

# Morphological Variations of the Thyroid Gland

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## Abstract

**Background:** Knowledge of morphological variations of thyroid gland is essential for surgeons operating in the region of neck as it can mislead the diagnosis. Considering these facts, we studied the variations of the thyroid gland.

**Material and methods:** During dissection of head and neck region in 20 cadavers, in department of anatomy, SDM medical college, Dharwad, variations observed in the morphology of thyroid gland were noted.

**Results:** Our observations were as follows :

- 1) 25 % of specimens had levator glandulae thyroideae (unilateral 20 %, bilateral 5 %)
- 2) 5 % of specimens had levator glandulae thyroideae along the midline of the neck.
- 3) 10 % of specimens had agenesis of isthmus of thyroid gland.

**Conclusion :** The study depicts the variations in the development of thyroid gland in this part of North Karnataka.

**Key words :** Thyroid gland, levator glandulae thyroideae, isthmus.

## 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 and fourth tracheal rings. In addition to its own capsule, the gland is enclosed by an envelope of pretracheal fascia. Each lateral lobe is pear shaped with a narrow upper pole and a broader lower pole, and appears approximately triangular in cross-section with lateral, medial and posterior surfaces.

The isthmus unites the anterior parts of the lobes towards the lower poles. The posterior surface of the isthmus is firmly adherent to the second, third and fourth rings of trachea, and the pretracheal fascia is here fixed between them. An anastomosis between the two superior thyroid arteries runs across the upper border and tributaries of the inferior thyroid veins emerge from its lower border.

A small portion of gland substance often projects upwards from the isthmus, generally to the left of the midline, 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 tissue; muscle fibers present in it are named levator glandular thyroideae (LGT) and are innervated by branch of external laryngeal nerve. Separate small masses of thyroid tissue (accessory thyroid glands) are not uncommonly 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].

## Material and methods

A detailed cadaveric study of the anterior midline region of the neck was carried out in 20 formalin fixed, adult cadavers provided for the medical students in the Department of Anatomy of SDM Medical College, Dharwad.

## Results

We observed different variations in the specimens. There was agenesis of the isthmus in one specimen associated with pyramidal lobe connected to the hyoid bone through levator glandulae thyroideae on the right side (Figure 1).

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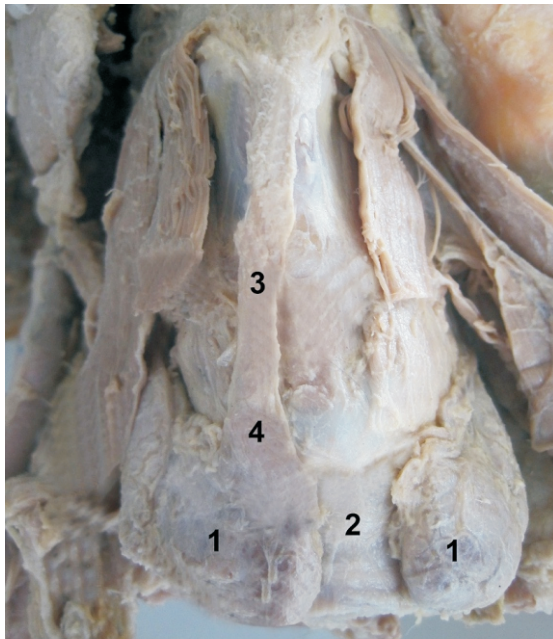
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The second specimen had pyramidal lobe with levator glandulae thyroideae on right side. Both the levator glandulae thyroideae were predominantly fibrous.

The next two specimens had pyramidal lobe with levator glandulae thyroideae on left sides which were predominantly muscular (Figure 2).

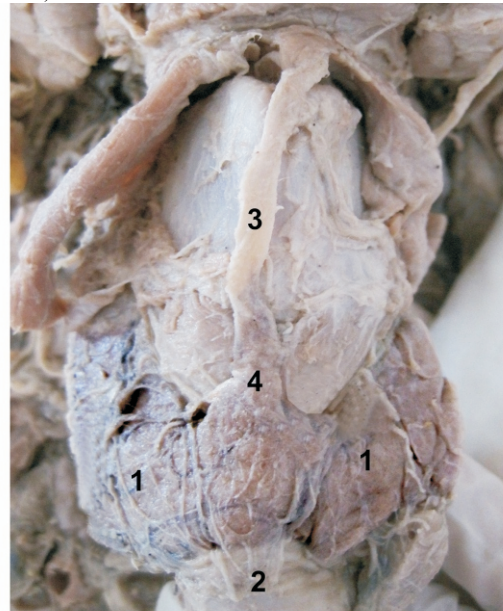


**Figure 1. Complete agenesis of isthmus of thyroid with levator glandulae thyroideae on right side**  
 1. Lateral lobe                      3. Levator glandulae thyroideae  
 2. Trachea                         4. Pyramidal lobe



**Figure 2. Partial agenesis of isthmus of thyroid gland with levator glandulae thyroideae on left side**  
 1. Lateral lobe                      3. Levator glandulae thyroideae  
 2. Trachea                         4. Pyramidal lobe

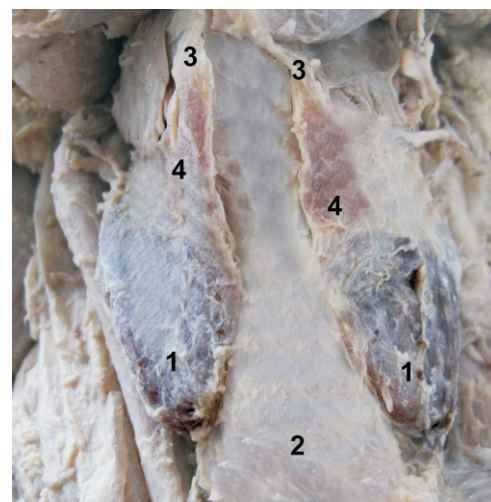
Another specimen showed pyramidal lobe arising from the isthmus and a musculofibrous levator glandulae thyroideae along the midline of the neck (Figure 3).



**Figure 3. Levator glandulae thyroideae along the midline of neck**  
 1. Lateral lobe                      3. Levator glandulae thyroideae  
 2. Trachea                         4. Pyramidal lobe

There was agenesis of isthmus with bilateral levator glandulae thyroideae in the sixth specimen. The levator glandulae thyroideae had predominantly muscle fibers, few of which were in continuity with the infrahyoid muscles (Figure 4).

Amongst the 20 specimens, 30% of the specimens showed variations. Among them 10% had absence of isthmus, 5% had levator glandulae thyroideae bilaterally, 5% had along midline, 10% had unilateral levator glandulae thyroideae on left side and another 10% on right side (Table 1).



**Figure 4. Complete agenesis of isthmus of thyroid gland with Levator glandulae thyroideae**  
 1. Lateral lobe                      3. Levator glandulae thyroideae  
 2. Trachea                         4. Pyramidal lobe



**Table 1. Variations of thyroid gland morphology in the present study**

| Absent isthmus | LGT Bilateral | LGT Midline | LGT Unilateral (left) | LGT Unilateral (right) |
|----------------|---------------|-------------|-----------------------|------------------------|
| 02             | 01            | 01          | 02                    | 02                     |
| 10%            | 5%            | 5%          | 10%                   | 10%                    |

**Discussion**

Agenesis of the thyroid isthmus is complete and congenital absence of the thyroid isthmus. The isthmus can normally be missing in amphibians, birds, and some mammals, including marsupials and rodents. This configuration does not seem to affect thyroid function. In all higher primates, including humans, thyroid is composed of two thyroid lobes joined by an isthmus [2]. It has been found in cadavers and can be explained embryologically. The caudal end of the thyroglossal duct bifurcates and forms the thyroid lobes and isthmus. A high division of the thyroglossal duct can result in two independent thyroid lobes and no isthmus. Thyroid isthmus agenesis does not cause clinical symptoms by itself and most of the times the diagnosis is incidental due to existence of other thyroid pathology [3].

**Table 2. Comparison of present study with other studies**

|               | Present study | Ranade et al | Braun et al | Gruber | Marshal |
|---------------|---------------|--------------|-------------|--------|---------|
| Present study | 10%           | 33%          | 6.8%        | 5%     | 10%     |
| LGT           | 30%           | 49.5%        | -           | -      | -       |

Many workers claim that the absence of isthmus is quite rare in humans, and in adult animals, the isthmus is either present or absent [4,5].

Nehtap et al observed failure of fusion of isthmus in the midline of the thyroid gland in a 48-year-old female cadaver [6]. The absence of an isthmus can be associated with other types of dysorganogenesis, such as absence of a lobe or presence of ectopic thyroid tissue [7]. The incidence of absent isthmus was 10%, 33%, 68%, 5% and 10% in the present study and the studies conducted by Ranade et al, Braun et al, Gruber and

Marshal respectively. Levator glandulae thyroideae was present to the extent of 30% and 49.5% in the present study and in the study conducted by Ranade et al. (Table 2). According to Gregory and Guse, Soemmerring's levator glandulae thyroideae 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 [8]. Merkel thought that the levator glandulae was constant and glandular, though it was usually surrounded by muscle fibres [9]. Huschke spoke of the structure only as glandular, while he mentioned nothing about the muscle [10]. Bourgerie described and illustrated a muscle which he called as "hyo-thyroïdien", which occupied the place of the pyramidal lobe [11]. Finally, Godart 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 and the musculus thyroideus of Merkel ; its usual full name in the literature being 'levator glandulae thyroideae of Soemmerring'[12]. In present study the LGT was found in 30% cases.

Moore and Persaud have stated that pyramidal lobe is seen in 50% of population and the muscular band may be made up of smooth muscle fibres and that the pyramidal lobe and the associated smooth muscle represent the persistent part of distal end of thyroglossal duct [13]. Another study done in 90 male cadavers revealed that, pyramidal lobe was present in 37.77%, frequently arising from the left lobe, while the levator glandulae thyroideae was present in 30% instances, mostly attached above to body of hyoid bone [14].

Agenesis of isthmus can be diagnosed via scintigraphy, ultrasonography, CT and MRI. When suspected, the individual may be directed for a differential pathological diagnosis such as autonomous thyroid nodule; thyroiditis; primary carcinoma; neoplastic metastases; and infiltrative diseases such as amyloidosis. This type of variations should be kept in mind during transthyroid tracheotomy procedures [15]. The present study was an effort to know the variations in morphology of thyroid gland in this part of North Karnataka. It specifically emphasizes on the developmental variations in the region of the isthmus of thyroid gland and imparts information as to how frequently a clinician can encounter such variations.

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