SHORT REPORT

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Agenesis of isthmus of thyroid gland and ectopic locations of the inferior parathyroid glands and thymus

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SUMMARY

The aim of this study is to report a case of agenesis of the isthmus of the thyroid gland, and ectopic locations of the inferior parathyroid glands and thymus observed in an 80-year old female cadaver during routine dissection of the head and neck. The two lobes of the thyroid gland were small and connected by pretracheal fascia at the midline, which upon histological study were seen to contain mainly connective tissue, with a few minute follicles laterally. A 2.5-cm-long portion of glandular tissue was seen posterior to the left lobe, which upon histological study proved to be an ectopic thymus with cysts. The location of the superior parathyroid glands was normal. The right inferior parathyroid gland was situated close and anteriorly to the inferior pole of the right lobe. The left inferior parathyroid gland was seen within the thymus in the superior mediastinum. Ectopic locations of the inferior parathyroid gland and the thymus have been attributed to abnormal migration during embryogenesis and common origin from the third pouch.

Key words: Ectopic inferior parathyroid gland – Ectopic thymus – Isthmus of thyroid gland – Embryogenesis – Hyperparathyroidism

INTRODUCTION

The isthmus of the thyroid gland connects the lower parts of the two lobes and is usually anterior to the second and third tracheal cartilages (Standring, 2005). Incidence of agenesis of the thyroid isthmus has been reported to vary from 5% to 10% (Pastor Vazquez et al., 2006).

Parathyroid glands found in positions other than the normal location are considered to be ectopic. The location of ectopic parathyroid glands is classified as submandibular, retropharyngeal, posterosuperior mediastinal, intrathyroidal, within the tracheo-oesophageal groove, carotid sheath or thyro-thymic ligament, intrathymic and anterosuperior mediastinal (Phitayakorn and Henry, 2006).

Ectopic thymic masses have been described to be located anywhere along the descent of the thymus, from the angle of the mouth or the base of skull to the superior mediastinum (Prasad et al., 2006).

Here we report a case of a variation in the thyroid gland and ectopic locations of the right and left inferior parathyroid glands and thymus in an Indian female.

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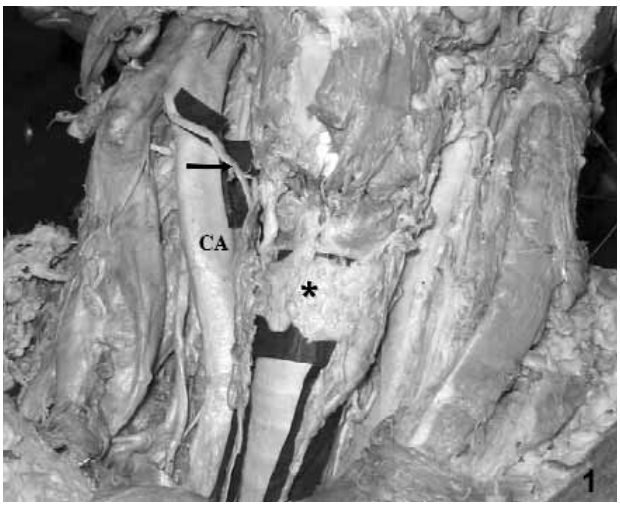

Fig. 1. Mid-line dissection of the neck of an 80-years old female showing the origin of the superior thyroid artery from the common carotid artery. *: pretracheal fascia connecting the two lobes of the thyroid gland; CA: common carotid artery; arrow: superior thyroid artery.

Fig. 3. Left lateral view of the neck. T: left lobe of the thyroid gland; E: ectopic thymus; arrow: left recurrent laryngeal nerve.

Case report

Routine dissection of the head and neck was done on the cadaver of an 80-year old woman that was donated to the Department of Anatomy for the purpose of teaching and research. During midline dissection of the neck, no glandular tissue was observed in the region of the isthmus of the thyroid gland (Fig. 1). Grossly only the pretracheal fascia connecting the right and left lobes of the thyroid gland was observed.

Unlike a normal thyroid gland, both lobes of the thyroid gland were slender; they were covered with a plexus of vessels. The extent of the gland was from the upper border of the cricoid cartilage to the fifth tracheal ring. The right lobe was 3.7 cm long, 3 mm thick, and 1.5 cm in circumference. The left lobe was 4 cm long, 3 mm thick, and its circumference was 1.5 cm. These measurements included the plexus of veins covering the lobes.

Fig. 2. Right lateral view of the neck showing the anterior location of the right inferior parathyroid gland. CA: common carotid artery; *: right inferior parathyroid gland; **: superior thyroid artery; arrow: inferior thyroid artery; black dot: recurrent laryngeal nerve; >: inferior thyroid vein.

The vessels supplying the gland were dissected out. The superior thyroid artery on the right side arose from the bifurcation of the common carotid artery (Fig. 1) and on the left side from the external carotid artery. The course of the inferior thyroid artery was normal and the recurrent laryngeal nerve was seen passing posterior to the inferior thyroid artery on both sides (Figs. 2, 3).

There was a flattened strip of glandular tissue about 2.5 cm long lying lateral to the oesophagus and the lower end of the pharynx (Fig. 3). This was connected to the left lobe of the thyroid gland by a pretracheal fascia containing the blood vessels, where the recurrent laryngeal nerve entered the larynx. A pretracheal fascia also covered this accessory glandular tissue. A median sagittal section of the head and neck was performed and a search was made for accessory thyroid tissue in the course of the thyroglossal duct. No accessory tissue was found.

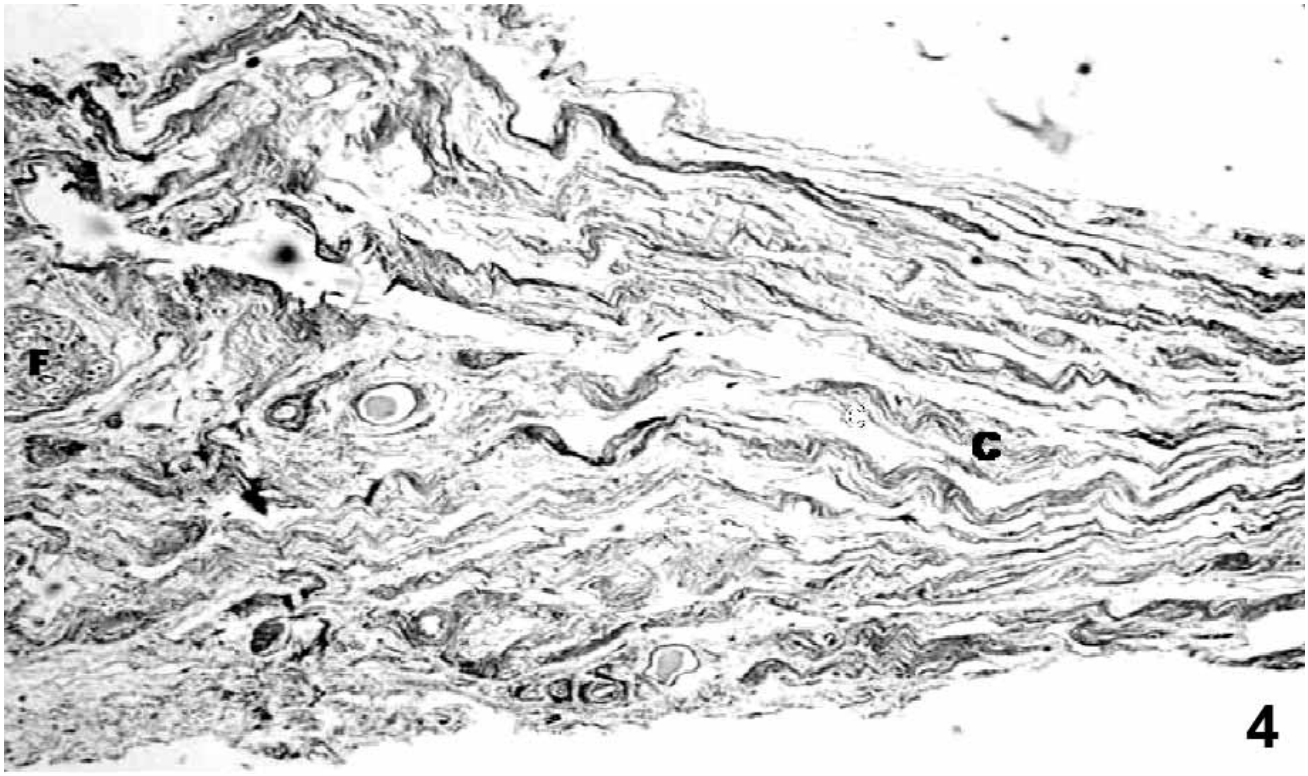

Fig. 4. Histology of the pretracheal fascia occupying the region of the isthmus (Verhoeff's staining). C: collagen fibres; F: follicle of the thyroid gland. x 80.

The parathyroid glands were dissected out. The location of the superior parathyroid glands was normal on both sides. A yellowish nodule was seen more anteriorly close to the inferior pole on the right lobe of the thyroid gland (Fig. 2). No such structure was found on the left side. A search for ectopic sites of the parathyroid gland was performed.

Both lobes of the thyroid gland, the pretracheal fascia connecting the two lobes of the thyroid gland, the lower poles of the thyroid gland, the accessory glandular tissue on the left side and the upper part of the thymic lobes from the superior mediastinum were processed for histological study.

Paraffin-embedded tissues were stained with haematoxylin and eosin. The pretracheal fascia connecting the two lobes of the thyroid gland was stained with Verhoeff's stain.

Upon histological examination, the pretracheal fascia connecting the right and left lobes of the thyroid gland showed a predominance of collagen fibres in the middle, with a few minute follicles laterally (Fig. 4). The nodule on the anterior part of the inferior pole of the right lobe of the thyroid gland appeared to be the parathyroid gland (Fig. 5). The inferior pole of the left lobe of the thyroid gland did not have parathyroid tissue.

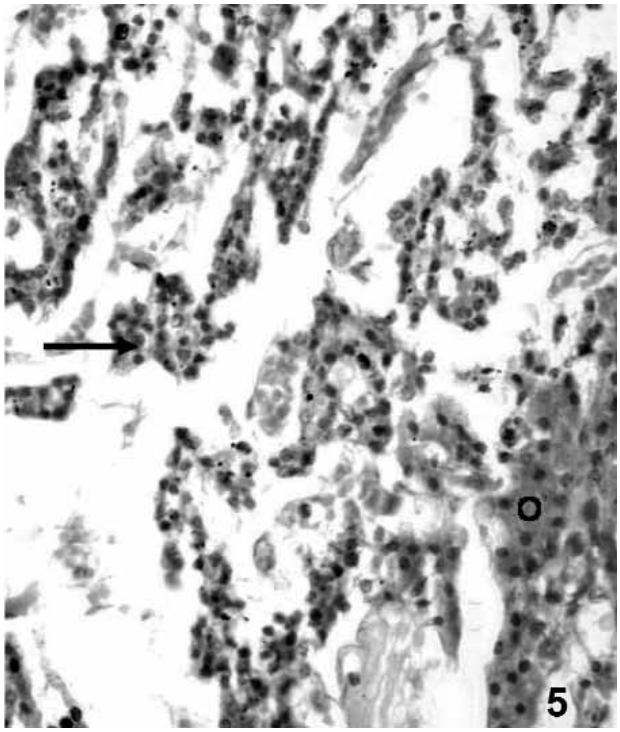

Fig. 5. Histology of the right inferior parathyroid gland (H & E staining). Arrow: chief cells / principal cells; O: oxyphil cells. x 400.

Accessory glandular tissue connected to the left lobe of the thyroid gland had the structure of the thymic tissue. Upon microscopic examination, this thymic tissue contained cysts with stratified epithelium (Fig. 6).

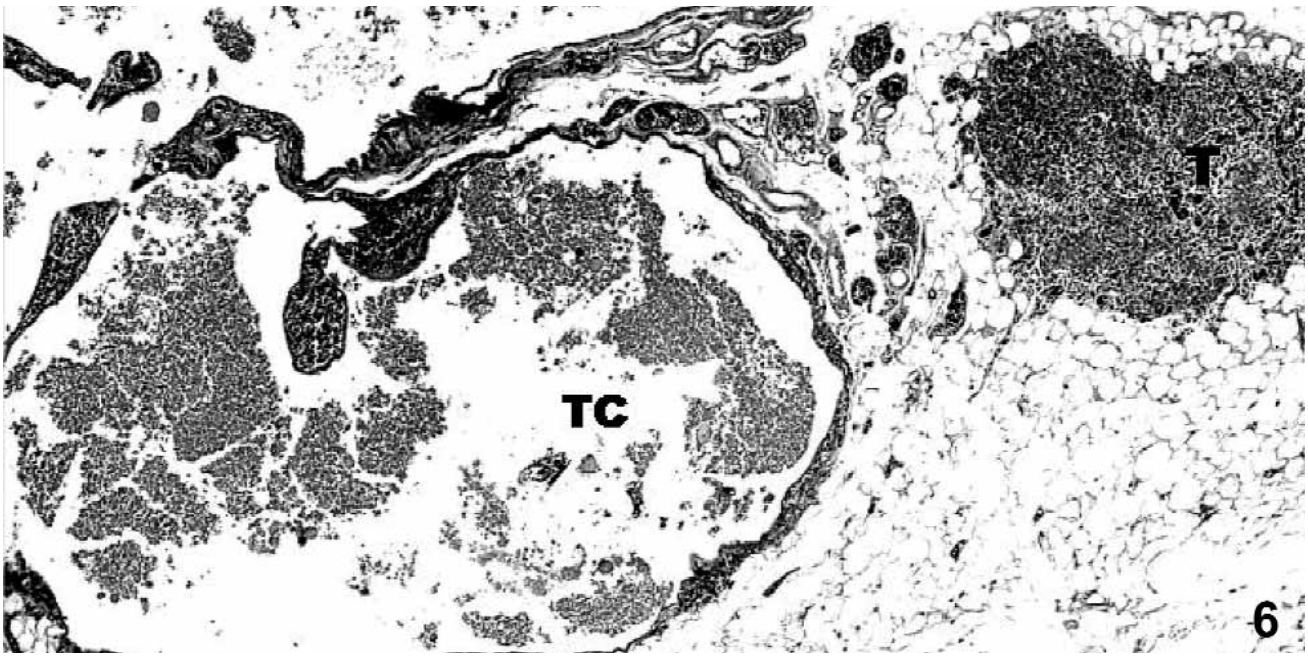

Fig. 6. Histology of ectopic cervical thymus with cysts (H & E staining). T: thymic tissue; TC: thymic cyst. x 100.

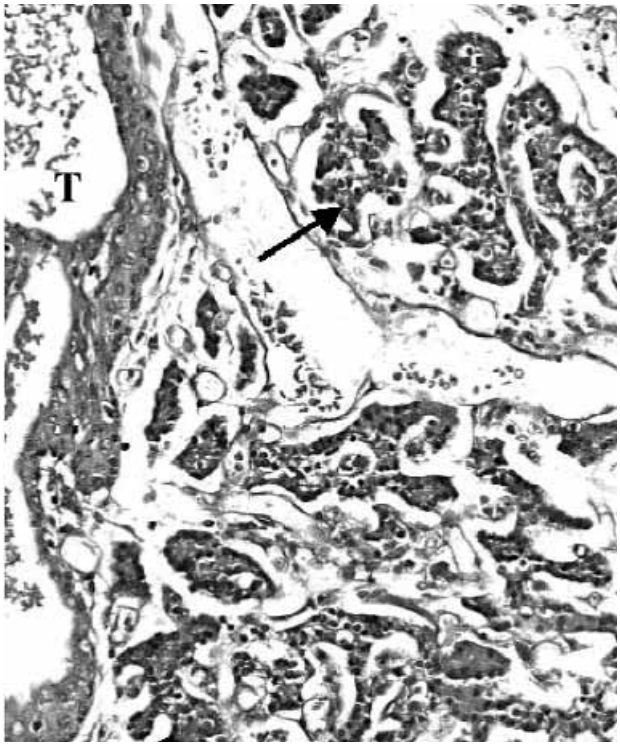

Fig. 7. Histology of the ectopic left inferior parathyroid gland in the thymus located in the superior mediastinum (H & E staining). T: thymic cysts; arrow: ectopic left inferior parathyroid gland. x 300.

The tissue from the upper pole of the thymus in the superior mediastinum contained parathyroid gland within the thymic tissue (Fig. 7).

Discussion

The normal size of each lobe of the thyroid gland has been described to be 5 cm long, its greatest transverse and anteroposterior extent being 3 cm and 2 cm respectively (Standring, 2005). Denham and Wills (1980) reported that on postmortem examination of the thyroid glands of elderly patients there was no correlation between the weight of the thyroid gland and the age of the patient. The thickness of both lobes of the glands was only 3 mm in the present study, indicating a considerable reduction in size (Fig. 1).

In a Caucasian cadaver, Pastor Vazquez et al. (2006) reported agenesis of isthmus of a thyroid gland with enlarged lobes and they defined agenesis of the isthmus of the thyroid gland as the complete and congenital absence of the thyroid isthmus. Marshall (1895) documented the variations in the gross structure of the thyroid gland in 60 children, varying in age from a few weeks to ten years and the absence of the isthmus was reported to be 10% in this group. The Incidence of the absence of the isthmus of the thyroid gland in northwest Indians is reported to be 7.9% in gross specimens (Harjeet et al., 2004). In the present study, microscopic sections of the pretracheal fascia in the region of the isthmus of the thyroid gland showed collagen fibres at the midline (Fig. 4) and minute follicles adjoining the lobes. Pastor Vazquez et al. (2006) explained the absence of an isthmus to

be due to a high division of a thyroglossal duct, leading to two independent thyroid lobes with the absence of an isthmus. They also suggested that a differential diagnosis of autonomous thyroid nodule, thyroiditis, primary carcinoma, neoplastic metastases should be considered when the isthmus of the thyroid gland is seen to be absent. The present study reports the absence of the isthmus of the thyroid gland and a reduction in the size of its lobes. No ectopic thyroid tissue was observed along the course of the thyroglossal duct.

In Italians, the incidence of ectopic parathyroid gland has been reported to be 15-20 % (Mariani et al., 2003). Different locations of the ectopic parathyroid gland have been reported in white and nonwhite patients with end stage renal disease subjected to parathyroidectomy in Brazil (Gomes et al., 2007). In this population such ectopic parathyroid glands were found mostly in the thyroid parenchyma (33.3%), the thyroid–thymus conduit (18.5%), and the thymus (14.8%). In a small percentage, they found such ectopic parathyroid glands in the carotid sheath, mediastinum, retropharyngeal space and adjacent to the oesophagus, the thyroid gland, and the recurrent laryngeal nerve. In our study, the right inferior parathyroid gland was located within the thyroid capsule, close to the inferior pole but on the anterior aspect (Fig. 2). This could be due to the reduction in the thickness of the thyroid glandular tissue.

Ectopic locations of parathyroid glands can be explained embryologically. The inferior and superior parathyroid glands originate from the endoderm of the third and the fourth pharyngeal pouches respectively. During normal migration the superior glands continue with the thyroid and come to lie in the posterolateral surface of superior part of the lobes of the thyroid gland while the inferior parathyroid glands go along with thymus. Inferior parathyroid glands separate from the thymus and come to lie on the posterolateral surface of inferior part of the thyroid lobes (Sadler, 2006). The location of the left inferior parathyroid gland within the thymus in the superior mediastinum in this case (Fig. 7) may be explained in terms of the failure of the parathyroid tissue to detach from the thymic tissue, together with more extensive migration during development.

According to Goncalves, (as quoted by Gomes et al., 2007) when the parathyroid is not found in its usual location, the thyroid lobes must be carefully examined for the presence of nodules, which should be frozen for analysis. Removal of the thymus is the next step, since the ectopic parathyroid may be found in an intrathymus position as was found in the present case (Fig. 7).

Ectopic thymic masses may be located along the descent of the thymus; anywhere from the angle of mouth or base of the skull to the superior mediastinum (Prasad et al., 2006).

A defective embryological descent of the thymic tissue could be the cause of its ectopic location. In the present study in addition to the location of the thymus in the superior medistinum, cystic cervical thymic tissue (Fig. 6) was found posterior to the left lobe of the thyroid gland and lateral to the oesophagus in the neck (Fig. 3). This may be due to the tail portion of the thymus persisting as isolated cervical thymic nests, while the main portion had moved to its final position in the superior mediastinum during embryogenesis.

Aberrant cervical thymic tissue has been described to be cystic, solid or mixed. Cysts may be small or quite large lined by non-keratinizing squamous, cuboidal, or columnar cells. Cyst contents range from straw-coloured proteineceous fluid to necrotic debris or old hemorrhage. A Cystic aberrant thymus could result from remnants of the thymopharyngeal ducts, from the degeneration of Hassal's corpuscles or from cystic degeneration of solid thymic tissue caused by infection or tumour (Joel et al., 1995). The present study revealed an ectopic thymic tissue in the cervical region that contained cysts lined by non-keratinised stratified squamous epithelium (Fig. 6).

To conclude, this study reports a case of a South Indian female with certain variations of the thyroid gland, the thymus, and the inferior parathyroid glands. The isthmus of the thyroid gland was absent and the lobes of the thyroid gland were reduced in thickness. The right inferior parathyroid gland was anterior in location. The thoracic location of the left inferior parathyroid gland and the ectopic thymic tissue in the cervical region, in addition to its location in the superior mediastinum, could be due to the developmental defect of the third pharyngeal pouch.

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