Spread of Goiters Outside the Thyroid Bed

A Review of 190 Cases and an Analysis of the Incidence of the Various Extensions

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Objectives: To analyze the distribution of thyroid goiters into the mediastinum and/or behind or along the sides of the pharynx, and to review the anatomy of the spaces in the neck that explains these extensions.

Methods: We used a 28-month period, to retrospectively identify 190 cases of neck goiters that underwent computed tomographic imaging. The maximal size of a normal thyroid gland and the limits of the normal thyroid bed were defined on the basis of established anatomic measurements. Standard definitions of the mediastinum and its compartments were also used. Each case was reviewed by 3 radiologists, and extension of the thyroid gland into the mediastinum or cranially behind or along the sides of the pharynx was noted. All cases were correlated with clinical observations.

Results: Of the 190 goiters, 106 (55.8%) were confined to the thyroid bed, 70 (36.8%) extended into the mediastinum, and 14 (7.4%) extended behind or along the sides of the pharynx. All 70 cases that extended into the mediastinum involved the anterior mediastinum, and 5 (7.1%) of these extended into the posterior mediastinum.

Conclusions: Goiterous extension outside of the thyroid bed occurred in 84 (44.2%) of cases. Although extension cranially behind the pharynx is uncommon, the physician should be aware of this diagnosis and the fascial anatomy that explains its occurrence. All of the goiters that were in the posterior mediastinum also had a component in the anterior mediastinum.

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THE EXTENSION of an enlarged thyroid gland outside the normal confines of the thyroid bed is well known. However, an analysis of the incidence of the various types of these extensions has not appeared in the literature. To make such an analysis, a definition of what constitutes the normal thyroid bed must first be made. Similarly, a definition of the upper limits of size of a healthy thyroid gland must be established. Using such definitions, we analyzed the extensions outside the boundaries of the normal thyroid bed for 190 enlarged thyroid glands. The enlarged thyroid gland may remain within the thyroid bed, or it may enlarge caudally into the anterior or posterior mediastinum. Less often, a goiter may extend cranially behind or along the sides of the pharynx. These various growth patterns of a goiter are contained by the fasciae that form the visceral space of the neck. The purpose of this article is to review the incidence of goiterous extension into each of these areas and to review the anatomy of the spaces that directs such extension.

METHODS

The levels of the normal thyroid bed were defined as being situated between the cranial level of the midthyroid cartilage ala and the caudal level of the fourth tracheal cartilage. On the basis of standard anatomic measurements, enlargement of a thyroid lobe was diagnosed when the thyroid lobe exceeded 3 cm in its greatest anteroposterior dimension and/or 2 cm in width. A goiter was retrospectively identified when a thyroid lobe exceeded this size on imaging. Since January 2000, 2418 computed tomographic (CT) imaging studies of the neck were performed at our institution (Mount Sinai Hospital, New York, NY), and with the use of these anatomic definitions, 190 cases of goiter were identified. Each of these cases was then correlated with the results of the clinical assessment of the patient. These 190 cases formed the basis of the images in this study. Extension into the mediastinum was defined as a goiter extending caudally to the level of the top of the sternum or the lower border of the manubrium. Extension behind or along the sides of the pharynx was defined as a goiter extending cranially to the level of the midthyroid ala and situated behind or along the sides of the pharynx. Each CT study was examined by 2 neuroradiologists (S.-C.C. and H.R.) and 1 head

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and neck radiologist (P.M.S.). Any differences in opinion were resolved by consensus.

RESULTS

In the past 28 months, 2418 CT imaging studies of the neck have been performed at our institution. Of these, 190 cases of goiter (7.8%) were identified retrospectively. Of these 190 cases, 106 (55.8%) were confined to the thyroid bed, 70 (36.8%) extended into the mediastinum, and 14 (7.4%) extended behind or along the side of the pharynx. All 70 cases that extended into the mediastinum involved the anterior mediastinum, and 5 (7.1%) of these also extended into the posterior mediastinum. Of the 190 patients with goiter, 136 (71.6%) were women. The age range of all patients with goiter was 27 to 92 years, with an average age for women of 61 years and for men of 63 years. Of the 84 cases of goiter that extended outside the thyroid bed, 78 (92.8%) involved both lobes, 4 (4.8%) involved the right lobe, and 2 (2.4%) involved the left lobe.

COMMENT

Clinically, enlargement of the thyroid gland due to any cause is referred to as a goiter, and patients who have a goiter may be hyperthyroid (Graves disease), hypothyroid (endemic goiter and dyshormonogenic goiter), or euthyroid (multinodular goiter). The direction taken by an extension of a goiter outside the thyroid bed is determined by the spaces about the thyroid gland. To better understand these extensions, a brief review of these spaces and some specific fasciae follows. The pharynx and cervical esophagus are surrounded posteriorly and along their lateral margins by the retrovisceral space (existing between the buccopharyngeal fascia or visceral fascia ventrally and the alar fascia dorsally). At the level of the pharynx, this space is often referred to as the retropharyngeal space, whereas at the level of the cervical esophagus, this same space is usually referred to as the retrooesophageal space. At the level of the thyroid cartilage and the attachment of the inferior pharyngeal constrictor muscles to this cartilage, the retrovisceral space has an anterior projection that extends around the sides of the cervical esophagus to encompass the larynx, trachea, thyroid gland, and parathyroid glands. This ventral extension is often referred to as the visceral compartment.

Projecting up into the lower aspect of this visceral compartment is a fold of fascia accompanying and containing the inferior thyroid artery. As a result, this fascial fold divides the lower visceral compartment into anterior and posterior sections. The anterior section, or pretracheal space, extends down behind the sternum to the level of the innominate vessels in the anterior mediastinum. The posterior section of the visceral compartment is the retrooesophageal space, which extends behind the esophagus down into the posterior mediastinum to approximately the level of the carina (where the visceral and alar fasciae fuse). Thus, the entire visceral space is a single, somewhat complex-shaped common space that contains in its anterior portion the larynx, trachea, thyroid gland, and parathyroid glands and that surrounds the cervical esophagus and pharyngeal constrictor muscles (Figure 1).

The superior mediastinum is defined as being separated from the inferior mediastinum by a plane connecting the joint between the manubrium and body of the sternum (second costal cartilage) and the lower border of the fourth thoracic vertebra. The inferior mediastinum is further subdivided into anterior (in front of the pericardium), middle (the pericardium, the heart, and the roots of the great vessels), and posterior compartments (behind the pericardium). The anterior mediastinum is continuous with the pretracheal space, whereas the posterior mediastinum is continuous with the retropharyngeal space and the spaces lateral to the esophagus and trachea, between the carotid sheaths.

Slightly enlarged goiterous glands and large goiterous thyroid glands may remain within the thyroid bed, without extension into the mediastinum or cranially around and behind the esophagus (Figure 2). If a thyroid gland is sufficiently large, it will extend outside the normal confines of the thyroid bed. Direct caudal growth is downward into the pretracheal space. As such, the thyroid extension lies in the retrosternal region, anterior to the common carotid arteries and the internal jugular veins (Figure 3A). In this location, the thyroid enlargement is usually referred to as a retrosternal or substernal goiter, and these goiters are usually resected via a cervical

Figure 1. Oblique drawings of the neck from the left side. A, Through a cutaway in the fascia, the thyroid gland and trachea are seen within the visceral compartment. The fascia around the inferior thyroid artery is also seen as it divides the lower portion of the visceral compartment into anterior pretracheal and posterior retrovisceral spaces. The common fascia around the cervical esophagus (visceral fascia) is also seen as it extends around the pharyngeal constrictor muscles extending up to the skull base. B, The actual space is represented without the visceral contents. The inside of the space is seen via a cutaway in the fascia. The arrows indicate the 3 directions of growth that the thyroid gland can take. The gland can extend caudally and anteriorly into the pretracheal space and subternal region. The thyroid gland can also grow posteriorly into the retrovisceral space. Once behind the esophagus, it can then grow caudally into the posterior mediastinum or cranially into the retropharyngeal space, both of which are areas of the common visceral space.


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approach, without the need for a sternotomy. If the caudal thyroid gland enlargement is posteriorly directed, the goiter can grow along the sides of the esophagus and eventually extend behind the esophagus. Once behind the esophagus, the goiter can project down into the posterior mediastinum or up behind the pharynx. If the thyroid growth is into the posterior mediastinum, the goiter is referred to as a mediastinal goiter, and it lies dorsal to the great vessels (Figure 3B). In this location, and depending on the size of the goiter, it may be resected via a cervical incision or a sternectomy approach. If the retroesophageal growth is directed cranially, the goiter can extend unilaterally or bilaterally up behind the pharynx. Such cranial extension behind the pharynx is resected via a cervical approach.

The thyroid gland is usually easily identified on non-contrast- and contrast-enhanced CT scans. This reflects the fact that the thyroid gland normally concentrates iodine at approximately 100 times greater than the iodine levels found in the serum (Figure 5). As iodine is the basic component of CT contrast agents, the result is a well-visualized normal thyroid gland on CT studies. The loss of iodine concentration within the thyroid gland, as assessed on non-contrast-enhanced CT scans, equates well with thyroid function. Because the thyroid gland is one of the most vascular glands, it also enhances dramatically on contrast-enhanced CT studies.

The normal thyroid gland is situated adjacent to the larynx and trachea, with its upper margin near the oblique line on the thyroid cartilage and its lower margin at the level of the fourth or fifth tracheal cartilage. This region is referred to as the thyroid bed. The normal thyroid gland weights 15 to 35 g. In men, the average thyroid volume is 19.6 mL, whereas in women it is 18.6 mL. The gland size varies with patient weight, age, and sex, and the thyroid gland enlarges in women during menstruation and pregnancy. A previous CT-based study noted the normal thyroid gland to have a mean transverse diameter of 28.79 mm (SD, 6.57 mm). The right lobe av-
eraged 15.05 mm (SD, 3.51 mm), and the left lobe averaged 13.74 mm (SD, 3.91 mm). However in anatomic texts, the average thyroid lobe measurements are given as 3 cm in the greatest anteroposterior dimension and/or 2 cm in width. Using these larger, rounded-off average measurements from the anatomic studies, we defined a goiter as existing when a thyroid lobe exceeded 3 cm in the greatest anteroposterior dimension and/or 2 cm in width (Figure 3). Although this might seem somewhat arbitrary, the correlation with the clinician’s assessment of the thyroid gland was very good. Of the 190 cases, a clinical diagnosis of goiter was made in 174 cases (91.6%). In the remaining 16 patients, their obese body habitus made clinical assessment of mild-to-moderate thyroid enlargement impossible.

In the literature, assessment of a substernal goiter or a posterior mediastinal goiter was based on surgical rather than imaging findings. In these reports, the percentage of substernal goiter varied from 5.7% to 20% of the cases. Extension into the posterior mediastinum was reported as 9.8% to 12% of cases, and this always occurred in conjunction with extension into the anterior mediastinum. In our study, 36.8% of the cases extended into the anterior mediastinum, and 7.1% extended into the anterior and posterior mediastinum. We also reported 14 cases (7.4%) of goiters extending cranially behind or along the sides of the pharynx. In the literature, there were only 11 case reports of such cranial extension of a goiter.

CONCLUSIONS

Of 190 goiters identified on CT studies of the neck, the goiter extended outside of the thyroid bed in 84 (44.2%) of cases. When there was caudal growth into the mediastinum, the anterior mediastinum was always involved, and in 7.1% of these cases there also was extension into the posterior mediastinum. Although extension...
cranially behind the pharynx occurred uncommonly (7.4% of cases), the radiologist should be aware of this diagnosis and the fascial anatomy that explains its occurrence.

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REFERENCES


