

Study of Absence of Isthmus of Thyroid Gland with its Developmental and Surgical Implications in Adult Human Cadavers – A case series

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Abstract

Thyroid gland has a wide range of morphological and developmental anomalies. We studied the incidence of absence of isthmus of thyroid gland and its embryological correlation. Our study included dissection of the thyroid gland in 15 adult human cadavers all aged between 50 and 70 years, out of which 10 were male and 5 were female cadavers. Various parameters like length of the lateral lobes, height of isthmus, presence of pyramidal lobe and absence of isthmus were studied. The average length of the right lobe of thyroid gland was 5.32 cms and that of the left lobe was 4.74 cms. The average height of the isthmus was 2.15 cms. During midline dissection of the neck, 3 out of the 15 cadavers (20%) showed no glandular tissue in the region of the isthmus of thyroid gland. The respective lateral lobes were positioned independently on either side of the trachea. The incidence of agenesis of isthmus, along with the developmental and clinical significance are discussed herein under. The knowledge of various developmental anomalies of the gland and variations in neurovascular relations will help the surgeon in better planning of a safe and effective surgery.

Key words: isthmus, agenesis, thyroid gland.

Introduction

The thyroid gland, brownish-red and highly vascular endocrine gland, is placed anteriorly in the neck, extending from the fifth cervical to the first thoracic vertebrae. It is unsheathed by the pre-tracheal layer of deep cervical fascia. The gland is composed of two lateral lobes connected by a narrow median isthmus. The normal size of each lobe of the thyroid gland has been described to be 5 cms long, its greatest transverse and anteroposterior extent being 3 cms and 2 cms respectively [1]. The isthmus measures about 1.25 cms transversely as well as vertically and is usually placed anterior to the second and third tracheal cartilages [2]. The anomalies of the development of the thyroid gland distort the morphology of the gland, and may cause clinical as well as functional disorders and various thyroid illnesses [3]. Agenesis of the thyroid isthmus is the complete and congenital absence of the thyroid isthmus as is defined by Pastor et al [4]. Incidence of agenesis of the thyroid isthmus has been reported to vary from 5% to 10% [4,5]. Ranade et al in their study on anatomical variations of the thyroid gland reported a 33% incidence of agenesis of the isthmus [6].

Materials and Methods

Our study included dissection of the thyroid gland in 15 adult human cadavers all aged between 50 and 70 years, out of which 10 were male and 5 were female cadavers. Various parameters like length of the lateral lobes, height of isthmus, presence of pyramidal lobe and absence of isthmus were studied in Department of Anatomy, KLE University's Jawaharlal Nehru Medical College, Belgaum.

Observations

The average length of the right lobe of thyroid gland was 5.32 cms and that of the left lobe was 4.74 cms. The average height of the isthmus was 2.15 cms. Pyramidal lobe was not found in any of the thyroid glands.

Three out of the 15 cadavers dissected showed no glandular tissue in the region of the isthmus of thyroid gland. Grossly, only the pre-tracheal fascia connecting the right and left lobes of the thyroid gland was observed. In case number 1, a male cadaver showed complete absence of isthmus and the two lobes were distantly apart (Figure 1). In case number 2, thyroid gland in female cadaver showed a large right lobe and smaller left lobe with

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absence of isthmus (Figure 2). In case number 3, thyroid gland in male cadaver showed absence of isthmus (Figure 3). The average lengths of the right and left lobes in these 3 cadavers were 5.10 cms and 4.54 cms respectively. In our study, the male to female ratio of incidence of agenesis of isthmus was 2:1.

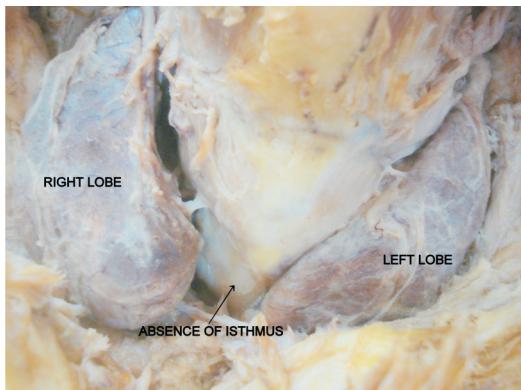


Figure 1. Male cadaver showing complete absence of isthmus.

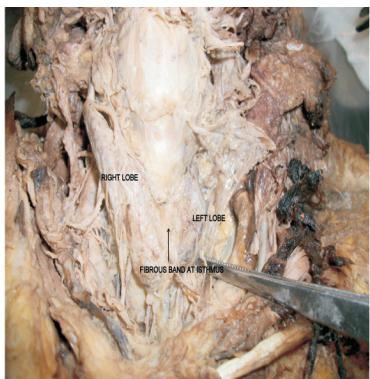


Figure 2. Female cadaver showing large right lobe and small left lobe with absence of isthmus.

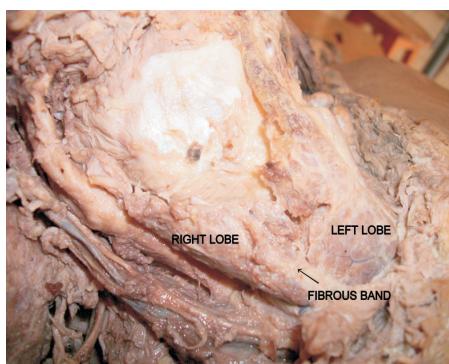


Figure 3. Male cadaver showing absence of isthmus.

Discussion

Absence of isthmus is quite rare in humans [3]. The agenesis of isthmus can be explained as an anomaly of embryological development. Daksha Dixit et al reported absence of isthmus in 6 out of 41 cases (14.6%). Ranade et al reported absence of isthmus in 35 out of 105 cases (33%), of which 8 were female cadavers [6]. According to the study by Braun et al, the isthmus was missing in 4 cases of the 58 cadavers [8]. Won and Chung have reported that in 3% of the cases studied by them, the isthmus was absent and the lateral lobes of the thyroid were separated [9]. The incidence in Northwest Indians is reported to be 7.9% in gross specimens [10]. In our study the incidence was 20%.

The thyroid gland begins to develop as a median thickening of endoderm on the floor of the pharynx between the tuberculum impar and hypobranchial eminence. This area later invaginates to form the median diverticulum, which appears in the later half of the fourth week. This thyroid diverticulum grows in allometric proliferation, becoming a solid cellular cord called the thyroglossal duct. The duct grows caudally and bifurcates to give rise to the thyroid lobes and the isthmus. At the same time that its caudal growth is taking place, the cephalic end of the thyroglossal duct degenerates [12]. A high division of the thyroglossal duct can generate two independent thyroid lobes with the absence of isthmus. The absence of the isthmus can be associated with other types of dysorganogenesis, such as the absence of a lobe or the presence of ectopic thyroid tissue [13].

Clinically, the diagnosis of agenesis of the isthmus can be done with scintigraphy. The diagnosis can also be done with the aid of ultrasonography, computerized tomography (C.T.), magnetic resonance imaging (M.R.I.) or during a surgical procedure. In asymptomatic patients with nodular goitres fine-needle aspiration biopsies and eventually immunohistochemistry tests are useful to support the medical decision but when agenesis is present the importance of pre-operative differentiation between benign and malignant lesions is critical, considering the surgical procedure and the possibility of impairment of the thyroid function [14]. When an image of the absence of isthmus is observed, a differential diagnosis against autonomous thyroid nodule, thyroiditis, primary carcinoma, neoplastic

metastasis and infiltrative diseases such as amyloidosis should be considered [4].

Conclusion

Agenesis of isthmus of thyroid gland is rare in humans, the incidence varying from 5% to 10%. This agenesis can be explained as an anomaly of embryological development i.e. a high division of the thyroglossal duct giving rise to two independent thyroid lobes with absence of isthmus. Agenesis of isthmus can be associated with other types of dysorganogenesis, such as the absence of a lobe or the presence of ectopic thyroid tissue and 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, etc. The surgeon planning a thyroidectomy must be prepared to find variations. Proper identification of vessels is very important in order to avoid major complications. Hence a thorough knowledge of the thyroid anatomy and its associated anatomical variations is very much essential, so that these anomalies are not overlooked in the differential diagnosis.

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