



Original research

Surgical management of substernal goitres at a tertiary referral centre: A retrospective cohort study of 2,104 patients



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HIGHLIGHTS

- The depth of the extension to the tracheal bifurcation on CT is the strongest predictor of the need for a thoracic approach.
- Substernal goitres with a unilateral extension are most common with equal frequency between right- and left-sided extensions.
- Clinical features and surgical outcomes are the same regardless of the substernal goitre location.
- The incidence of malignant substernal goitres is similar to that of malignant cervical goitres.

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ABSTRACT

Background: When to use a thoracic approach to treat substernal goitres has often been discussed in the literature. But there are few published reports describing surgical outcomes and associated complications for patients with right-sided vs. left-sided substernal goitres.

Objective: This study evaluated the characteristics and clinical outcomes of patients who underwent surgical management of substernal goitres, presenting factors indicating the use of a thoracic approach and differences between right- and left-sided goitre extensions.

Design: Retrospective cohort study.

Setting: Tertiary referral centre.

Methods: Between January 2007 and December 2012, 2104 patients underwent thyroidectomy at Chang Gung Memorial Hospital and 140 (6.7%) were diagnosed with substernal goitres. Patient medical records were retrospectively reviewed, and data were analysed to assess surgical outcomes.

Results: Seven (5.0%) patients required a thoracic approach for goitre removal. Goitre malignancy was verified in 17 (12.1%) patients. The most common postoperative complication was transient hypoparathyroidism (15.0%). Permanent RLN injury occurred in 4.3% of patients and was significantly more frequent using the thoracic approach. Unilateral extension of a substernal goitre was more common than bilateral extension. Right- and left-sided extensions occurred with equal frequency. The rate of postoperative complications was similar between groups and there were no patient deaths.

Conclusion: Chest radiography and thyroid sonography may provide initial radiologic evidence of goitre extension into the superior mediastinum. Computed tomography evaluation of the depth of goitre extension to the tracheal bifurcation was the strongest predictor of the need to use a thoracic approach. There were no significant differences in the clinical features and outcomes of patients with right- and left-sided substernal goitres. The right recurrent laryngeal nerve shows increased susceptibility to damage during thyroid surgery for substernal goitres. The incidence of malignant substernal goitres is similar to that of malignant cervical goitres.

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1. Introduction

Enlarged thyroid tissue that extends through the thoracic inlet into the mediastinum is referred to as a substernal, retrosternal, intrathoracic, or mediastinal goitre. There are no consistent criteria for diagnosing this condition; therefore, the reported substernal goitre incidence rate varies from 0.2% to as high as 45% [1]. The clinical symptoms and signs associated with this condition are directly related to goitre size and the potential to compress adjacent structures.

Surgery remains the most effective treatment for symptomatic patients, with most substernal goitres safely removed through a cervical incision. However, a thoracic approach may be more appropriate when computed tomography (CT) imaging shows that the goitre extends below the aortic arch or into the posterior mediastinum, when it is shaped like a dumbbell, or when it is wider than the thoracic thyroid component [2]. Although substernal goitres can occur either unilaterally or bilaterally, there are few reports that describe the surgical outcomes and complications associated with right-sided vs. left-sided substernal goitres. Another controversial issue concerns the surgical removal of substernal goitres with regard to malignancy.

The present study evaluated the clinical features of patients with substernal goitres. The parameters evaluated included associations between goitre location, predisposing factors associated with the preferential use of a thoracic approach for goitre removal and patient surgical outcomes and complications.

2. Materials and methods

2.1. Study design

This retrospective study was approved by the Institutional Review Board of Chang Gung Memorial Hospital, Linkou, Taiwan (IRB 102-3506B) and was conducted in accordance with the STROBE Statement guidelines [3]. A substernal goitre was defined as any part of a goitre that extended below the thoracic inlet, with the diagnosis made based on either radiologic evidence or intraoperative assessment. Among the 2104 patients with nodular goitres who had undergone thyroidectomy between January 2007 and December 2012, 140 (6.7%) were identified as having substernal goitres and were included in the present analysis. The clinical records of these patients were reviewed and data on the following parameters were collected for analysis: age, sex, symptoms, imaging findings, surgical methodologies, pathologic diagnosis, associated complications and long-term outcomes.

2.2. Preoperative evaluation

All patients had a preoperative thyroid function test performed to ensure that they were euthyroid. The 28 (20.0%) patients exhibiting hyperthyroidism were treated with an anti-thyroid medication to achieve a euthyroid state prior to surgery. All patients underwent a preoperative thyroid ultrasound and a standing chest X-ray that captured the posterior–anterior view. If the substernal projection extended beyond the level of the clavicle, neck and chest CT imaging was performed to better assess the lesion.

2.3. Postoperative evaluation

Postoperative assessments included monitoring and recording wound condition, respiration, voice and the presence of hypocalcaemia symptoms. Starting on postoperative day 1, serum

calcium and parathyroid hormone concentrations were assessed at least once throughout the period of postoperative hospitalisation. If a patient exhibited symptoms of hypocalcaemia, oral calcium supplementation with or without calcitriol (1,25-dihydroxycholecalciferol) was initiated and then tapered off during outpatient follow-up. Permanent hypoparathyroidism was defined as a postoperative serum parathyroid hormone concentration <14 pg/ml with >6 months of medication required for maintaining normocalcaemia.

If a patient developed a postoperative voice disorder or easy aspiration on swallowing, they were referred to an otolaryngologist for laryngoscopic evaluation of vocal cord palsy. Permanent recurrent laryngeal nerve (RLN) injury was defined as persistent vocal cord palsy for >6 months with no intervention.

2.4. Statistical analyses

Group differences in continuous variables were evaluated using the Mann–Whitney U test or the Kruskal–Wallis H test. Group nominal data were analysed using Fisher's exact test or Pearson's chi-square test. All analyses were performed using Statistical Package for Social Sciences software (SPSS®, Ver.17.0, Chicago, IL, USA). Statistical significance was accepted when $p < 0.05$.

3. Results

3.1. Patients

Demographic data, clinical symptoms and diagnoses for the 140 patients with substernal goitres are presented in Table 1. The median patient age was 58 years (range, 19–85 years) and the female:male ratio was 3:1. Chest radiographs showed deviation of the trachea in 126 (90.0%) patients and narrowing of the tracheal lumen in 14 (10.0%) patients. CT scans of the neck and chest were performed on 42 (30.0%) patients, with 31 (73.8%) of these patients presenting with substernal extension above or at the level of the aortic arch. The remaining 11 (26.2%) patients showed extension beyond the level of the aortic arch and included two patients with ectopic goitres. Goitre extensions into the middle mediastinum ($n = 10$) and anterior mediastinum ($n = 1$) were also observed. However, none of these patients showed substernal extension beyond the bifurcation of the trachea. Twenty-eight (20.0%) patients underwent Tc-99m pertechnetate thyroid scans, with most

Table 1
Demographic data, clinical symptoms, and preoperative diagnosis of patients with substernal goitres who underwent surgery.

	n = 140
Age (years), median (range)	58 (19–85)
Gender	
Male	34 (24.3%)
Female	106 (75.7%)
Symptoms	
Neck mass	114 (81.4%)
Compression	54 (38.6%)
Thyrotoxicosis	28 (20.0%)
Others	12 (8.6%)
None	8 (5.7%)
Preoperative diagnosis by FNAC ^a	
Non-toxic nodular goitre	117 (83.6%)
Hyperthyroidism	14 (10.0%)
Indeterminate ^b	8 (5.7%)
Malignancy	1 (0.7%)

^a Fine needle aspiration cytology.

^b Includes follicular neoplasm and Hurthle cell neoplasm.

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