

## Case Report



# Anterior Mediastinal Goiter Removed via Median Sternotomy: Short Communication and Literature Review

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No potential conflict of interest relevant to this  
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## ABSTRACT

The majority of substernal goiters can be retrieved through the neck. However, sternotomy is indicated in roughly 1% to 8% of cases. Herein, we report a case of huge anterior mediastinal goiter removed via median sternotomy. A 62-year-old woman visited our hospital in October 2015, complaining of a large mass in her neck. Her thyroid function test results including antibody levels were within normal limits. Ultrasonography showed multiple nodules that ranged in diameter from 1.0 to 4.7 cm. We were unable to exclude the possibility of papillary thyroid carcinoma following fine-needle aspiration cytology. Furthermore, computed tomography revealed a bulky, 17×8×6 cm thyroid gland that extended to the thoracic cavity. The patient underwent total thyroidectomy via median sternotomy in December 2016; the operation time was 370 minutes. During surgery, 600 mL of red blood cells were transfused, and the patient's estimated blood loss was 1,600 mL. The patient's Simplified Acute Physiology Score III was 35, and she was admitted to the intensive care unit for 2 days immediately post-operation. The recovered patient was discharged 11 days after the operation. The pathologist reported multi-nodular hyperplasia, along with stage I (T1aNO) papillary thyroid microcarcinoma. Sternal split occurs in cases involving difficult retrieval of substernal components or unexpected thoracic hemorrhage. Patients should be well informed of sternotomy and its potential complications.

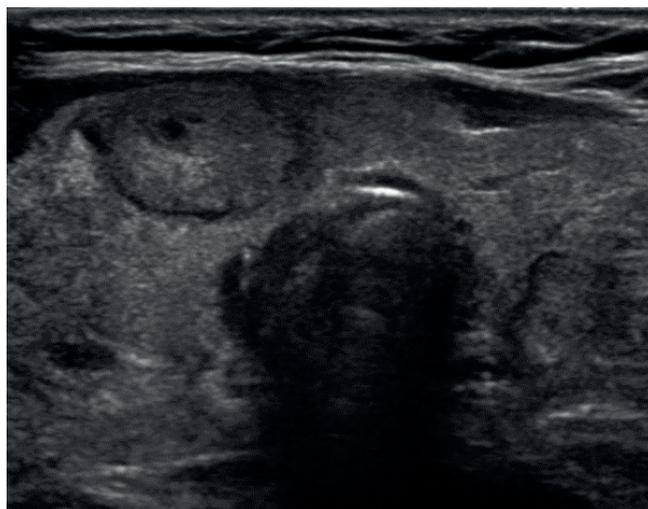
**Keywords:** Thyroid gland; Goiter; Mediastinum; Sternotomy

## INTRODUCTION

The extirpation of the thyroid gland in goiter typifies, perhaps better than any operation, the supreme triumph of the surgeon's art, as Halsted stated (1). The term "goiter" refers to an abnormal enlargement of the thyroid gland, and the term "substernal goiter" is associated with substernal extension warranting mediastinal dissection. The rate of sternotomy in substernal goiter ranges from 1% to 8% (2). Mediastinal exposure is a common clinical challenge in cases of difficult retrieval of substernal components or unexpected hemorrhage in the thorax. Therefore, sternotomy, whether partial or complete, must be discussed preoperatively with patients. Herein, in addition to a literature review, we report a case of a large anterior mediastinal goiter removed via median sternotomy. The patient provided informed consent for the publication of this report.

## CASE REPORT

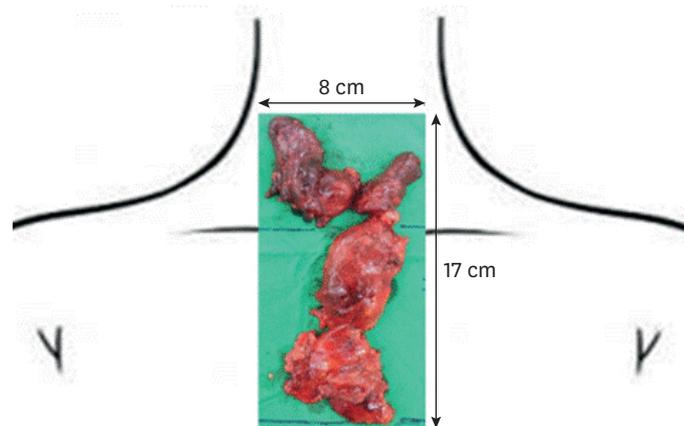
A 62-year-old woman visited our hospital in October 2015 complaining of a large mass in her neck. No obvious symptoms such as respiratory difficulty, voice change, or dysphagia were presented. Facial plethora (Pemberton's sign), however, was marked within one minute after the patient raised both arms. The patient's intact parathyroid hormone (PTH) level was 59.99 pg/mL, total calcium was 9.3 mg/dL, and phosphorous was 3.7 mg/dL. Her thyroid function test results including antibody measurement were within normal limits. Ultrasonography showed multiple nodules that ranged from 1.0 to 4.7 cm at their longest diameters (**Fig. 1**). Fine-needle aspiration was performed for the indeterminate nodules, and the microscopic view showed papillary clusters of atypical follicular cells with a few nuclear grooves and pseudo-inclusions. We did not exclude the possibility of papillary thyroid carcinoma. Furthermore, computed tomography (CT) revealed a bulky, 17×8×6 cm thyroid gland that extended to the thoracic cavity (**Fig. 2**). On the CT scan, the trachea was compressed and deviated to the right side. Following discussion among physicians from different departments, we planned a sternotomy. The patient underwent total thyroidectomy via median sternotomy in December 2016 (**Fig. 3**). During the sternotomy, the skin incision extended from below the collar incision to above the xyphoid process. Sternum was dissected in the midline to ensure appropriate healing and stability of the sternum. The suprasternal notch was dissected free from the surrounding tissue to minimize the risk of injury to the innominate vein and the pleura. After meticulous mobilization, goiter was incrementally resected from the mediastinum, sparing no efforts to preserve parathyroid glands and recurrent laryngeal nerves. The operation time was 370 minutes. During surgery, the patient was transfused with 600 mL of red blood cells following estimated blood loss of 1,600 mL. The patient's Simplified Acute Physiology Score III was 35, and she was admitted to the intensive care unit for 2 days after the operation. The immediate postoperative chest X-ray showed atelectasis and pleural effusion, which were resolved the next day. The total amount of drainage in the neck was 418 mL, while the total amount of chest tube drainage in the mediastinum was 1,638 mL. The patient did not experience any surgical complications. The recovered patient was discharged 11 days following the operation. The pathologist reported multi-nodular hyperplasia, along with stage I (T1aNO) papillary thyroid carcinoma according to the 7th edition of the American Joint Committee on Cancer staging system; the specimen



**Fig. 1.** Ultrasonography showed multiple nodules that ranged from 1.0 to 4.7 cm at their longest diameters.



**Fig. 2.** CT revealed a bulky, 17×8×6 cm thyroid gland that extended to the thoracic cavity: (A) coronal view, (B) sagittal view.  
CT = computed tomography.

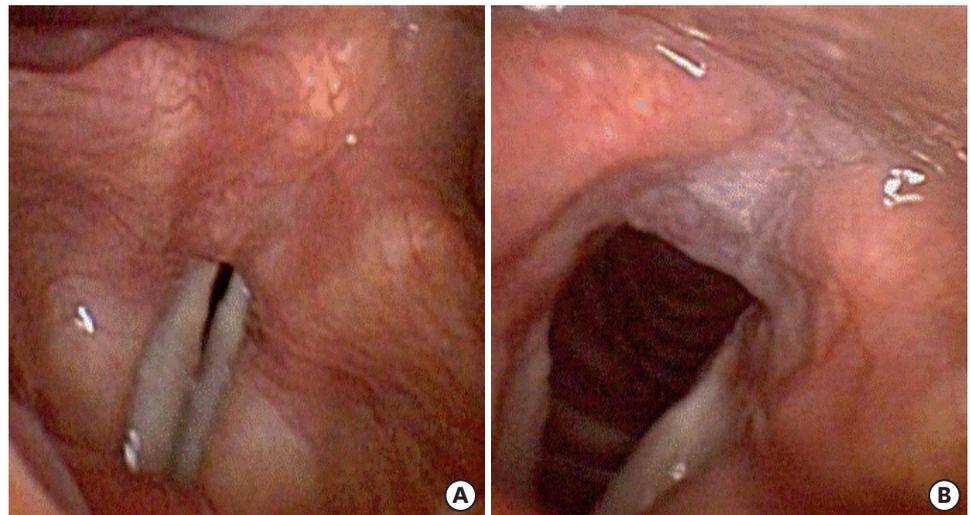


**Fig. 3.** Surgical specimen was obtained after total thyroidectomy via median sternotomy.

was also positive for the BRAF<sup>V600E</sup> mutation. During a regular outpatient visit 6 months after the surgery, the patient reported no discomfort and had regular follow-up test results. Her intact PTH was 35.13 pg/mL, total calcium was 8.7 mg/dL, and phosphorous was 4.3 mg/dL. We identified no vocal cord dysfunction during the laryngoscopic evaluation (**Fig. 4**).

## DISCUSSION

Multi-nodular goiters affect 4% of the American population and 10% of the British population (3). New thyroid nodular disease occurs in 0.1%–1.5% of the general population every year, and substernal goiter represents 3%–47% of all goiters removed. Goiters are known to develop due to genetic alterations, iodide deficiency, thyroiditis, lithium, carcinoma, and other causes (4). Goiters can be toxic or nontoxic, and those greater than 5 cm can elicit symptoms such as respiratory difficulty, dysphagia, and voice change (4). Pemberton's sign indicates the compression of vascular structures caused by goiters (5).



**Fig. 4.** No vocal cord dysfunction was found in the laryngoscopic evaluation after the surgery: (A) phonation, (B) inspiration.

CT is usually recommended for defining anatomic relationships (4). Surgery is a rational treatment option for patients with symptoms, hyperthyroidism, or malignancy as well as for patients with substernal goiter (6).

A classification system for substernal goiters is highly useful based on their distinguishing features (**Table 1**) (7). Type II substernal goiter affects the posterior mediastinum in 15% of cases. When a substernal goiter expands to the posterior mediastinum, it excavates the region posterior to the trachea, pushing the trachea anteriorly and splaying the great vessels anteriorly. Type III isolated mediastinal goiters represent only 0.2%–3.0% of goiters requiring surgery. These lesions are important in that blood can be supplied by purely mediastinal arteries and veins unlike other types of substernal goiters. Sternotomy is indicated for types IIB/III and for type I only if the diameter of the intrathoracic component of the goiter is substantially greater than the diameter of the thoracic inlet (7).

Postoperative surgical complications include recurrent laryngeal nerve injury, hypoparathyroidism, hypothyroidism, tracheomalacia, and post-sternotomy mediastinitis. Recurrent laryngeal nerve paralysis is consistently higher with goiter surgery than in routine thyroidectomy (8). Analyses of risk factors revealed that increased recurrent laryngeal nerve paralysis was predicted by preoperative compressive symptoms, substernal extension, the presence of bilateral cervical goiter, or presence of revision surgery (7). Rates of hypoparathyroidism have been reported as low as 1.0%–1.5%, with a possible association between hypoparathyroidism and extent of thyroid surgery (9). The risk of hypothyroidism is determined by dietary iodine status, the presence of autoimmune thyroid antibodies, and the

**Table 1.** Substernal goiters can be classified as below

Type	Location	Prevalence (%)	Approach
I	Anterior mediastinum	85	Transcervical (sternotomy if goiter exceeding thoracic inlet)
II	Posterior mediastinum	15	Sternotomy or right posterolateral thoracotomy if type IIB
IIA	Ipsilateral extension	-	-
IIB	Contralateral extension	-	-
III	Isolated mediastinal goiter	<1	Transcervical or sternotomy

Adapted from reference 7.

degree of thyroid resection. Tracheomalacia is extremely rare, with an estimated incidence of 0.001% to 1.5% (7). Treatment recommendations for tracheomalacia include intubation, tracheotomy, trachelopexy, mesh, and tracheal grafting (10). Post-sternotomy mediastinitis is a life-threatening complication with incidence varying from 0.3% to 3.4% (11). The development of mediastinitis depends on the presence of co-morbidities and surgical techniques. The American Association for Thoracic Surgery recently published guidelines for the prevention and treatment of sternal wound infection (12). Surgeons who do not routinely perform sternotomy should discuss the management of substernal goiters in collaboration with thoracic surgeons (7).

In our case, the patient had a large goiter suggesting papillary thyroid carcinoma, and was treated surgically. However, during the preoperative work-up, the thyroid examination revealed a type I substernal goiter that extended to the thoracic cavity. The diameter of the intrathoracic goiter was larger than that of the thoracic inlet, and sternotomy was indicated, following discussions with other physicians from different specialties. The possible complications and longer hospital stay including intensive care were explained to the patient.

In conclusion, sternal split is possible in cases of difficult retrieval of substernal components or unexpected hemorrhage in the thorax. Patients should be well informed about the sternotomy procedure and its potential complications.

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