Anatomical variations of the thyroid gland: possible surgical implications


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 hypoplasia, ectopy, hemiagenesis and agenesis. 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 105 (88 male and 17 female) cadavers from the coastal belt of southern India, an endemic goitre region.

Results: The pyramidal lobe was present in 61 (58 percent) male cadavers, and 52 (49.5 percent) cadavers showed the presence of the levator glandulae thyroideae. 33 percent of the specimens studied showed agenesis of the isthmus. 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.

Keywords: accessory thyroid tissue, anatomical variations, ectopic thyroid tissue, levator glandulae thyroideae, pyramidal lobe

INTRODUCTION

The anomalies of the development of the thyroid gland distort the morphology of the gland, and may cause clinical functional disorders and various thyroid illnesses.[1,3] The thyroid gland lies deep to the sternothyroid and sternohyoid muscles, located anteriorly in the neck at the level of the C5-T1 vertebrae.[4] Accessory nodules/ectopic thyroid tissue of the thyroid are usually found at the embryonic origin of thyroid gland, at the foramen caecum, or on the lingual duct and thyroglossal tract within the tongue.[5] These accessory nodules/ectopic thyroid tissue of the thyroid may also be seen at various other sites of body, such as the anterior mediastinum,[6] heart,[7] lung,[8] submandibular region,[9] trachea,[10] duodenum[11] and adrenal gland.[12] These ectopic thyroid tissues may later undergo malignant changes.[6,10] Approximately 50 percent of thyroid glands have a pyramidal lobe. This lobe, which varies in size, extends superiorly from the isthmus of the thyroid gland, usually to the left of the median plane. The isthmus may be incomplete.[4] A band of connective tissue may continue from the apex of the pyramidal lobe to the hyroid. The pyramidal lobe and the band develop from remnants of the epithelium and connective tissue of the thyroglossal duct.[4] The purpose of this study was to highlight various developmental anomalies of the thyroid gland, thereby forming a cornerstone to safe and effective surgery.

METHODS

Dissections were performed on the head and neck region of 105 cadavers of both genders (88 male and 17 female). The thyroid gland was exposed and studied for any variations and developmental anomalies, including partial and total agenesis of the gland, presence of ectopic tissues or accessory thyroids, and permanent thyroglossal duct anomalies such as cysts, fistulae, or sinuses, and pyramidal lobes or fibrous bands.

RESULTS

The gross anatomical features observed in the present study (Table 1) are summarised below:

1. Presence of pyramidal lobe in 61 (58%) male cadavers (Fig. 1). The pyramidal lobe was absent in female cadavers.

2. Presence of levator glandulae thyroideae in 52 (49.5%) cadavers. Among them only two (12%) female cadavers showed the presence of levator glandulae thyroideae (Fig. 2).

Table 1. The number of male and female cadavers with gross anatomical features.

<table>
<thead>
<tr>
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<th>Male cadavers</th>
<th>Female cadavers</th>
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<tbody>
<tr>
<td>Pyramidal lobe</td>
<td>61</td>
<td>Absent</td>
</tr>
<tr>
<td>LGT</td>
<td>50</td>
<td>2</td>
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<tr>
<td>AI</td>
<td>27</td>
<td>0</td>
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<tr>
<td>ATT + AI</td>
<td>1</td>
<td>Absent</td>
</tr>
<tr>
<td>Pyramidal lobe + LGT</td>
<td>23</td>
<td></td>
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</tbody>
</table>

LGT: levator glandulae thyroideae; AI: absence of isthmus; ATT: accessory thyroid tissue
3. Absence of isthmus in 35 (33%) cadavers, of which eight were female cadavers (Fig. 3).
4. In one case, accessory thyroid tissue was found above the cricoid cartilage as a separate mass supplied by the branch of superior thyroid artery (Fig. 4).

**DISCUSSION**

Most of the variations of the thyroid gland are due to a partial persistence of the median or thyroglossal duct. Failure of the development of the entire gland, or part of the gland, results in agenesis or hemiagenesis, which may be unilateral or bilateral. Many workers claim that the absence of isthmus is quite rare in humans, and in adult animals, the isthmus is either present or absent. According to the studies by Braun et al., the isthmus was missing in four cases of the 58 cadavers they studied. Won and Chung have reported that in 3% of the cases studied, the isthmus was absent and the lateral lobes of the thyroid were separated. Nehtap et al. observed failure of fusion of isthmus in the midline of the thyroid gland in a 48-year-old female cadaver. According to Gruber (quoted by Testut and Latarjet), the incidence of agenesis of the thyroid isthmus is about 5%, while according to Marshall, it is about 10%. The absence of an isthmus can be associated with other types of dysorganogenesis, such as the absence of a lobe or the presence of ectopic thyroid tissue. When the absence of isthmus is observed, a differential diagnosis against the following pathologies should be carried out: (a) autonomous thyroid nodule; (b) thyroiditis; (c) primary carcinoma; (d) neoplastic metastases; and (e) infiltrative diseases such as amyloidosis.

The frequency of the presence of pyramidal lobes could be a source of pitfalls in thyroideectomy during preoperative diagnosis on scintigraphical images. A pyramidal lobe was found to be present in 55% (32/58) of the cadavers studied by Braun et al. According to them, it was found more frequently in men than in women. In a study performed to clarify the morphological characteristics of the thyroid glands in Koreans, the frequency of the existence of the pyramidal lobe was 76.8 percent.

An accessory thyroid gland was present in one specimen among 58 cadavers studied by Braun et al. Ectopic thyroid may cause hypothyroidism. Accessory thyroid gland at the carotid bifurcation may present as a carotid body tumour. The possibility of the presence of ectopic thyroid tissue should be thought of, when magnetic resonance imaging of a presumed carotid body tumour shows tumour characteristics, which are not completely specific for a carotid body tumour, because this ectopic tissue could be the patient’s only properly functioning thyroid tissue. An ectopic tissue in the
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Fig.

Krause,<32>

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Huschke spoke

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muscle. (4)

Soemmerring’s

levator glandulae thyroideae is an accessory muscle

which runs from the hyoid bone to insert partly on the

thryoid cartilage and partly on the isthmus of the thyroid

gland. (27) Merkel thought that the levator glandulae was

constant and glandular though usually surrounded by

muscle fibres. (28) Huschke spoke of the structure only

as glandular, mentioning nothing about the muscle; (29)

Bourger described and illustrated a muscle, which he
called “hyo-thyroïdien”, occupying the place of the

pyramidal lobe. (30) Finally, Godart reported a case in

which the structure was indeed muscular, on the basis of

the nitric acid test for muscle. (31) Soemmerring’s muscle

is the same as the hyo-thyro-glandulaire of Pointe, the

levator glandulae thyroideae superficialis medius et longus

of Krause; (23) and the musculus thyroideus of Merkel;

its usual full name in the literature is levator glandulae

thyroideae of Soemmerring. Saadeh et al reported an

unusual levator glandulae thyroideae on the left side of

the neck in a female cadaver. It arose from the mastoid

process, extended superficially to the superior belly of the

omohyoid muscle and inserted into the connective tissue

of the left lobe of the thyroid gland. (32)

Reports in the literature suggest that chromosome

22 could play a role in the thyroid development. (33) The

surgeon planning a thyroidectomy must be prepared to

find variations in two important structures in the neck. He

must be prepared to find ectopic thyroid nodules around

the normally-located thyroid gland. Any unattached

gland that shows should be considered malignant until proven

otherwise. (33) Therefore, the anterior cervical region has

to be investigated very carefully during an operation,
in order not to leave behind residual thyroid tissue
during total thyroidectomy. (17) Knowledge of vascular

aberrations is essential in routine surgical procedure.

Proper identification of these vessels, as in one of our

findings (Fig. 4), is very important in order to avoid major

complications, especially during head and neck surgery.

Therefore, through training and understanding of the

thyroid anatomy and its associated anatomical variations

are very much essential, so that these anomalies are not

overlooked in the differential diagnosis.

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