

A surgical algorithm for the management of retrosternal goiters

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Abstract

Key points: - The heterogeneity of retrosternal goiter size and location, nearby anatomical structures, and evolving surgical techniques means selecting the most appropriate individualised surgical approach remains challenging. - Although most retrosternal goiters can be removed transcervically, a small proportion of patients fulfill anatomical and radiological criteria for concurrent extracervical approaches based on decades of experience at the London Health Sciences Centre. - Anterior goiters above the level of the pericardium were resected using cervical thyroidectomy with either mediastinoscopic-assisted delivery or cervical thyroidectomy with video- assisted thyroidectomy (VATS) - Anterior goiters extending beyond the pericardium require median sternotomy to facilitate sufficient vascular control and exposure. - Posteriorly extending goiters can be managed using trans-thoracic approaches including lateral thoracotomy or VATS.

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- Although most retrosternal goiters can be removed transcervically, a small proportion of patients fulfill anatomical and radiological criteria for concurrent extracervical approaches based on decades of experience at the London Health Sciences Centre.
- Anterior goiters above the level of the pericardium were resected using cervical thyroidectomy with either mediastinoscopic-assisted delivery or cervical thyroidectomy with video- assisted thyroidectomy (VATS)
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- Posteriorly extending goiters can be managed using trans-thoracic approaches including lateral thoracotomy or VATS.

Introduction

Retrosternal goiter refers to those which partially or completely extend posterior to the sternum. They may be classified either as primary, due to ectopic thyroid tissue, or secondary, due to the direct downwards

migration of thyroid tissue.¹The primary goal in the treatment of retrosternal goiters is often to relieve obstructive symptoms using surgical resection, with numerous grading systems being developed to help clinicians guide operative choices. Delbridge² based his classification on the relationship between the cervical and thoracic components of the thyroid tissue; Page, Strunski³ and Huins, Georgalas, Mehrzad, Tolley⁴ based their classification on the extent of inferior extension of the goiter; and Randolph, Shin, Grillo, Mathisen, Katlic, Kamani, Zurakowski⁵ based their classification on the direction of extension, either into the anterior or posterior mediastinum. Still, the heterogeneity of goiter size and location, nearby anatomical structures, and evolving surgical techniques means selecting the most appropriate individualised surgical approach remains challenging.

Objectives

The aim of this study is to describe our experience at tertiary/quaternary referral institution to provide a practical surgical treatment algorithm for the management of retrosternal goiters based on anatomical features.

Methods

Ethical considerations

This is a purely descriptive study outlining the approaches to the management of retrosternal goiter using several case examples. All information was de-identified and, hence, ethics board review was not sought. However, informed consent was gained from the included patients.

Study design and participants

All patients with retrosternal goiter presenting to the London Health Sciences Centre were managed within a multidisciplinary team consisting of Head and Neck surgeons, thoracic surgeons, endocrinologists, and nuclear medicine physicians. Patients were investigated with a contrast-enhanced CT scan to assess the extent of the retrosternal goiter to direct the surgical approach. Selective cases examples illustrating the management principles at this institution are described and discussed below.

Surgical resection

Surgical decisions were guided using an institutional treatment algorithm (**Figure 1**). If extracervical access was not necessary, patients were managed using a cervical approach only through digital dissection and upwards traction of the goiter. Where an extracervical approach was indicated, surgical management was guided by the extent and direction of inferior extension. Anterior goiters above the level of the pericardium were resected using cervical thyroidectomy with either mediastinoscopic-assisted delivery or cervical thyroidectomy with video- assisted thyroidectomy (VATS). Those extending beyond the pericardium instead required median sternotomy to facilitate sufficient vascular control and exposure. Goiters extending into the posterior mediastinum were managed using trans-thoracic approaches, this time via the posterolateral route such as a lateral thoracotomy or VATS.

Results

Case one

A 59-year-old male presented with an enlarged neck mass and voice changes. CT imaging revealed an enlarged thyroid gland with retrosternal extension to T4 in contact with, but not beyond, the aortic arch in the anterior mediastinum (**Figures 2a and 2b**). He underwent a total thyroidectomy via Kocher's incision where the strap muscles were divided, and the thyroid gland was mobilised using subcapsular dissection technique. The superior, lateral, posterior, and much of the inferior poles of the thyroid gland were freed using forceps dissection before upward traction applied to the superior poles delivered the gland's mediastinal component

(**Figures 2c and 2d**). The patient had an uneventful recovery and was discharged on postoperative day two. The final histology confirmed benign nodular hyperplasia.

Case two

A 59-year-old female presented with dysphagia and a CT scan demonstrating an enlarged thyroid gland with an anterior mediastinal component connected via a fibrous stalk. Total thyroidectomy was performed as described in case one, however, the fibrous stalk did not allow for traction delivery of the mediastinal component. Instead, the stalk was amputated, the cervical goiter was delivered via the neck incision, and the remaining mediastinal component was removed with an extracervical approach using VATS.

The right lateral chest wall and the upper abdomen were exposed, and the patient was tilted slightly to the left before the anaesthetist inserted and inflated a blocker into the right mainstem bronchus. Three ports were inserted along the inframammary line and one port was inserted through the anterior chest after deflation of the lung. The pseudocapsule around the goiter was dissected free and the feeding vessels were ligated. The goiter was then delivered via one of the thoracic ports in an endopouch. The final histology demonstrated benign nodular hyperplasia for both lesions.

Case three

A 76-year-old female presented with right heart failure and pleural effusion secondary to a retrosternal goiter in the anterior mediastinum compressing upon the right heart, thus necessitating resection using a transcervical-sternotomy approach (**Figure 3a and 3b**). A low collar incision was made in continuity with the median sternotomy wound which was carried down to the xiphoid process before sternal retraction was applied (**Figure 3c**). The mediastinal component of the goiter was mobilised and freed up to the aortic arch and multiple feeding vessels from the mediastinum were ligated. The cervical component was mobilised as described in case one. After full mobilisation superiorly and identification of both recurrent laryngeal nerves, the pleura was opened superiorly, and bilateral phrenic nerves were identified. At this point, the retrosternal goiter was progressively removed from the superior mediastinum en bloc with full visualisation of both the recurrent laryngeal nerves and phrenic nerves (**Figure 3d**). On follow-up, the patient demonstrated normal vocal cord movement bilaterally, intact parathyroid gland function, and resolution of the symptoms from right heart failure. Her final histology confirmed a multinodular goiter.

Case four

A 68-year-old female with a history of retrosternal goiter treated with iodine ten years prior presented with a large right-sided thyroid mass. Fine needle aspiration suggested a diagnosis of papillary thyroid cancer and her repeat CT scan confirmed an enlarged thyroid gland with cystic retrosternal extension into the posterior mediastinum, adherent to surrounding mediastinal structures. Total thyroidectomy was performed as described in case one. The isthmus was divided, and the left lobe was removed. Transcervical digital dissection of the retrosternal component was performed as much as possible, and the right thyroid lobe was pedicled on the retrosternal component (**Figure 4a**).

The remaining retrosternal component was removed with VATS. The goiter was visualised in the posterior mediastinum and an incision was made on the pleura (**Figure 4b**). The azygous vein appeared adherent to the goiter and was subsequently ligated with an Endo-GIA stapler. The tumour was mobilised with endoscopic Ligasure. It was freed from the trachea and continued circumferentially up to the level of the thoracic inlet (**Figure 4c**). The goiter was subsequently delivered through the neck, attached to the right hemithyroid (**Figure 4d**). The patient had an uneventful recovery and was discharged on postoperative day three. Final pathology confirmed a five-centimetre papillary thyroid cancer with clear margins.

Discussion

Our institutional algorithm firstly involves determining whether an extracervical approach is warranted. Approximately 95% of retrosternal goiters can be removed cervically through the neck incision using upward traction, digital dissection, and with assistance of long instruments (**case one**).⁶ However, some cases necessitate a concurrent extracervical approach (**Figure 1**). Adequate exposure is challenging with a cervical approach in goiters extending below the aortic arch or carina or situated within the posterior mediastinum.⁷ Similarly, an extracervical approach is necessary for vascular control where the goiter has blood supply originating from mediastinal vessels or for safe resection where no tissue plane between it and surrounding tissues can be identified on CT.⁸ Finally, upward traction in the cervical approach may be difficult in patients with thyroid tissue beyond easy reach via the neck incision, isolated primary or ectopic retrosternal goiters, or where the thoracic component connects to the cervical component via a fibrous stalk (**case two**).⁹

Median sternotomy is the most common extracervical approach in the literature. Whilst this provides excellent exposure to anteriorly extending retrosternal goiters (**case three**), it is associated with considerable morbidity and exposure to the posteriorly extending goiters remains limited by the heart and great vessels. Consequently, the lateral thoracotomy is instead often used for posterior retrosternal goiters due to better exposure and decreased morbidity.⁴

VATS and mediastinoscopic approaches are increasingly used in the treatment of retrosternal goiter (**cases two and four**). In comparison to open thoracotomy, VATS has been shown to be associated with decreased postoperative pain, shorter hospital stay, improved postoperative pulmonary function.¹⁰ In our experience, these techniques may be utilised in cases where the retrosternal component extends to the aortic arch, but the surgeon is unable to obtain adequate vascular control for safe delivery of the lesion with cervical blunt dissection. This is particularly valuable as the tissue plane between the goiter and the pretracheal fascia, prevertebral fascia and the oesophagus is often described as quite dense, with transcervical approaches increasing the risk of inadvertent oesophageal tear or uncontrollable bleeding.

Conclusion

Although most retrosternal goiters can be removed transcervically, a small proportion of patients require concurrent extracervical approaches. Based on decades of experience in the surgical management of retrosternal goiters, a practical institutional algorithm has been presented to guide surgical planning in a complex field.

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Figures

Figure 1 . Surgical algorithm for the management of retrosternal goiters.

Figure 2. (a) Coronal plane CT and (b) sagittal plane CT scan showing retrosternal goiter extending into anterior mediastinum just above the aortic arch. (c) Progressive removal of retrosternal goiter with combination of upwards traction and blunt dissection. (d) Final surgical specimen of the retrosternal goiter.

Figure 3: Axial CT of the neck (a) and the chest (b) showing a large retrosternal goiter with low anterior mediastinal extension. Right pleural effusion and basal collapse of the lung was also noted.(c) Exposure of the anterior mediastinum after a low collar incision, median sternotomy, and application of mediastinum retractor.(d) Final surgical specimen, super-imposed on the patient's chest to demonstrate the extent of retrosternal extension.

Figure 4 . (a) Right thyroid lobe pedicled on the retrosternal component, extending behind the innominate artery. (b) Complete thyroidectomy specimen. (c) View from the intrathoracic endoscope showing exposure of the posterior mediastinal thyroid lobe after incising the right pleura. (d) View of the mediastinal component of the thyroid gland completely free from the surrounding tissues.

Data availability statement

Data sharing is not applicable to this article as no new data were created or analyzed in this study.







