Research Article

A study on morphometric features and incidence of agenesis of isthmus of thyroid gland

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Abstract

Background: The thyroid gland is a highly vascular endocrine gland. The gland consists of two lateral lobes and an isthmus connecting them across the midline, giving it an H-shaped appearance. Of all the endocrine glands, from widely noted to uncommon developmental anomalies are known to be associated with the thyroid glands. Literature has recorded different types of morphological disparities and developmental anomalies of the thyroid gland, which pose several clinical and surgical repercussions.

Objective: To discuss the morphometric features of thyroid gland and the incidence of agenesis of isthmus and its developmental and clinical significances.

Materials and Methods: This study was conducted by dissection of the thyroid gland in 30 adult human cadavers all aged between 35 and 75 years, of which 25 were male and 5 female cadavers. Length and breadth of the right and left lobes and height of the isthmus were measured, and the presence of pyramidal lobe and levator thyroideae glandulae was noted.

Result: The mean length of the right lobe measured 5.15 cm, and that of the left lobe measured 5.27cm. The mean breadth of the right lobe measured 3.5 cm, and that of the left lobe measured 3.7 cm. The mean length of the isthmus measured 1.55 cm. The pyramidal lobe and levator thyroideae glandulae were both present in four cadavers. There was no isthmus connecting the two lateral lobes in two cadavers.

Conclusion: In order to ensure safe performance of surgical procedures in thyroid pathological conditions, agenesis of the isthmus of the thyroid gland should be accounted for.

KEY WORDS: Agenesis, isthmus, thyroid gland

Introduction

The thyroid gland is a highly vascular endocrine gland situated in front and at the sides of trachea opposite fifth cervical to the first thoracic vertebrae. The condensation of the fibrous stroma of the gland forms the inner true capsule, while the splitting of the pretracheal fascia forms the outer false capsule of the gland. The gland consists of two lateral lobes and an isthmus connecting them across the midline, giving it an H-shaped appearance. Each lobe is roughly pyramidal, measuring 5 cm in length, 3 cm in breadth, and 2 cm in thickness. The isthmus connects both the lobes across the midline opposite second to fourth rings of trachea and measures about 1.25 cm in both vertical and transverse diameters.[1] Thyroid gland is well known for its developmental anomalies. The developmental anomalies will not only alter the morphology but also cause various functional disorders.[2] About 33% of incidence of agenesis of the isthmus of the thyroid gland was observed in a study on anatomical variations of the thyroid gland by Ranade et al.[3]

The occurrence of the thyroid isthmus agenesis has been recorded to differ from 5% to 10%.[4] Thyroid anomalies can cause difficulty in diagnosis and interventions.[5] The

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understanding of different morphological and developmental anomalies of the gland will aid the surgeons in efficient planning of a safe and effective surgery.[6]

Objective

To study the morphometric features of the thyroid lobes and isthmus of the thyroid gland.

Materials and Methods

This study was conducted by the dissection on the thyroid gland in 30 adult human cadavers all aged between 35 and 75 years, of which 25 were male and 5 female cadavers. Parameters such as the length of the lateral lobes and height of the isthmus were measured, and the presence of pyramidal lobe and levator thyroideae glandulae was noted.

Results

On dissection, the position of the thyroid gland appeared to be normal. The lobes were pyramidal in shape. The mean length of the right and left lobes measured 5.15 and 5.27 cm, respectively. The mean breadth of the right and left lobes measured 3.5 and 3.7 cm, respectively. The mean length of the isthmus measured 1.55 cm. The pyramidal lobe and levator thyroideae glandulae were both present in four cadavers.

There was no isthmus connecting the two lateral lobes in two cadavers [Figure 1]. The individual lobes were supplied by branches of superior and inferior thyroid arteries. There were no anastomoses between the arteries of right and left sides. No accessory thyroid arteries were present, and no accessory thyroid tissue was found.

Discussion

Isthmus joins the two lobes of the thyroid gland, and its absenteeism is certainly quite uncommon in humans.[7] Irregular embryological development can be caused by the fundamental mechanism of the agenesis of the isthmus. Available knowledge proposes that chromosome 22 plays a vital role in the thyroid development.[8] The thyroid gland begins to develop as a median thickening of the endoderm on the floor of the pharynx between the first and second pharyngeal pouches. The median diverticulum is formed by the invagination of this area later, which can be seen in the latter half of the fourth week. Further development of this thyroid diverticulum occurs into a solid cellular cord known as the thyroglossal duct, which duct grows caudally and divides to produce the thyroid lobes and the isthmus. Simultaneous caudal growth and degeneration of the thyroglossal duct's cephalic end can be observed.[9] An enormous division of the thyroglossal duct can give rise to two independent thyroid lobes, without the development of isthmus. Other types of dysorganogenesis, such as the absence of a lobe or the presence of ectopic thyroid tissue, can also account for the absence of the isthmus.[10]

The absence of isthmus is also noted in amphibians, birds, and among mammals such as monotremes, some marsupials, cetaceans, carnivores, and rodents. In rhesus monkey (Macacus rhesus), no isthmus but with the presence of normal position of the thyroid glands is observed.[4] The morphological variance in the evolutionary origin does not result in any changes in thyroid function. About 33% of the incidence of agenesis of isthmus of thyroid gland was observed in a study on anatomical variations of the thyroid gland by Ranade et al.[3] The occurrence of the thyroid isthmus agenesis has been reported to differ from 5% to 10%.[4] In this study, the incidence was 6.6%.

Agenesis of isthmus of thyroid gland is difficult to determine and can be made out when the patients presents with thyroid pathologies. It can be diagnosed by scintigraphy, ultrasonography, computed tomography, and magnetic resonance imaging. Such variations must be noted when performing transthyroid tracheostomy surgeries.[11]

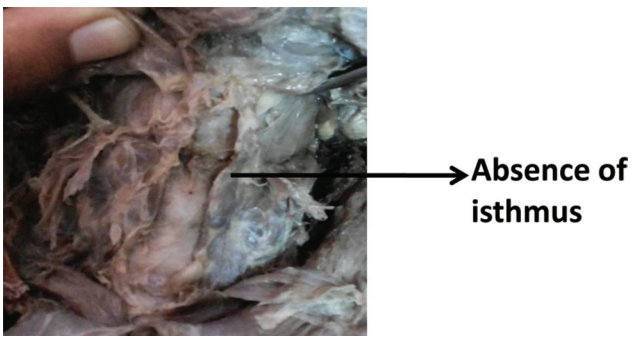

Figure 1: Thyroid gland without isthmus.

Conclusion

When there is a concern of the absence of isthmus, the patient may be subjected to a differential pathological diagnosis such as autonomous thyroid nodule, thyroiditis, primary carcinoma, neoplastic metastases, and infiltrative diseases such as amyloidosis.[4] Knowledge on the thyroid anatomy and related anatomical differences is a must in order to avoid ignoring of these differences in the differential diagnosis. An awareness of variations of thyroid gland is important to all clinicians involved in the diagnosis and treatment of thyroid disorders.

References

1. Standring S, Herold E, Healy JC, Johnson D, Williams A. *Gray's Anatomy*, 39th edn. London: Elsevier Churchill Livingstone, 2005. pp. 560–4.
2. Larochelle D, Arcand P, Belzile M, Gagnon NB. Ectopic thyroid tissue—a review of the literature. J Otolaryngol 1979;8(6): 523–30.

3. Ranade AV, Rai R, Pai MM, Nayak SR, Prakash, Krishnamurthy A, et al. Anatomical variation of the thyroid gland: possible surgical implications. *Singapore Med J* 2008;49:831–4.
4. Pastor Vazquez JF, Gil Verona JA, De Paz Fernandez FJ, Cachorro MB. Agenesis of the thyroid isthmus. Eur J Anat 2006;10:83–4.
5. Bajwa SS, Sehgal V. Anaesthesia and thyroid surgery: the never ending challenges. Indian J Endocr Metab 2013;17:228–34.
6. Dixit D, Shilpa MB, Harsh MP, Ravishankar MV. Agenesis of isthmus of thyroid gland in adult human cadavers: a case series. Cases J 2009;2:6640.
7. Harjeet A, Sahni D, Jit I, Aggarwal AK. Shape, measurements and weight of the thyroid gland in northwest Indians. Surg Radiol Anat 2004;26:91–5.
8. Gangbo E, Lacombe D, Alberti EM, Taine L, Saura R, Carles D. Trisomy 22 with thyroid isthmus agenesis and absent gall bladder. Genet Couns 2004;15:311–5.
9. Moore KL, Persaud TVN. *The Developing Human, Clinical Oriented Embryology*, 6th edn. Philadelphia, PA: WB Saunders Company, 2003. pp. 230–3.
10. Duh QY, Ciulla TA, Clark OH. Primary parathyroid hyperplasia associated with thyroid hemiagenesis and agenesis of the isthmus. *Surgery* 1994;115:257–63.
11. Sankar KD, Bhanu PS, Susan PJ, Gajendra K. Agenesis of isthmus of thyroid gland with levator glandulae thyoideae. Int J Anat Variat 2009;2:29–30.

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