

## AN ANATOMICAL STUDY OF MORPHOLOGICAL VARIATIONS OF THE THYROID GLAND

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### ABSTRACT

**Introduction:** The organogenesis of the thyroid gland in humans is often disturbed, leading to a variety of morphological variations of the gland, such as presence of pyramidal lobe, levator glandulae thyroideae, pyramidal lobe along with levator glandulae thyroideae, absence of isthmus and presence of accessory thyroid tissue. As the morphological variations are usually diagnosed incidentally during examination for other thyroid gland diseases, the true incidence is therefore uncertain.

**Methods:** This study was structured to investigate the gross anatomical features of the thyroid gland in 100 (58 male and 42 female) cadavers from the Maharashtrian population.

**Results:** The variations in the thyroid gland were present in 94% of cases. In the present study; the most common variation was presence of Levator glandulae thyroideae (30.85%) and least common variation was accessory thyroid tissue (1.6%). The isthmus was absent in 28(29.78%) cases. Absence of isthmus was more common in females than in males and the difference was statistically significant. Pyramidal lobe was more common in males than in females. Most commonly the pyramidal lobe arises from the isthmus of the thyroid gland and least commonly from the left lobe. Levator glandulae thyroideae was present in 19 male cases (32.75%) and 10 female cases (23.80%). Pyramidal lobe along with levator glandulae thyroideae was present in 8 males (72.72%) and in 3 females (27.27%). However, the accessory thyroid tissue was found in only one cadaver.

**Conclusion:** This study highlights the various developmental anomalies of the thyroid gland, which forms a cornerstone to safe and effective surgery.

**KEY WORDS:** Accessory Thyroid Tissue, Anatomical Variations, Levator glandulae thyroideae, Pyramidal Lobe, Absence Of Isthmus.

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DOI: 10.16965/ijar.2016.297

**Web site:** International Journal of Anatomy and Research  
ISSN 2321-4287  
[www.ijmhr.org/ijar.htm](http://www.ijmhr.org/ijar.htm)

Received: 02 Jul 2016      Accepted: 09 Aug 2016  
Peer Review: 03 Jul 2016      Published (O): 31 Aug 2016  
Revised: None                      Published (P): 31 Aug 2016

### INTRODUCTION

The thyroid gland is an important, highly vascular endocrine gland in human body which is situated anteriorly in the lower part of the neck extending from the level of the fifth cervical to the first thoracic vertebrae, consists

of two symmetrical lobes connected by H shaped isthmus and lies against second, third and fourth tracheal rings. It is first endocrine organ to evolve in the vertebrates [1].

The normal size of each lobe of the thyroid gland has been described to be 5 cm long, its greatest

and anteroposterior extent being 3 cm and 2 cm respectively. The isthmus measures about 1.25 cm transversely as well as vertically and is usually placed anterior to the second and third tracheal cartilages [2]. Most of the diseases affecting the thyroid gland e.g. goitre, thyrotoxicosis, adenoma, carcinoma etc. are usually associated with enlargement of the gland and require medical and surgical intervention. There are many morphological variations in the thyroid gland. Therefore, knowledge of the variation is very important in evaluation and management of the thyroid disorders in clinical practice. The present study is an approach to increase the information pool and help the clinicians in their practice.

### MATERIALS AND METHODS

With prior permission and approval of the Ethics Committee, one hundred apparently normal thyroid gland specimens were collected from human cadavers of known age and gender. The thyroid glands were obtained from 58 male and 42 female adult cadavers aged between 35 to 90 years. Cadavers having goitre and thyroidectomy were excluded.

The region of neck was dissected to expose thyroid glands. The abnormalities in the thyroid gland (agenesis of isthmus, pyramidal lobe, levator glandulae thyroideae and pyramidal lobe associated with levator glandulae thyroideae, accessory thyroid tissue) were noted. The samples were divided into two groups according to the gender. Statistical analysis was done to find out whether there was any significant difference regarding variations of thyroid gland. For statistical analysis of all variations, the chi square test was applied. For the statistical analysis SPSS and Minitab software were used.

### RESULTS

In this study, the thyroid gland was said to be normal when both lobes of thyroid gland were present with an isthmus which was a part of the gland which connects the two lobes with each other.

The following variations were included for the present study

1. Absence of isthmus
2. Presence and origin of pyramidal lobe (PL)
3. Levator glandulae thyroideae (LGT)
4. Pyramidal lobe associated with levator glandulae thyroideae (PL + LGT)
5. Accessory thyroid tissue observed and noted

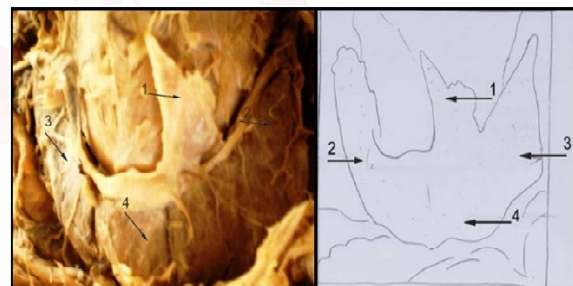
The presence of LGT was a most common variation and least common variation was accessory thyroid tissue. (Table 1)

The isthmus was absent more commonly in females than males and it was statistically significant.

Other variations were more common in males than females and it was statistically insignificant. (Table 2)

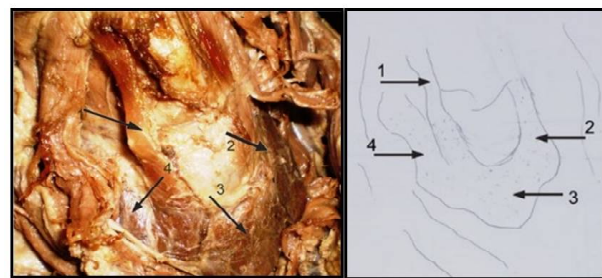
The pyramidal lobe was most commonly arising from isthmus and least commonly from left lobe. (Table 3)

**Fig. 1:** Showing pyramidal lobe.



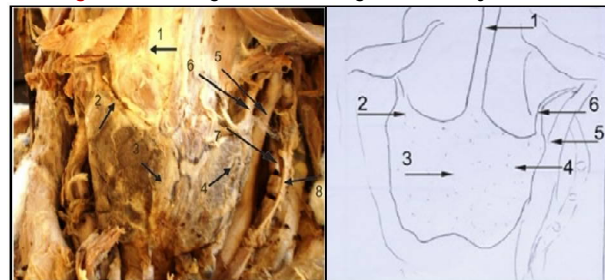
1-pyramidal lobe, 2-left lobe, 3-right lobe, 4-isthmus

**Fig. 2:** Showing the pyramidal lobe with levator glandulae thyroideae.



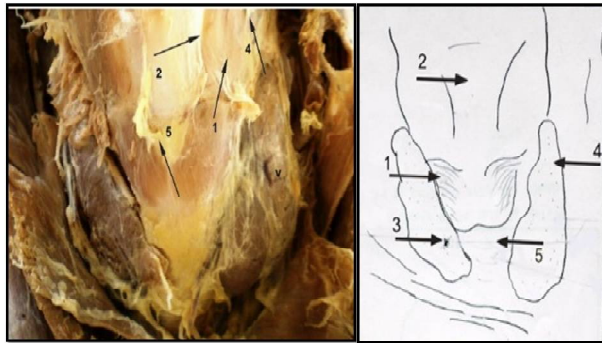
1-pyramidal lobe with levator glandulae thyroideae, 2-left lobe, 3-isthmus, 4-right lobe

**Fig. 3:** Showing the levator glandulae thyroideae.



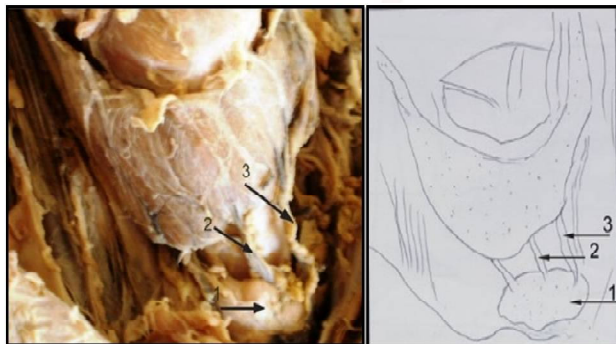
1-levator glandulae thyroideae, 2-right lobe, 3-isthmus, 4-left lobe, 5-external carotid artery, 6- superior thyroid artery, 7- external jugular vein, 8- vagus nerve

**Fig. 4:** Showing absence of isthmus.



1-cricothyroid muscle, 2- thyroid cartilage, 3- left lobe, 4- right lobe, 5- absence of isthmus

**Fig. 5:** Showing accessory thyroid tissue.



1-accessory thyroid tissue, 2- inferior thyroid vein, 3- middle thyroid vein

**Table 1:** Showing number of variations in thyroid gland.

| Sr.no. | Type of variation                              | No. of variations |
|--------|--|-------------------|
| 1      | Absence of isthmus                             | 28 (29.78%)       |
| 2      | Presence of Pyramidal lobe (PL)                | 25 (26.59%)       |
| 3      | Presence of Levator glandulae thyroideae (LGT) | 29 (30.85%)       |
| 4      | Presence of PL + LGT                           | 11 (11.70%)       |
| 5      | Accessory thyroid tissue                       | 1 (1.6%)          |
|        | <b>Total</b>                                   | <b>94</b>         |

**Table 2:** Showing gender wise variations in thyroid gland.

| Sr.no. | Variation                |         | Gender       |             | 94 |
|--------|--------------------------|---------|--------------|-------------|----|
|        |                          |         | Male         | Female      |    |
| 1      | Isthmus                  | Absent  | 10 (17.24%)  | 18 (42.85%) | 28 |
| 2      | LGT                      | Present | 19 (32.75%)  | 10 (23.80%) | 29 |
| 3      | PL                       | Present | 18 (31.034%) | 7 (16.66%)  | 25 |
| 4      | PL+LGT                   | Present | 8 (72.72%)   | 3 (27.27%)  | 11 |
| 5      | Accessory thyroid tissue | Present | 1(1.6%)      | -           | 1  |

**Table 3:** Showing variation regarding pyramidal lobe.

| Sr. no |                | Present         |            | Total     |    |
|--------|----------------|-----------------|------------|-----------|----|
|        |                | Male            | Female     |           |    |
| 1      | Pyramidal lobe | 18 (31.034%)    | 7 (16.66%) | 25        |    |
| 2      | Origin         | From left lobe  | 4(80%)     | 1(20%)    | 5  |
|        |                | From right lobe | 5(71.42%)  | 2(28.57%) | 7  |
|        |                | From isthmus    | 9(69.23%)  | 4(30.76%) | 13 |

## DISCUSSION

The thyroid gland is a very important endocrine gland which is concerned with rate of metabolism, blood calcium level and affects on growth and development in mammals. The thyroid gland is a notably labile gland that varies greatly in size and structure [3].

Approximately 70% of the congenital lesions in the neck region result from variable persistence of the thyroglossal duct [4]. An embryological basis should be considered for all such developmental anomalies. Of all the endocrine glands, thyroid development starts at earliest during embryonic development of human beings [5]. Any deviation from the normal development of the thyroid gland, including descent of median thyroid diverticulum from foramen caecum at the tongue to its adult position between fifth cervical and first thoracic vertebra and partial persistence of the thyroglossal duct or tract, result in formation of various structures such as a pyramidal lobe, levator glandulae thyroideae, agenesis of thyroid gland, partial or complete absence of isthmus and accessory thyroid tissue.

On comparison, the present study has similar results as study of S.D.Joshi in case of males and Ranades study in case of females for absence of isthmus.

According to the studies by sultana et al, the isthmus was missing in eighteen cases (37.5%) of the forty eight male cadavers and it was absent in one case (8.3%) of the twelve female cases they studied.

Ranade and Prakash have reported that isthmus was absent in 30.9% & 9.6% in males respectively. According to Ranade it was more commonly absent in females (47.1%) than males (30.9%) and according to Prakash it was more commonly absent in males (9.6%) than females 5.6%.

In the present study, the Chi-Square value and P value was 7.929 and 0.005 respectively for the absence of isthmus.

So it shows that this variation is statistically significant.

The present study (31.05%) has similar results as study of S.D.Joshi in case of males (37.77%)

for presence of pyramidal lobe. In case of females the present study has (16.66%) has approximately similar results as study of Prakash (22.2%) for presence of pyramidal lobe. According to sultana et al and Prakash et al the pyramidal lobe was more commonly present in males (52.1% , 43.9%) than females (41.7%, 22.2%) respectively. It was present in 58% male cases according to Ranades study.

In the present study, the presence of pyramidal lobe has the Chi-Square value and P value 2.682 and 0.101 respectively. It shows that it was statistically insignificant.

The results of present study were (M-36.20%; F-23.80%) similar to the results of Prakash et al (M-34.8%; F-27.80%). According to S.D.Joshi, the levator glandulae thyroidea was present in 30% male cases. Sultana et al reported presence of LGT in 43.33% female cases. According to Ranade, it was found more frequently in men (56.8%) than in women (11.8%).

In the present study, the presence of levator glandulae thyroidea has the Chi-Square value and P value 0.500 and 0.479 respectively. It shows that it was statistically insignificant.

The findings of Sultana et al (84.65%) were higher than the present study (37.93%) for presence of LGT with Pyramidal lobe.

In the present study, the presence of levator glandulae thyroidea with pyramidal lobe has the Chi-Square value and P value 1.100 and 0.294 respectively. It shows that it was statistically insignificant.

The accessory thyroid tissue was present in 1.6% cases in the present study and it was almost similar to the result of Ranade et al study (1.1%).

The study conducted by Sultana et al states that the isthmus was absent in 31.66% cases. It was higher than the present study (28%).

The presence of pyramidal lobes was more in the present study (26.29%) than the study conducted by the D.Dixit (7.31%).

The study conducted by Braun (55%), Nurunnabi (41.67%) et al states that the results were higher than the present study (26.29%) for the presence of the pyramidal lobe.

The result of the present study (26.29%) was almost similar to the results of Begum (26%) &

Harjeet (28.9%).

The study conducted by Sultana et al reported that in 43.33% cases the levator glandulae thyroidea was present. The findings of present study were (30.85%) almost similar to the findings of Enayetullah (32%).

The results of Harjeet (19.5%), D. Dixit (7.31%), and Nurunnabi (20%) were less than the present study (30.85%).

The study conducted by Sultana et al stated that the pyramidal lobe along with levator glandulae thyroidea was present in 84.65% cases. It was higher than the present study (37.93%).

The results of the study conducted by D. Dixit (7.31%) and Nurunnabi (20%) were less than the present study.

In the present study, the accessory thyroid tissue was present in 1.6% cases and it was approximately same as the result of study conducted by Braun (1.7%).

## CONCLUSION

During thyroidectomy, the pyramidal lobe, also called Lalouette's lobe, should be looked for and removed, as failure in its identification can result in incomplete resection of the thyroid gland [14]. All thyroid diseases are described in the pyramidal lobe, which is formed from normal thyroid tissue [4]. Residual thyroid tissue in the pyramidal lobe can lead to serious complications in diseases like cancer and Graves' disease, where complete removal of the thyroid gland is indicated [15]. So, the knowledge about the variant anatomy of the thyroid gland is very important in the surgical treatment of different tumours of the thyroid gland and thyrotoxicosis. Total, subtotal and partial thyroidectomy performed for the treatment of different stages of thyroid malignancy requires precise and accurate knowledge of the variations associated with the thyroid gland and it helps the surgeon in the better planning of a safe and effective surgery.

## ABBREVIATIONS

**PL** - Pyramidal Lobe

**LGT**- Levator glandulae thyroidea

**PL + LGT**- Pyramidal lobe associated with levator glandulae thyroidea

**M** - Male

**F** - Female

## ACKNOWLEDGEMENTS

Dr. Pritha Bhuiyan, Professor & Head, Department of Anatomy, Seth G S Medical College, Mumbai for her kind support and encouragement.

**Conflicts of Interests: None**

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### How to cite this article:

Shobha Gaikwad, Rajani Joshi. AN ANATOMICAL STUDY OF MORPHOLOGICAL VARIATIONS OF THE THYROID GLAND. *Int J Anat Res* 2016;4(3):2665-2669. DOI: 10.16965/ijar.2016.297