Pyramidal Lobe of the Thyroid: Anatomical Considerations of Importance in Thyroid Cancer Surgery

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Introduction
Thyroid cancer is the most common malignancy of endocrine glands. Despite some controversy in the past, currently, total thyroidectomy is considered as the procedure of choice for the management of this neoplasm. Theoretically total thyroidectomy achieves complete removal of thyroid parenchyma, thereby maximizing the efficacy of radiiodine therapy (for differentiated thyroid cancer), minimizing the risk of local recurrence, and facilitating follow-up of these patients [1, 2]. Total thyroidectomy necessitates the resection not only of the 2 thyroid lobes and the isthmus of the thyroid, but also of the pyramidal lobe. The aim of this mini-review is to summarize and present data regarding embryology and anatomy of the pyramidal lobe, which could be useful for the practicing endocrine surgeon in achieving a really total thyroidectomy.

Embryology

The thyroid parenchyma appears about 24 h after fertilization on the border between the first and second branchial arch [3]; the thyroid gland arises from a midline endodermal invagination of the foregut (the so-called 'thyroid diverticulum') at the future foramen cecum. This invagination is hollow at first but soon it becomes solid and descends to its normal adult location down to the neck through the thyroglossal duct by weeks 7–8 of development. At this time, the thyroid gland has assumed its adult shape and location. Consequently, and during weeks 9–10 of development, the thyroglossal duct disappears. The pyramidal lobe represents the inferior part of the thyroglossal duct and is considered as a normal component of the thyroid gland [1, 4]. The persistence of an elongated lower portion of the thyroglossal part increases the volume (size) of the pyramidal lobe.

Anatomy

The pyramidal lobe varies greatly in shape, position, appearance, and size, and is not present in all individuals. In anatomical studies the frequency of the pyramidal lobe is between 15 and 75% [3]. The pyramidal lobe is located to the left in 50%, right in 12%, or midline of the isthmus in 28% of individuals [5]. The most common location to the left of the midline may be due to the fact that the thyroglossal duct is generally developed in the left caudal direction [1]. Many morphological variants have been described, including pyramidal, triangular, string, or flat. The length of the pyramidal lobe also varies considerably. Many authors have reported lengths ranging from 10 to 50 mm, while others found a median length of 24.1 mm, with a range of 3–63 mm with longer length in females [4]. The pyramidal lobe may be attached to the thyroid cartilage and/or the hyoid bone by a fibrous or muscular band; this band is named the levator glandulae thyroidae muscle, and represents an accessory and variable muscle that has been reported to...

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occur in 0.49–31.2% of cases [6]. Mori’s classification of the levator glandulae thyroidae included 5 types (hyopyramidalis, thyreopiramidalis, thyreoglandularis, hyoglandularis, and tracheoglandularis) [7].

**Clinical Implications**

The pyramidal lobe may be affected by the same primary diseases (diffuse or focal) affecting the rest of the thyroid parenchyma. The involvement of the pyramidal lobe is more common in diffuse thyroid diseases, such as Hashimoto thyroiditis, Grave’s disease, and multinodular goiter, while it is more rarely affected by focal thyroidopathy, including thyroid neoplasms (benign and malignant), probably as a result of its minimal size compared to the rest of the thyroid gland parenchyma [4, 8]. Papillary carcinoma may originate from the pyramidal lobe or may represent intraglandular metastasis and be clinically apparent as a palpable, rigid mass, visible in the midline of the neck. Multifocal papillary carcinomas with foci in the pyramidal lobe were reported in 1–3% of patients [9]. Ogawa et al. [5] reported a case of a minimally invasive follicular carcinoma arising from the apex of the pyramidal lobe.

Given its high frequency, the pyramidal lobe should be regarded as a normal part of the thyroid gland. Preoperative scintigraphic imaging may fail to demonstrate the presence and size of the pyramidal lobe, since scintigraphy gives only functional and not morphological information [10]. Ultrasonography may be useful for imaging the pyramidal lobe. During surgery, the anterior cervical region should be carefully investigated to avoid leaving residual thyroid parenchyma in situ when complete resection of the thyroid gland is required [10]. Nowadays, total or near total thyroidectomy has emerged as the treatment of choice for the surgical management of the majority of thyroid diseases, including thyroid cancer. To achieve complete removal of the thyroid parenchyma, resection of the pyramidal lobe is also required, in addition to complete removal of both thyroid lobe and thyroid isthmus. This will minimize the possibility of local recurrence in both benign thyroid diseases (e.g. recurrence of hyperthyroidism in Grave’s disease) and malignant disease. In patients with differentiated thyroid cancer, complete excision of the pyramidal during thyroidectomy is mandatory given the high incidence of multifocality of these tumors. This aggressive approach also increases the effectiveness of postoperative adjuvant radioiodine therapy (when indicated) by minimizing the residual mass of thyroid parenchyma. Finally, complete resection of the pyramidal lobe during total thyroidectomy facilitates postoperative surveillance of these patients by increasing the sensitivity of serum thyroglobulin measurements [3, 4, 9]. The surgeon should, therefore, be aware of the clinical anatomy of pyramidal lobe to recognize it properly during surgery and to achieve complete removal when a total/near total thyroidectomy is required, as in patients with differentiated thyroid cancer.

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**References**