

Morphological Variations of the Thyroid Gland among the People of Upper Assam Region of Northeast India: A Cadaveric Study

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ABSTRACT

Introduction: The morphological variations of the thyroid gland have been reported from different parts of the world. The variations are due to remnant or non-specific development of the parts of the thyroid gland. Surgical operation of the thyroid gland has been the treatment of choice in various thyroid pathologies. Prior knowledge of the morphological variation is important to ensure better results from these surgical operations.

Aim: To study the prevalence of morphological variations seen in the thyroid glands in the upper Assam region of Northeast India.

Materials and Methods: This was a hospital based cadaveric study. Total number of Thyroid glands dissected were 80.

The thyroid gland was examined properly for the presence of pyramidal lobe, levator glandulae thyroideae and complete absence of isthmus. Statistical analysis was done by SPSS 21.0.

Results: It was found that 17 (21.25%) cadavers did not show an isthmus. The pyramidal lobe was present in 31(38.75%) cases and frequently arising from the left side (74.2%) of the isthmus. Levator glandulae thyroideae was found in 15 (18.75%) of the thyroid specimens. In all cases, it was extended from the apex of the pyramidal lobe to the hyoid bone.

Conclusion: Morphological variation of the thyroid gland is very common hence requires detection prior to any surgery on the thyroid gland.

Keywords: Isthmus, Levator glandulae thyroideae, Pyramidal lobe

INTRODUCTION

The thyroid gland is a highly vascular gland placed anteriorly in the lower part of the neck consisting of two symmetrical lateral lobes connected by a midline isthmus [1]. The size of the thyroid gland varies considerably with age, sex, physiological state, race and geographical location and it is observed that the size is larger in female than in male [2]. The right lobe is slightly larger than the left one [3]. The thyroid gland appears as an epithelial proliferation in the floor of the pharynx between the tubercular impar and the copula in the form of bi-lobed diverticulum, called the thyroglossal duct. The lower part of the duct develops into median isthmus and two lateral lobes. The upper connection of the duct with the floor of pharynx later disappears [4]. Agenesis of the thyroid isthmus is defined as the complete and congenital absence of the isthmus [5]. A high division of the thyroglossal duct generate two independent thyroid lobes with the absence of isthmus [6]. The embryological remnant of the caudal end of the thyroglossal duct commonly known as the pyramidal lobe often ascends from the isthmus or adjacent part of either lobe (more often from the left side) towards the hyoid bone [7]. The upper end of the pyramidal lobe continues as a fibro-muscular strand, called the Levator Glandulae Thyroideae (LGT), attached to the hyoid bone. When the pyramidal lobe is absent, LGT may attach to the upper part of the isthmus [8]. Thyroid diseases are among the most common endocrine disorders in India [9]. Most of the diseases, affecting the thyroid gland require medical and surgical intervention. The surgeons planning a total thyroidectomy operation must be aware about the morphological variations of the gland. Therefore, it is important to know the details regarding surgical anatomy of the thyroid gland. The North-eastern region of India is famous for its diverse ecology and distinct culture and lifestyle specific to different ethnic groups. Different ethnic groups existing in Assam are Ahoms, Bodos, Koch, Matak, Chutiya and different branches of Kacharis such as Dimasa, Sonowal and Thengal.

The prevalence of goitre remained high (42.2%) in Dibrugarh district [10]. Results of the morphological study of the thyroid gland in the people of this region are most likely to differ from those with adequate iodine intake, as iodine is very essential for the biological activity of the thyroid gland. The present study is an approach to popularise the information pool on the morphology of the thyroid gland and help the clinicians in their practice. Moreover, limited information is available regarding the morphological variations of the thyroid gland from the Upper Assam region of Northeast India. The present study is an approach to popularise the information pool on the morphology of the thyroid gland and help the clinicians in their practice.

MATERIALS AND METHODS

A cross-sectional descriptive study was done in the Department of Anatomy, Assam Medical College and hospital, Dibrugarh for a period of one year from August 2014 to July 2015. A total of 80 thyroid glands (30 adult and 50 perinatal cadavers) were dissected and out of which 49 were male and 31 were female. Adult specimens (30) were collected from the cadavers provided for the dissection and perinatal specimens (50) were obtained from Department of Obstetrics & Gynaecology, Assam Medical College & Hospital.

After taking the approval from the institutional ethical committee, the cadavers were received in the Department of Anatomy. The particulars of the specimens were collected from the cadaver register. Cases with known thyroid diseases or crushing injury to the neck and those fetuses with gross congenital malformation were excluded from the study.

A vertical incision was given on the skin from the chin to the sternum in the mid line. The subcutaneous fat and deep fascia was exposed; the infrahyoid muscles were identified and reflected laterally. The pretracheal fascia was removed and the right and the left lobe of the gland were identified. The thyroid gland was examined carefully

for the presence of isthmus, pyramidal lobe and LGT. When the pyramidal lobe was present, its position was observed. LGT if present, its extension and its relation with the pyramidal lobe were also observed.

STATISTICAL ANALYSIS

Statistical analysis was done using chi-square test by SPSS 21.0.

RESULTS

A total 80 number of thyroid glands were collected from 49 male and 31 female cadavers. Presence of pyramidal lobe, levator glandulae thyroideae and absence of isthmus were the only morphological variations observed in the gland. Forty eight out of the total glands dissected had morphological variations the others had normal anatomy [Table/Fig-1]. Morphological variations were more common in males but the difference was not statistically significant (chi-square value=0.43, df=1; p-value = 0.67). All the major morphological variations observed in the study are summarized in [Table/Fig-2].

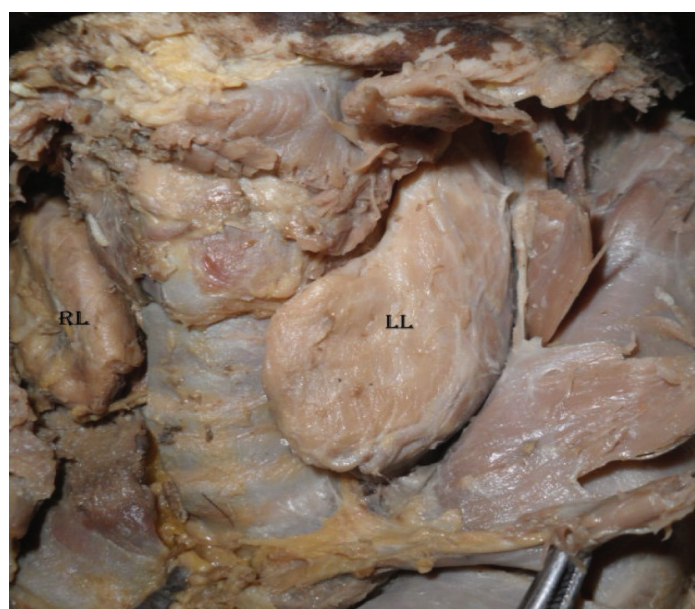
Sex	Morphological variations	Normal anatomy
Male	28	21
Female	20	11
Total	48	32

[Table/Fig-1]: Morphological variations in either sex.

Morphological variations	Male	Female	Total	Percentage
Pyramidal lobe (PL)	18	13	31	38.75%
Absence of isthmus (ISTH)	11	6	17	21.25%
Presence of Levator Glandulae Thyroideae (LGT)	9	6	15	18.75%

[Table/Fig-2]: Different types of morphological variations and sex distribution of the cadavers dissected.

Note: More than one variations were seen in few specimens

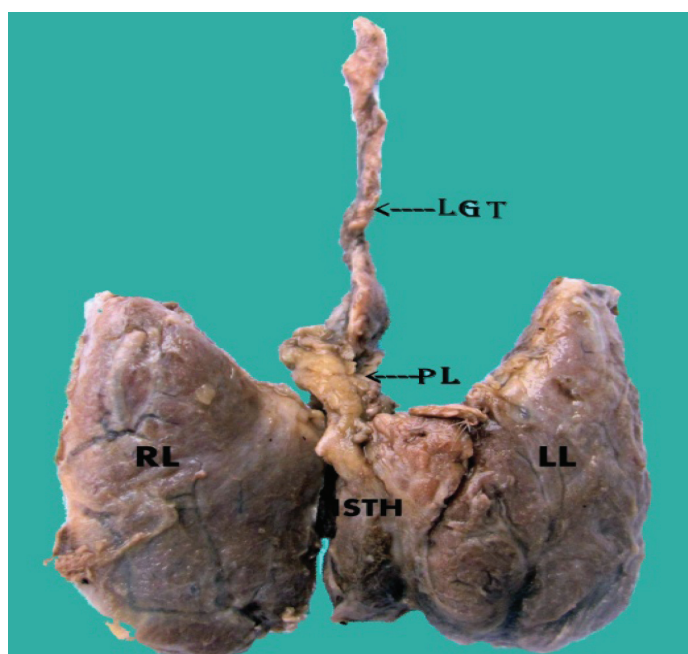


[Table/Fig-3]: Thyroid gland with absence of isthmus in an adult cadaver. Note: LL - Left lobe; RL - Right lobe

The isthmus was absent in 17 (21.25%) cases; of which 11 were male cadavers [Table/Fig-3]. The pyramidal lobe was observed in 31(38.75%) cases. Among them, pyramidal lobe was found more frequently in males (18). In 74.2% cadavers, the pyramidal lobe was attached to the left side of the isthmus [Table/Fig-4] and to the middle in 25.8% [Table/Fig-5]. According to the origin and location of pyramidal lobe, Milojevic B et al., classified five types of pyramidal lobe [11]. On the basis of that classification, we have found two types-Type III (74.2%) and Type I (25.8%) with the left sided being predominant [Table/Fig-6]. The LGT was present in



[Table/Fig-4]: Pyramidal lobe with levator glandulae thyroideae arising from the left half of isthmus. Note: LL - Left lobe; RL - Right lobe; LGT - Levator Glandulae Thyroideae; PL - Pyramidal lobe



[Table/Fig-5]: Pyramidal lobe with levator glandulae thyroideae arising from the middle of isthmus. Note: LL - Left lobe; RL - Right lobe; LGT - Levator Glandulae Thyroideae; PL - Pyramidal lobe; ISTH - Isthmus

15(18.75%) cadavers [Table/Fig-5] and in all specimens LGT was extending from the apex of the pyramidal lobe to the hyoid bone.

DISCUSSION

The morphological variations of the thyroid gland found in present study were compared with other studies [Table/Fig-7] [12-18].

Incidence of absence of isthmus varies from 5% to 10% [5]. The absence of isthmus in the present study closely matched with the study by Joshi et al. (15 of 90) [15]. The differences between various studies were probably due to difference in sample selection or due to differences in the population studied.

The pyramidal lobe observed in the present study was comparable with that of (41%) [13] and (37.8%) [15]. In the present study, the pyramidal lobe was situated more on the left side of the gland which was also observed in various studies [11,14,15]. In studies based on the surgically removed thyroid gland after total thyroidectomy operation in Turkey and Serbia, 65.7% [19] and 61% [20] of thyroid glands respectively had pyramidal lobes. The conclusion of

Sex	Central part of the isthmus (Type I)	Junction of the right lobe with the isthmus (Type II)	Junction of the left lobe with the isthmus (Type III)	Left lobe (Type IV)	Right Lobe (Type V)	Total
Male	5(16.1%)	0	13 (41.9%)	0	0	18
Female	3 (9.6%)	0	10 (32.25%)	0	0	13
Total	8 (25.8%)	0	23 (74.2%)	0	0	31

[Table/Fig-6]: Classification of the pyramidal lobe on the basis of its attachment to the thyroid gland.

Author	Sample Size	Year	Absent Isthmus	Pyramidal Lobe	Levator Glandulae thyroideae
Ranade AV et al., [12]	105	2008	33%	58%	49.5%
Nurunnabi ASM et al., [13]	60	2008	-----	41%	20%
Begum M et al., [14]	60	2009	-----	26.7%	15%
Joshi S D et al., [15]	90	2010	16.7%	37.8%	30%
Kulkarni V et al., [16]	20	2012	10%	-----	30%
Veerahanumaiah S et al., [17]	89	2014	9%	46%	41%
Rathod S Mansingh et al., [18]	76	2015	13%	58%	-----
Present Study	80	2015	21.25%	38.75%	18.75%

[Table/Fig-7]: Morphological variations of the thyroid gland compared with other studies [12-18].

the above discussion is that presence of pyramidal lobe is quite common in all over the world.

The levator glandulae thyroideae observed in the present study was similar to observations of 20% [13] and 15% [14].

The morphological variation in the thyroid gland does not affect the function of the gland but presence of these variations may simulate some thyroid pathologies. Agenesis of isthmus is a differential pathological diagnosis for autonomous thyroid nodule, thyroiditis, primary carcinoma, neoplastic metastases and infiltrative diseases such as amyloidosis [21]. Agenesis of isthmus can be diagnosed via scintigraphy, ultrasonography, computed tomography and magnetic resonance imaging. Total or near total thyroidectomy is recommended for patients with ongoing thyroid cancer, those who refuse radio-ablation as a therapeutic procedure, or have a life threatening reaction to antithyroid drugs such as vasculitis, agranulocytosis and liver failure and is the operation of choice for patients undergoing surgical treatment for Grave's disease [22]. Incomplete excision of thyroid gland in patients with auto-immune disorders may cause recurrence of the diseases. Anatomical variations of thyroid gland may cause many difficulties during complete removal of the gland. Removal of the pyramidal lobe and other accessory thyroid tissue has considerable beneficial effect on the total thyroidectomy operation [19].

In the present study, more than two-third of the thyroid glands dissected had one or more morphological variations hence presence of pyramidal lobe or other morphological variations should be looked for during total thyroidectomy operation to ensure complete removal of the gland tissue.

LIMITATION

This type of study can be done in all age groups; but present study focused only on adult and perinatal cadavers. We have only used dissection as a tool for the study but radiological techniques like MRI, CT scan and Ultrasonography can also be applied.

CONCLUSION

Precise and accurate knowledge of variations associated with the thyroid gland would be helpful for surgeons in performing total, subtotal & partial thyroidectomy and in the evaluation of Scintigraphic findings.

REFERENCES

- [1] Stranding S. Gray's anatomy, Churchill Livingstone, Elsevier, 40th Edn-2008; 462.
- [2] Wood Jones. Buchanan's Manual of Anatomy, Bailliere Tindall & Cox, 7th Ed-1946; 1125.
- [3] Montgomery & Welbourn. Clinical Endocrinology for Surgeons, Edward Arnold Pub, 1st Ed-1963; 218.
- [4] Saddler TW. Langman's Medical Embryology, Thyroid gland. Lippincott Williams and Wilkins, 11th Ed-2010;278.
- [5] Pastor VJF, Gil VJA, De Paz Fernández FJ, Cachorro MB. Agenesis of the thyroid isthmus. *Eur J Anat.* 2006;10:83-84.
- [6] Dixit D, Shilpa MB, Harsh MP, Ravishankar MV. Agenesis of isthmus of thyroid gland in adult human cadavers-A case series. *Cases Journal.* 2009;2:6640.
- [7] Sinnatamby CS. Last's anatomy, Churchill livingstone Elsevier, 11thEd- 2006: 351-352.
- [8] Hamilton WJ. Textbook of Human Anatomy,The McMillan Press Ltd. 2nd Ed -1976; 488.
- [9] Kochupillai N. Clinical endocrinology in India. *Current Science.* 2000;79(8):106.
- [10] Patowary AC, Kumar S, Patowary S, Dhar P. Iodine deficiency disorders (IDD) and iodised salt in Assam: A few observations. *Indian J Public Health.* 1995;39(4):135-40.
- [11] Milojevic B, Tosevski J, Milisavljevic M, Babic D, Maljkovic A. Pyramidal lobe of the human thyroid gland- An anatomical study with clinical implications. *Rom J Morphol Embryol.* 2013;54(2):285-89.
- [12] Ranade AV, Rai R, Pai M, Nayak SR, Prakash, Krisnamurthy A, et al. Anatomical variations of the thyroid gland-possible surgical implications. *Singapore Med J.* 2008;49(10):831-34.
- [13] Nurunnabi ASM, Alim A, Mahub S, Segupta K, Begum M, Khatun M, et al. Morphological and histological study of the pyramidal lobe of the thyroid gland in bangladeshi people-a postmortem study. *Bangladesh Journal of Anatomy.* 2009; 7(2):94-100.
- [14] Begum M, Khatun M, Kishwara S, Ahmed R, Naushaba HA. Postmortem study of the pyramidal lobe of the thyroid gland in bangladeshi people. *J Dhaka Med Coll.* 2009;18(2):120-23.
- [15] Joshi SD, Joshi SS, Daimi SR, Athavale SA. The thyroid gland and its variations-A cadaveric study. *Folia Morphol.* 2010;69(1):47-50.
- [16] Kulkarni V, Sripadma S, Deshpande SK. Morphological variation of thyroid Gland. *Medica Innovatica.* 2012;1(2):36-38.
- [17] Veerahanumaiah S, Dakshayani KR, Menasinkai SB. Morphological variations of the thyroid gland. *Int J Res Med Sci.* 2015;3(1):53-57.
- [18] Mansingh RS, Mahesh ST, Santosh D. Morphological variations of thyroid gland. *International J. of Healthcare and Biomedical Research.* 2015;03(02):175-77.
- [19] Gurleyik E, Gurleyik G, Dogan S, Cobek U. Pyramidal lobe of the thyroid gland-surgical anatomy in patients undergoing total thyroidectomy. *Anatomy Research International.* 2015;2015:384148, 55.
- [20] Zivic R, Radovanovic D, Vekic B. Surgical anatomy of the pyramidal lobe and its significance in thyroid surgery. *SAJS.* 2011;49(3):110-16.
- [21] Devi SK, Bhanu S, Susan P, Gajendra KPJ. Agenesis of isthmus of thyroid gland with bilateral levator glandulae thyroideae. *International Journal of Anatomical Variations.* 2009;2:29-30.
- [22] Bojic T, Paunovic I, Diklic A, Zivaljevic V, Zoric G, Kalezic N, et al. Total thyroidectomy as a method of choice in the treatment of Graves'disease-Analysis of 1432 patients. *BMC Surg.* 2015;15:39.

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