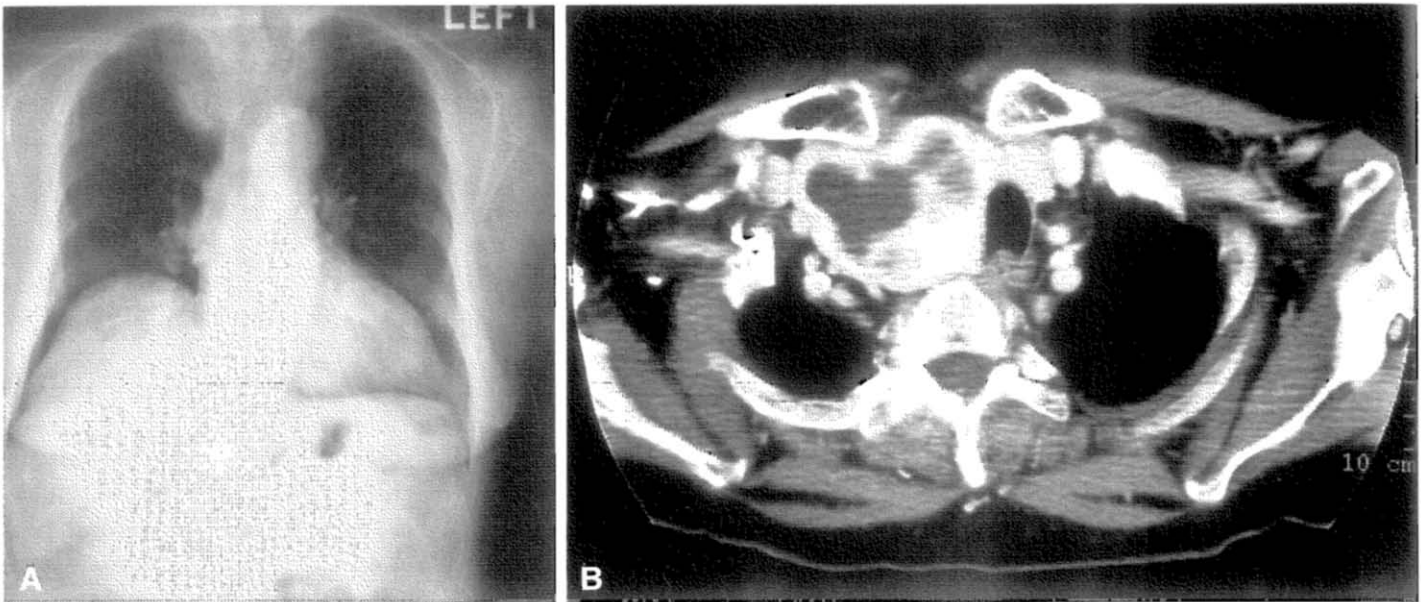

Resection of Substernal Thyroid Gland

R. Sudhir Sundaresan

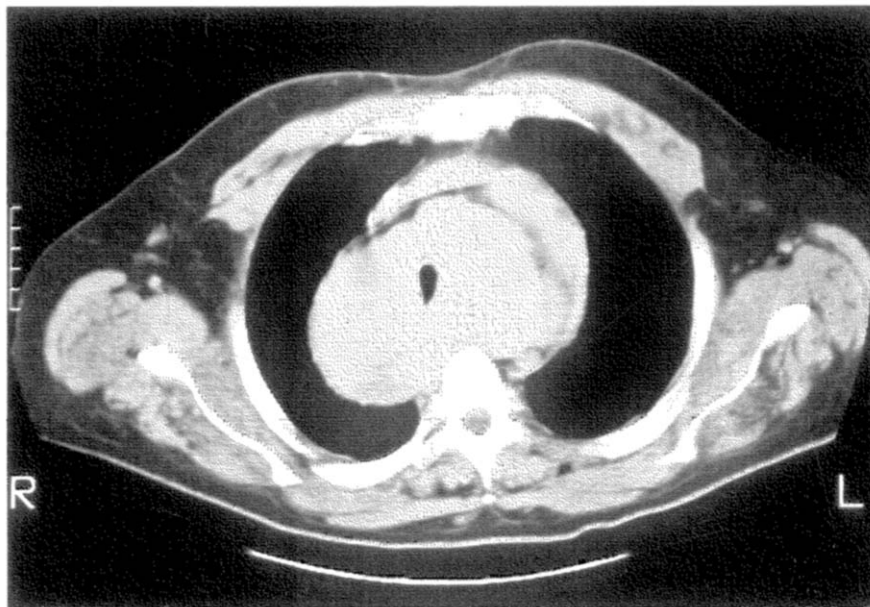
Extension of thyroid goiters or tumors into the chest is uncommon, seen in well under 5% of patients undergoing thyroidectomy. In this situation, the intrathoracic goiter virtually always represents extension of cervical thyroid tissue into the mediastinum, rather than discontinuous aberrant thyroid tissue. Because the thyroid gland derives its blood supply from neck vessels, resection of the substernal thyroid usually can be accomplished using the standard cervical approach. Through a collar incision, the vascular connections of the thyroid gland can be divided while preserving the integrity of the recurrent laryngeal nerves. Then the substernal portion generally can be bluntly mobilized and extracted from the neck. The chest x-ray and

computed tomography (CT) scan of a patient with a substernal thyroid gland amenable to transcervical resection alone are shown in Figure I.

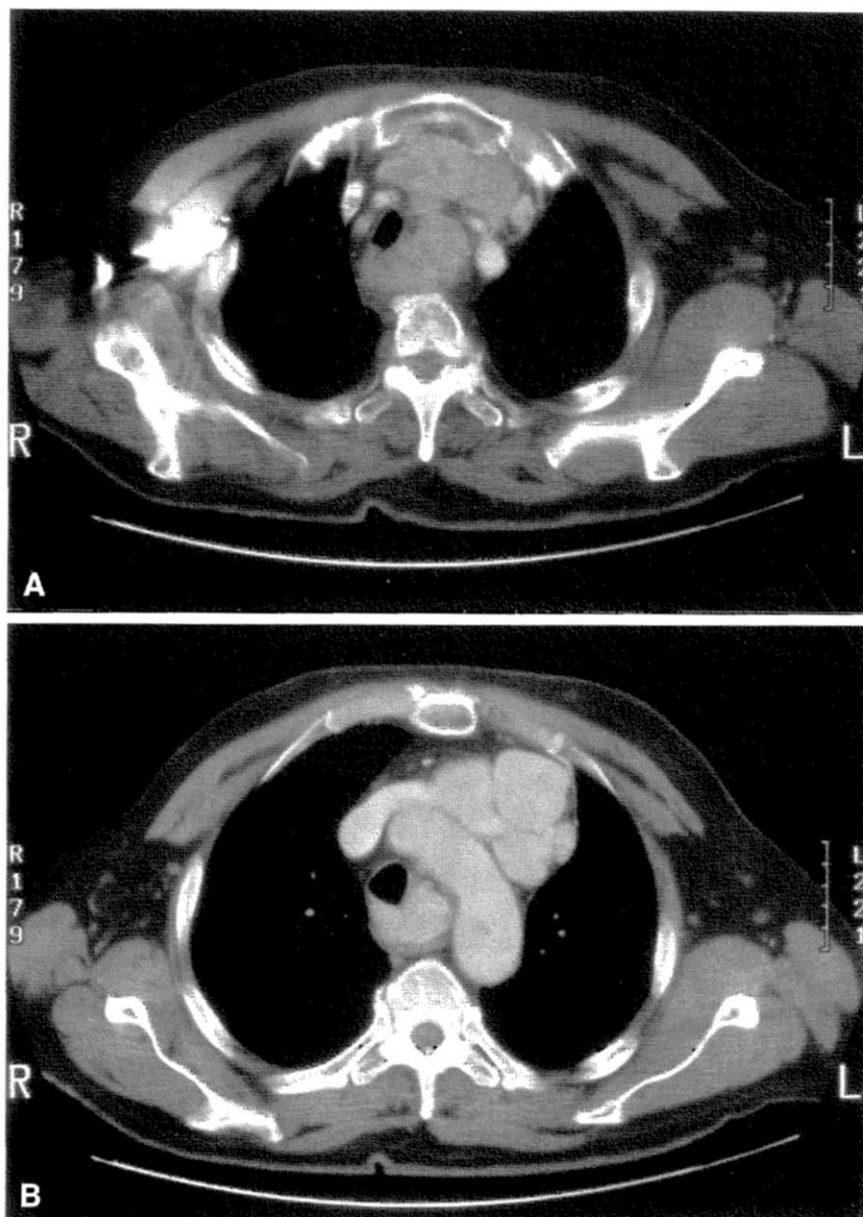
Rarely, substernal extension of a massive thyroid goiter or tumor cannot be safely resected using a neck incision alone. In this situation, a transsternal approach must be used along with a collar incision to safely resect the thyroid gland. This may entail performing either a partial or a complete median sternotomy. Lesions dictating the need for full median sternotomy are shown in Figures II and III. This article depicts and describes the technique of resection of substernal thyroid gland using both the transcervical and the transsternal approaches.



I (A) Posteroanterior chest x-ray of a 70-year-old woman with a large, asymptomatic substernal thyroid. Note the downward extension of the thyroid into the mediastinum, with leftward deviation of the airway. (B) CT scan of the same patient. The bulk of the substernal thyroid extends just caudal to the clavicular heads and lies behind the manubrium. This lesion was easily resected using a standard transcervical approach.

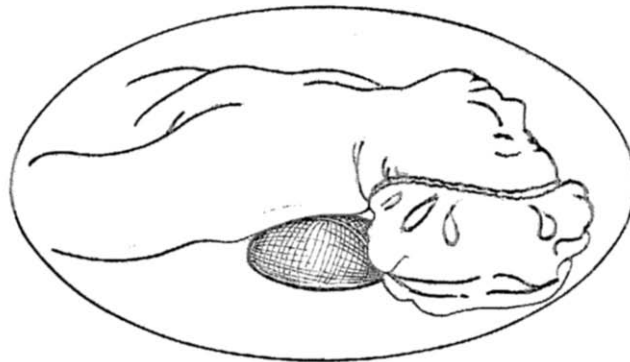
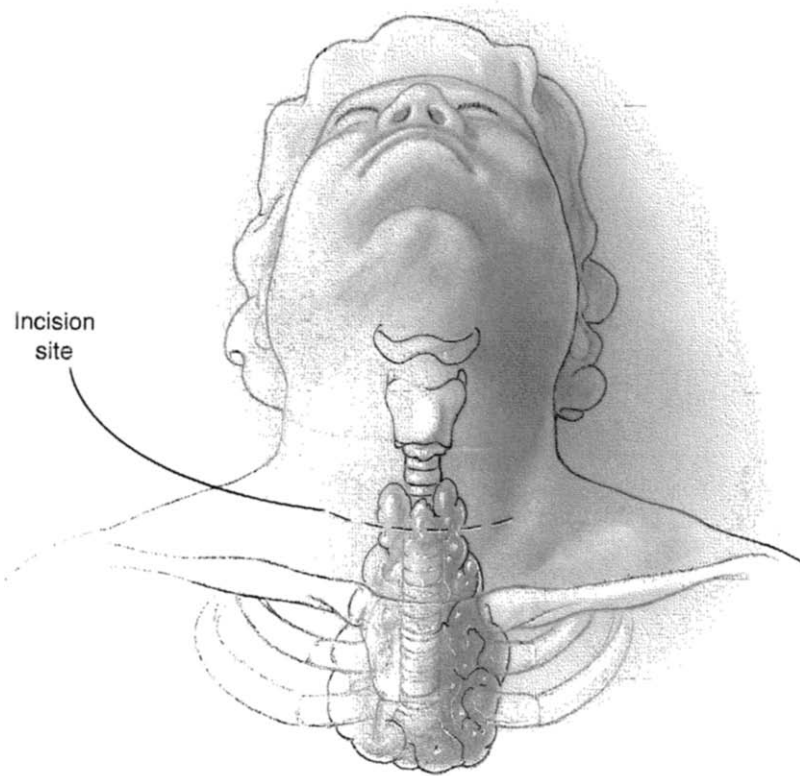


II CT scan of a middle-aged man presenting with a massive chronic thyroid goiter. Symptoms included stridor and facial and upper extremity swelling secondary to chronic superior vena caval obstruction. The lesion clapsed around the airway and esophagus extending posteriorly as far as the spine, and required full median sternotomy for resection.

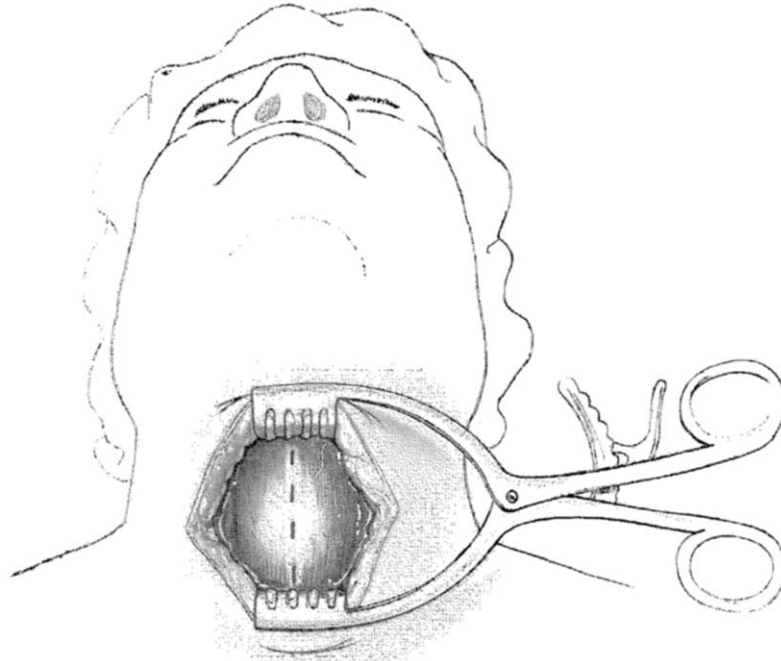


III (A) CT scan of an 80-year-old man with a large medullary thyroid carcinoma extending into the mediastinum. (B) A more caudal image from the CT scan of the same patient. Note the “horseshoe-like” extension of the lower pole of the tumor, with an anterior (prevascular) component as well as a component lying lateral and posterior to the airway. The lesion required full median sternotomy for resection, incorporating transpericardial exposure of the distal airway to facilitate resection of the deep portion of the tumor.

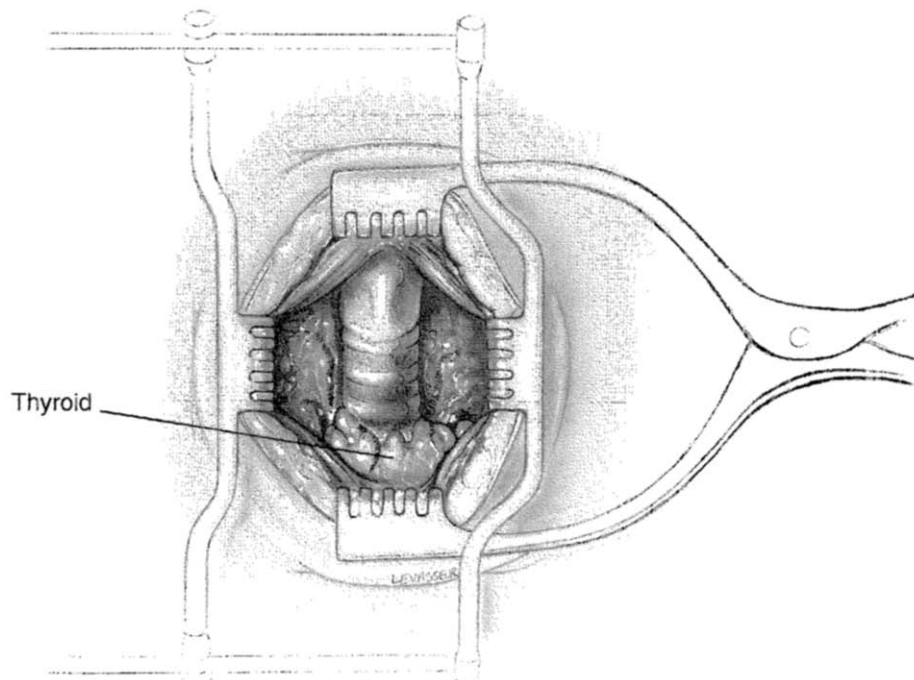
SURGICAL TECHNIQUE



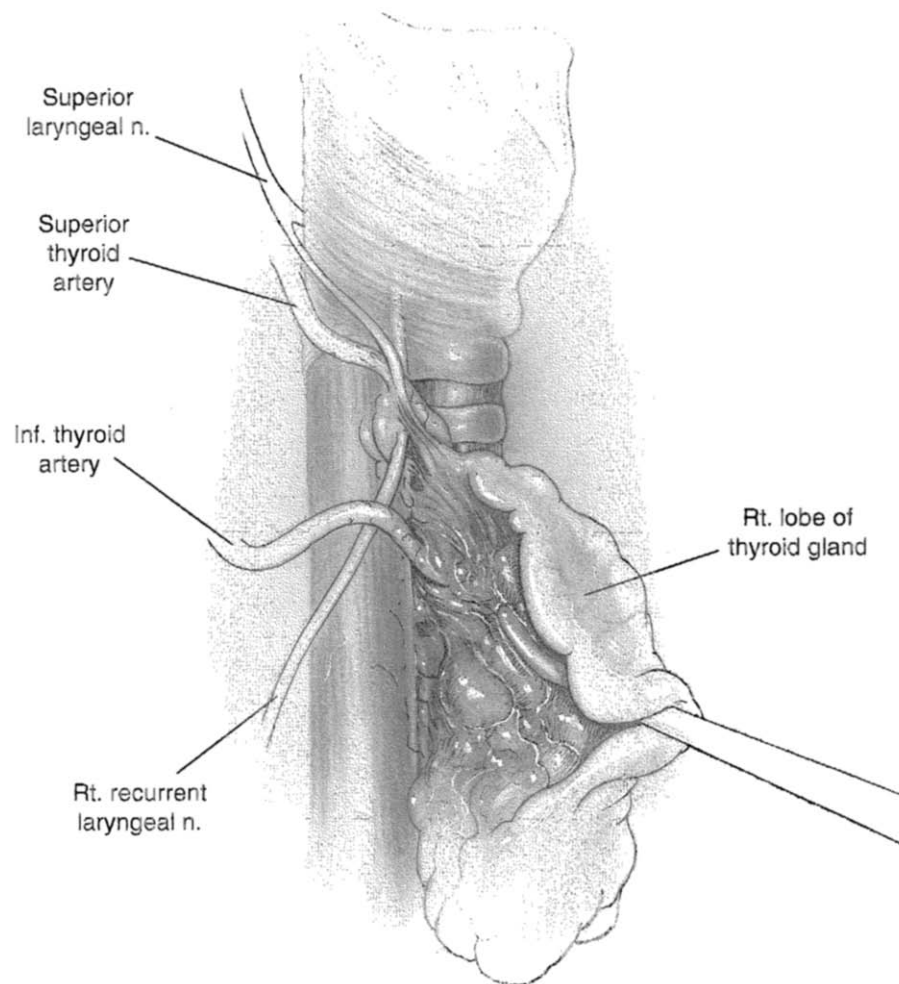
I The patient is positioned supine with the arms tucked at the sides. A mattress is inflated beneath the shoulders (see insert) to extend the neck maximally. The anterior neck and entire chest are prepared and draped as a sterile field, in the event that a full median sternotomy is required.



2 A standard transverse cervical incision (collar incision) is made, following a natural skin crease about 1–2 cm above the clavicle. This is deepened through the subcutaneous tissue and platysmal layers down to the cervical fascia overlying the strap muscles and anterior jugular veins. Subplatysmal flaps are then raised superiorly to the brow of the thyroid cartilage and inferiorly down to the suprasternal notch. The midline fascia is then vertically incised, allowing the strap muscles to be mobilized and retracted to either side.

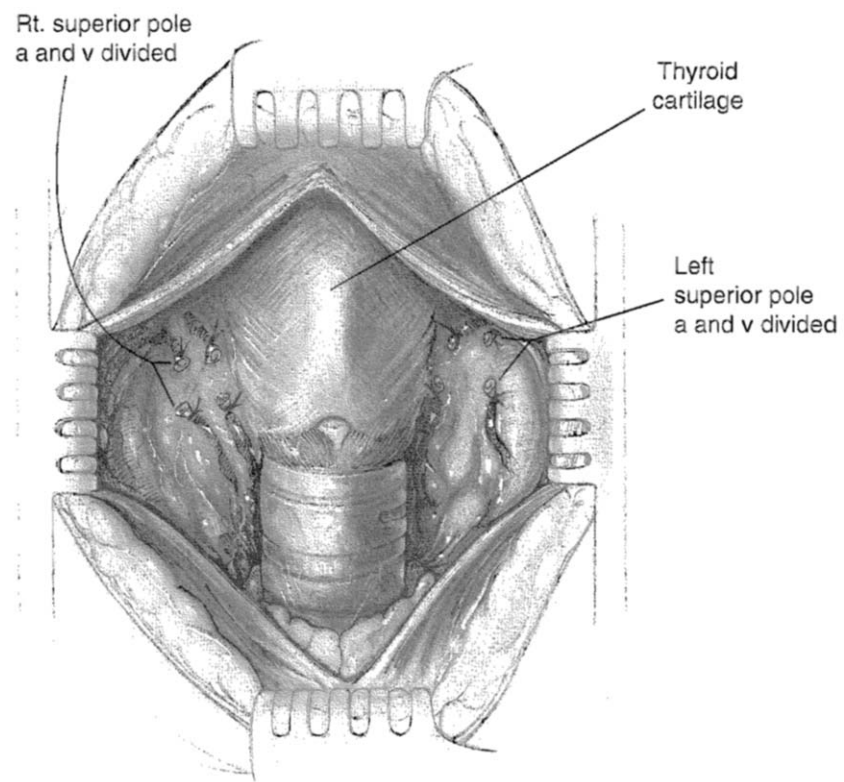


3 Self-retaining retractors are inserted at right angles to maintain the exposure. The thyroid gland is then visualized.

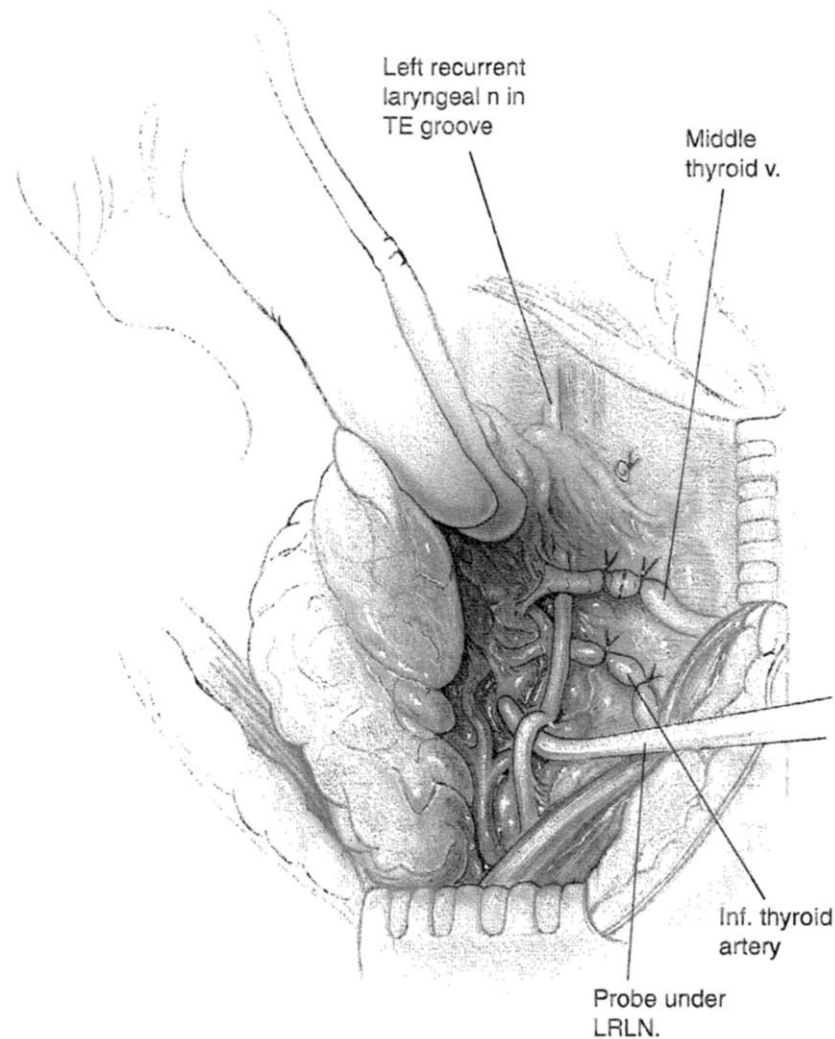


4 The vascular attachments to the thyroid must be safely dealt with in the neck before the substernal portion of the gland can be mobilized and delivered. Here the right lobe of the thyroid gland is shown retracted medially. This facilitates identification as well as ligation and division of the middle thyroid vein. The loose connective tissue superior to the thyroid isthmus and around the upper pole of the gland is dissected to safely identify the upper pole. Care must be taken during dissection of the upper pole to avoid injury to the superior laryngeal nerve. This illustration shows the division of the superior laryngeal nerve into its internal branch (providing sensory fibers to the larynx) and its external branch (a motor nerve innervating the inferior pharyngeal constrictor and cricothyroid muscles). The nerve is carefully dissected away from the upper pole vessels, which are then divided between ligatures.

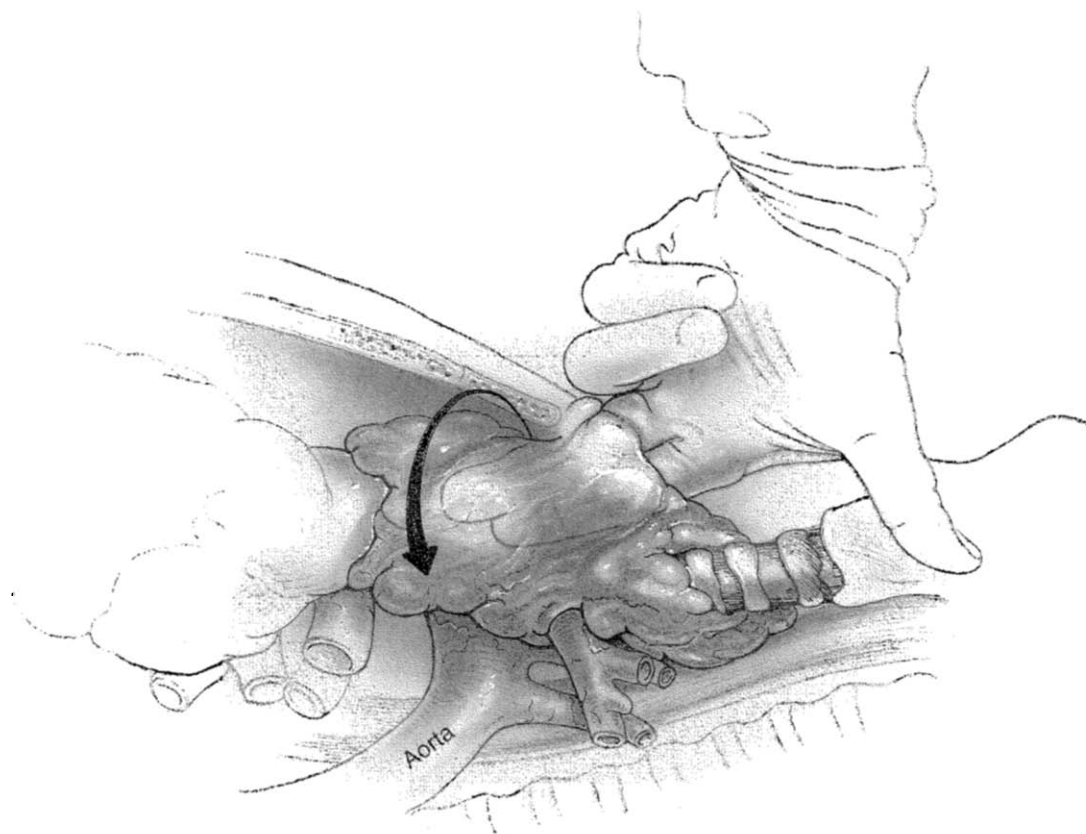
Medial retraction of the thyroid gland also facilitates exposure of the inferior thyroid artery. Its intimate relationship with the recurrent laryngeal nerve is demonstrated. For that reason, the inferior thyroid artery must be carefully dissected free of the recurrent laryngeal nerve, and then divided between ligatures. This illustration depicts the oblique course taken by the right recurrent laryngeal nerve on its path toward the junction of the trachea and larynx.



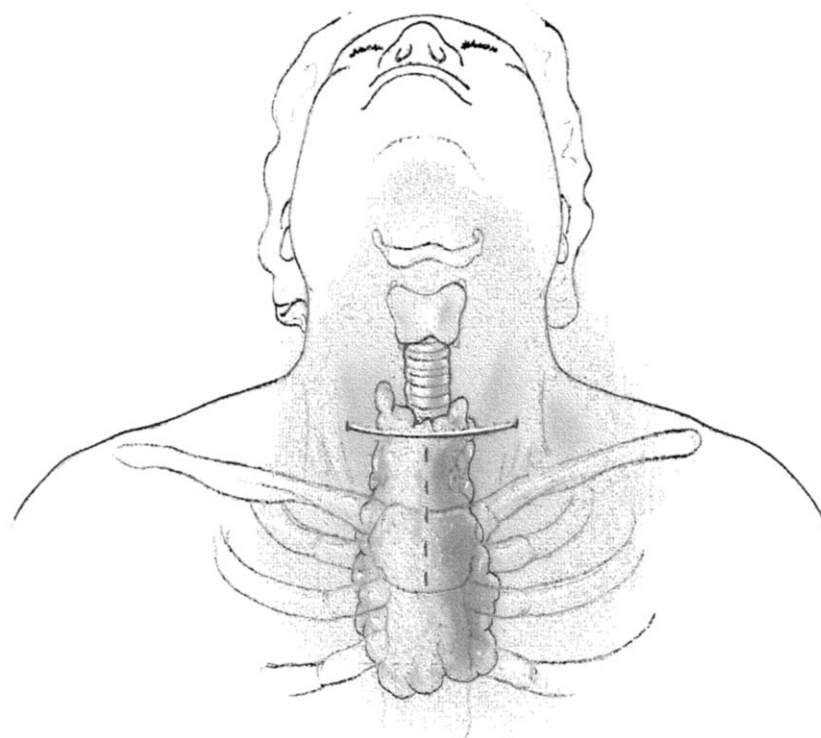
5 Here, the right-sided vascular connections of the thyroid have been completely divided. The left superior pole vessels have also been divided.



6 On the left side, the left recurrent laryngeal nerve assumes a straight course confined to the tracheoesophageal groove. The inferior thyroid artery must be isolated and divided, with careful attention given to the nerve. On both the right and left sides, the preferred technique is to ligate and divide the terminal branches of the inferior thyroid artery nearly flush with the thyroid gland, thereby staying medial to the recurrent laryngeal nerve. Once all of the vascular connections have been securely ligated and divided, the thyroid gland can be mobilized from the airway. The area of greatest concern is at the upper aspect of the recurrent laryngeal nerves where they connect with the junction of the trachea and larynx. Once the fixation of the upper and lateral aspects of the thyroid is completed, attention is then focused on the substernal component.

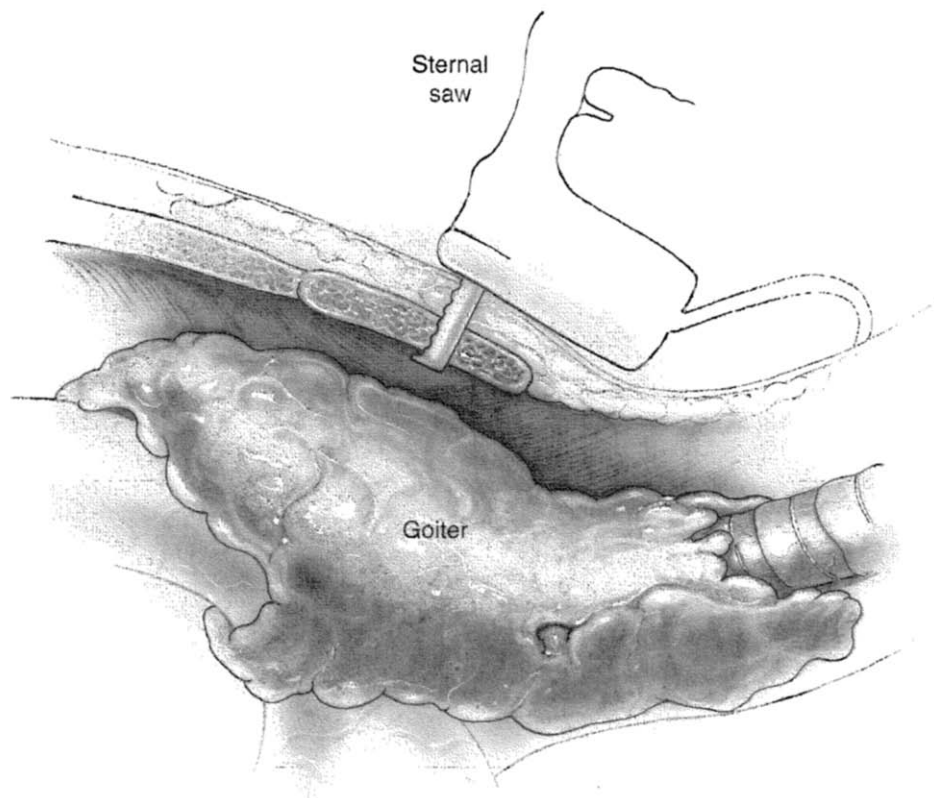


7 In most substernal goiter resections, blunt digital dissection is used within the pseudocapsule around the thyroid gland. This is done circumferentially to mobilize the substernal gland. The surgeon must be able to get the tip of the finger just beyond the most dependent portion of the gland, so the gland can be gently scooped upward and out of the mediastinum. Once this maneuver is completed, a few residual fibrofatty connections may remain; these can be divided sharply or with cautery. The specimen has then been fully extracted.

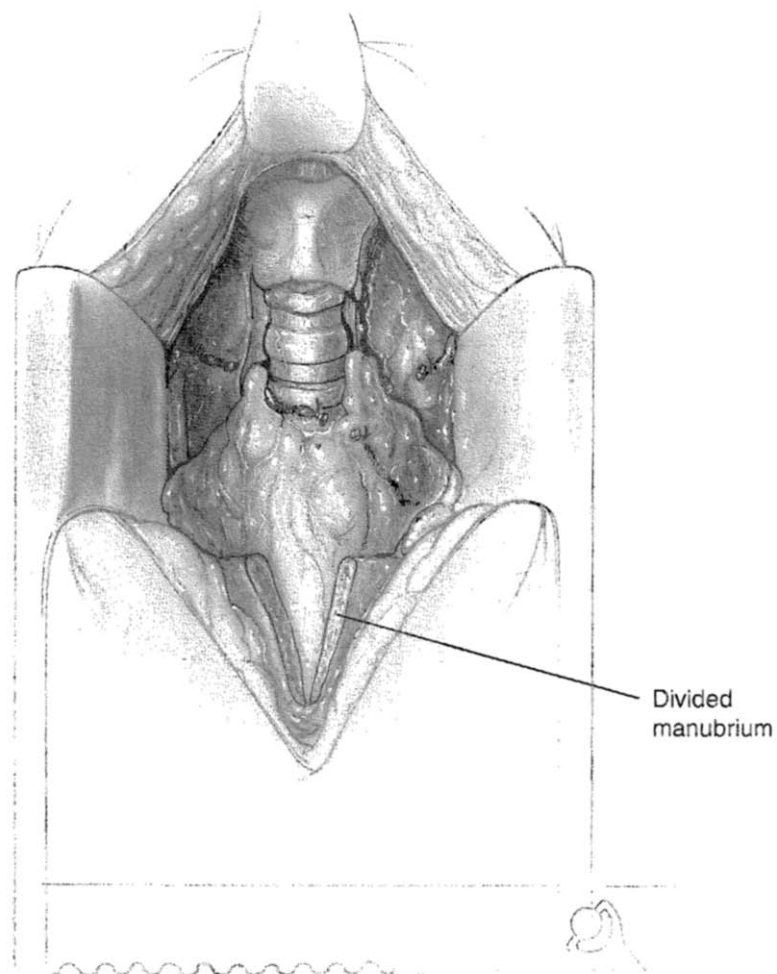


Partial sternotomy

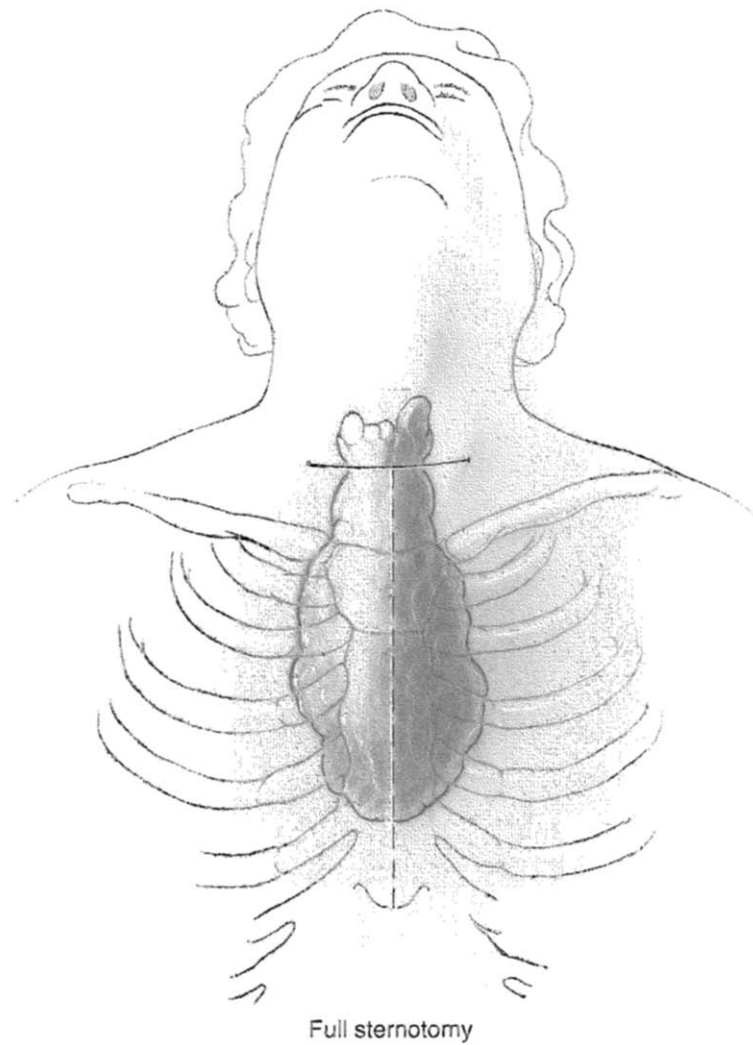
8 Occasionally, the bulk of the substernal extension cannot be safely mobilized from the neck alone, as described earlier (7). The exposure can be improved with a partial upper sternotomy. A vertical skin incision is made in the midline from the midportion of the collar incision to the manubriosternal junction. This is deepened in the midline down to the sternum.



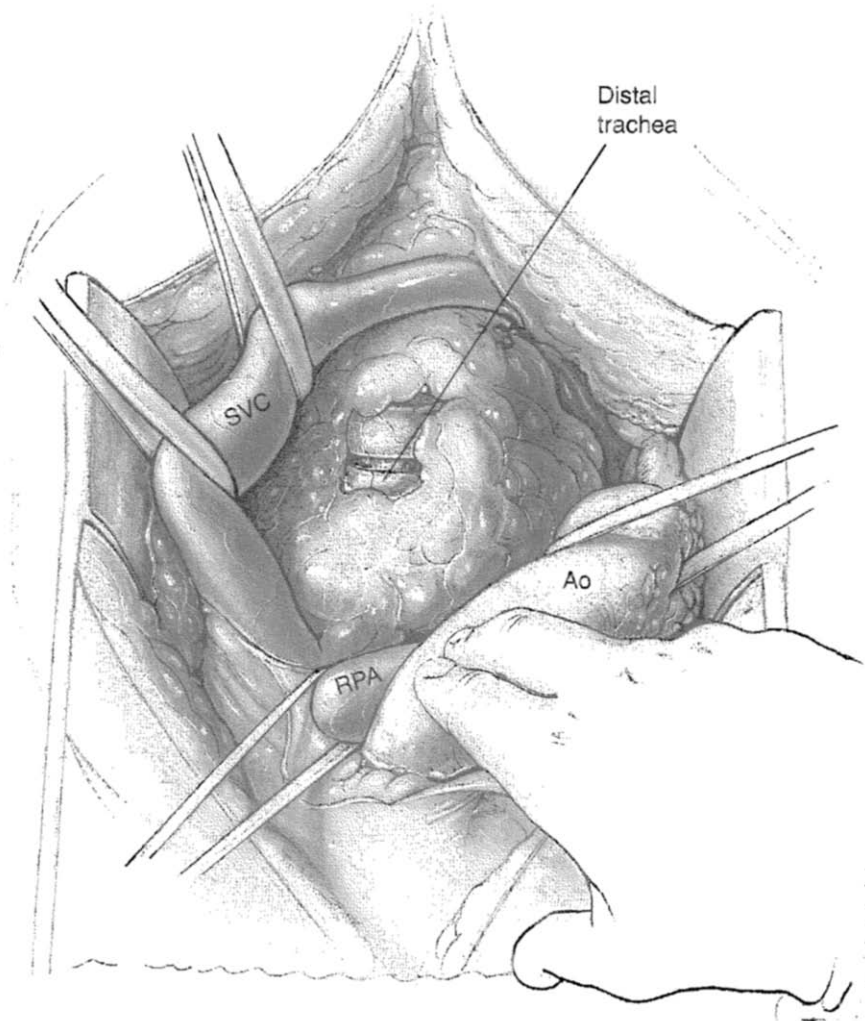
9 Here, a sternal saw has been used to divide the manubrium just distal to the manubriosternal junction.



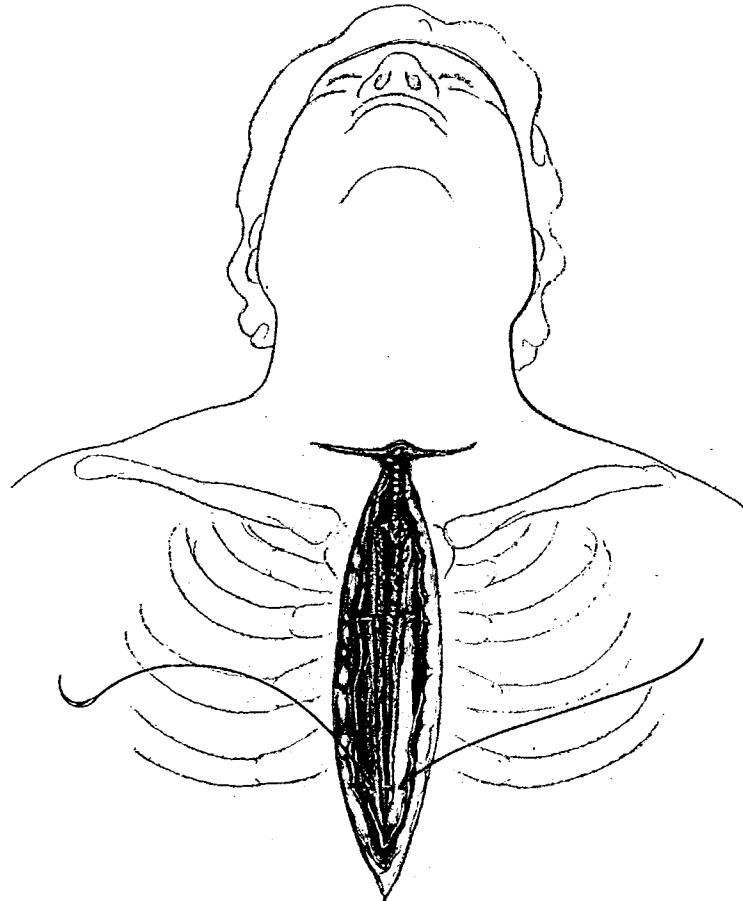
10 A small retractor, such as a Tuffier retractor, is inserted. Opening the retractor between the margins of the divided manubrium will generally transect a portion of the sternum into the second intercostal space. This provides excellent exposure of the upper mediastinum to facilitate safe mobilization and extraction of the entire thyroid gland.



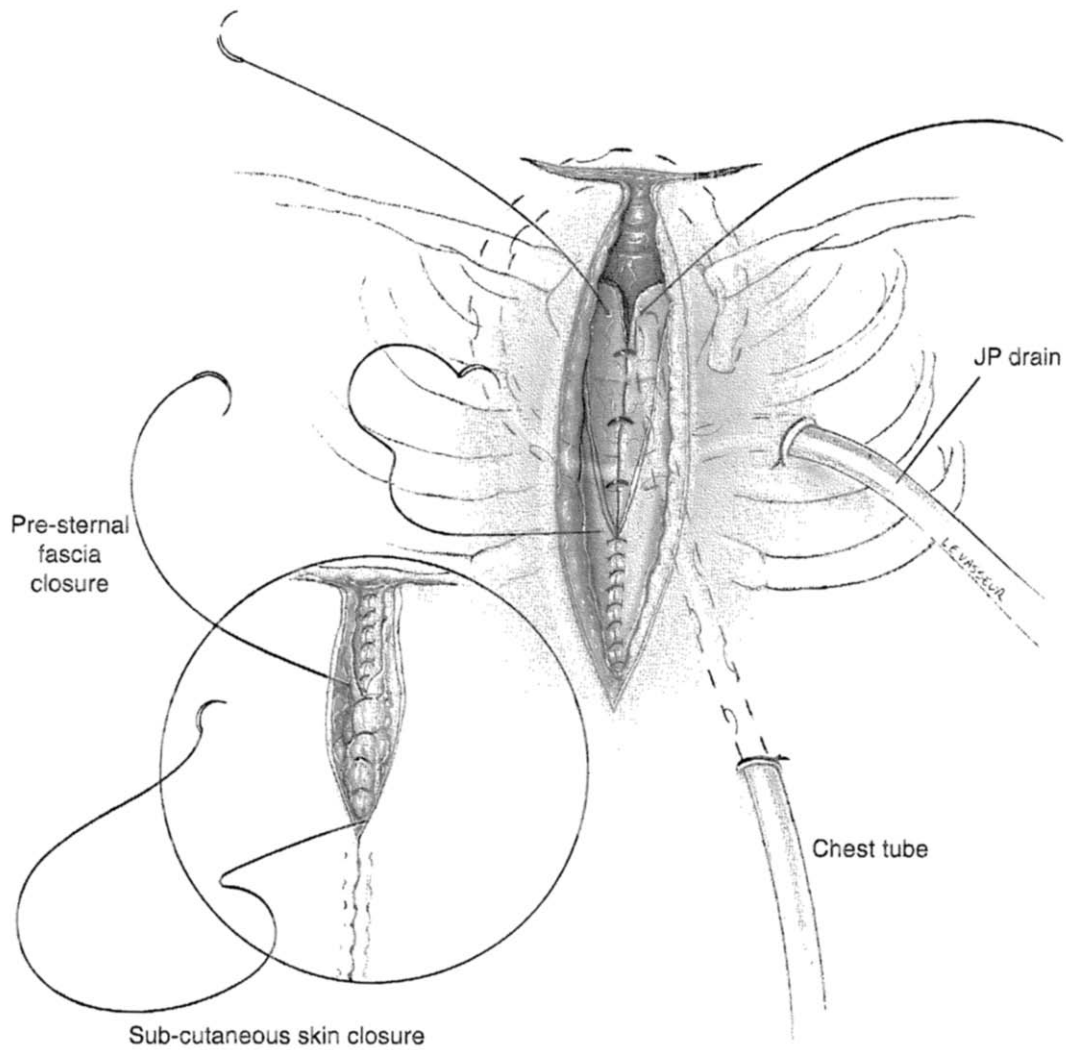
I I In cases of massive extension of the goiter into the mediastinum, particularly with neoplasms that may invade the great vessels or distal airway, a full median sternotomy exposure is preferred. The skin incision is taken down as far as the xiphi sternum. A full sternotomy is performed, and a standard sternotomy retractor is placed.



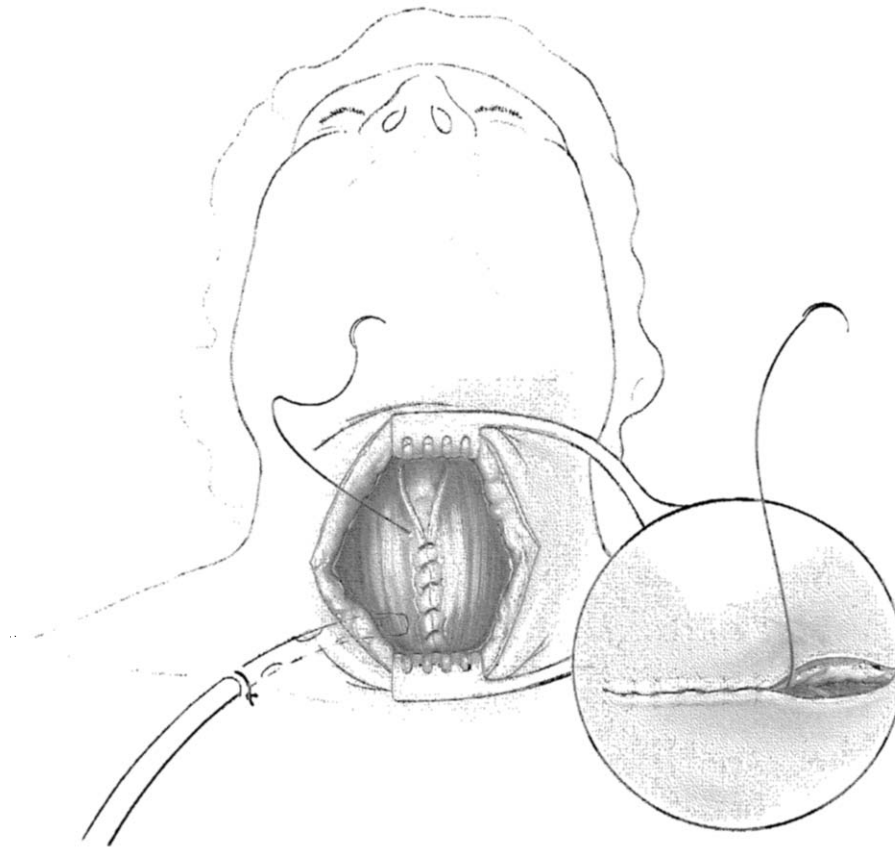
12 Bulky mediastinal extension of benign goiters or malignant tumors (as shown in Figs II and III) often extend along the airway toward the carina, passing behind the great vessels. Thus it is often necessary to use the transpericardial approach to the distal airway. The superior vena cava is mobilized and retracted laterally using umbilical tapes or Penrose drains. Similarly, the ascending aorta is mobilized and retracted toward the left side. This is best done by the assistant applying gentle digital retraction. Finally, the right pulmonary artery is mobilized between the aorta and vena cava and retracted caudally to complete the distal airway exposure to the level of the carina. These maneuvers facilitate complete dissection of the deep component of the mediastinal extension of the thyroid gland. This transsternal, transpericardial exposure (similar to that used for carinal resections) is often essential to safe resection of bulky mediastinal goiters and mobilization and resection of thyroid malignancies.



13 The partial or full median sternotomy is closed with heavy-gauge stainless steel wires in the sternum.



14 Closure is completed with 0 Vicryl in the presternal fascia, 2-0 Vicryl suture in the subcutaneous layer, and a subcuticular skin closure. A Jackson-Pratt drain is left in the cervical bed of the thyroid gland and brought out through a separate stab wound lateral to the main incision. A single midline mediastinal chest tube is positioned with its tip deep to the manubrium of the sternum. This is also brought out through a small stab wound inferior to the main incision and connected to a suction apparatus.



15 Even if partial or full median sternotomy has not been used, leaving closed suction drain in the wound is still desirable. Finally, the strap muscles are approximated with a continuous Vicryl suture in the midline, and the platysmal layer and skin are approximated using a subcuticular skin closure.

Postoperative Care

Extubating the patient at the conclusion of the operative procedure is done if possible. Occasionally, after resection of a large substernal thyroid, secondary tracheomalacia can occur, which can lead to respiratory distress postoperatively. In such situations, it is prudent to extubate the patient over a bronchoscope, to assess airway integrity. Similar care is advisable in a patient presenting with features of chronic obstruction of the superior vena cava before resection. Otherwise, the vast majority of patients should tolerate immediate extubation.

If significant airway manipulation has been required to mobilize and resect the substernal thyroid, the resultant edema may lead to more subtle symptoms of airway compromise that can progress after extubation.

These usually can be easily managed by upright positioning, early diuresis, and racemic epinephrine. Steroid (dexamethasone) therapy generally is not necessary in this circumstance.

The closed-suction drains and mediastinal drains usually can be removed within 48 hours of surgery. Early resumption of a general diet and ambulation are encouraged.

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