similar study done by Ranade et al. where it was 49.5%, it was low in studies done by Prakash et al. & Veena Kulkarni where it was 32.85% & 30% respectively, This incidence was too low to extent of 19.6% & 7.31% in studies conducted by Hussein Muktyaz et al. & Veena Kulkarni et al. (Table 4).

Table 4: Percentage of presence of levator glanduli Thyroidea with other studies.

Authors & year of study	Sample size	% of presence of levator glanduli thyroidea
Ranade et al. (2008))	Total-105	49.5%
Daksha Dixit et al. (2009)	Total-41	7.31%
Prakash et al. (2011)	Total -70	32.85%
Veena kulkarni et al. (2012)	Total-20	30%
Hussein Muktyaz et al. (2013)	Total-56	19.6%
Present study (2014)	Total-89	41.57%

According to Gregory & Guse Sommerring's levator glandulae thyroideae is an accessory muscle which runs from the hyoid bone to insert partly on the thyroid cartilage & partly on the isthmus of the thyroid gland.¹⁰ It's usual full name in the literature being "Levator glandulae thyroideae of Soemmerring".¹¹

The incidence of presence of Accessory thyroid tissue in our study is 2.24% which can be compared with the studies done by Ranade et al., Hussein Muktyaz where it was 1% & 3.57% respectively. It was nil in study conducted by Prakash et al (Table 5).

Table 5: Percentage of presence of accessory thyroid tissue with other studies.

Authors & year of study	Sample size	% of presence of accessory thyroid tissue
Ranade et al. (2008))	Total-105	1%
Hussein Muktyaz et al. (2013)	Total-56	3.57%
Prakash et al. (2011)	Total-70	0
Present study (2014)	Total-89	2.24%

The nature of specimens studied, and the region where study was carried out, affect of different Goiter zones, age, sex and race of population studied, all of which can contribute to the anatomical variations of the Thyroid gland found in different reports by various authors.⁹

CONCLUSION

In order to perform safe & effective surgery as well as diagnosis of thyroid disorders, knowledge of normal anatomy & morphological variations of the thyroid gland are essential.

Usually agenesis of isthmus is difficult to determine unless the patients present for other thyroid pathologies. Agenesis of isthmus can be diagnosed via scintigraphy, ultrasonography, computed tomography and magnetic resonance imaging. When the absence of isthmus is suspected, the individual may be directed for a differential pathological diagnosis such as autonomous thyroid nodule, thyroiditis, primary carcinoma, neoplastic metastasis & infiltrative diseases such as amyloidosis.⁶

Agenesis of isthmus can be associated with other types of dysorganogenesis, such as the absence of a lobe or presence of ectopic thyroid tissue & 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 and so on.⁷

While planning for thyroidectomy one should be prepared to find variations like ectopic thyroid nodules around normally located thyroid gland.

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