

Thyroidectomy for Multinodular Goiter

Kristin L. Long

Introduction:

Thyroidectomy can be performed for numerous reasons, including hyper- or hypo functioning glands, concern for malignancy, or compressive symptoms from a multinodular goiter. Thyroid goiters can present in many ways, and along a wide spectrum of enlargement. This can include unilateral nodular enlargement, which can be treated with a thyroid lobectomy and often preserves thyroid function, or may include severe diffuse enlargement requiring subtotal or total thyroidectomy.

Growth of the gland, particularly in iodine-deficient regions, can extend anteriorly and is quite easily appreciated. Importantly, however, the gland can also grow into the retropharyngeal space or substernally, requiring additional evaluation prior to surgical intervention to thoroughly assess the extent of enlargement.

Ultrasound remains the mainstay of thyroid imaging assessment, and can provide optimal evaluation of thyroid nodules and parenchyma, as well as central and lateral neck lymphadenopathy. However, if the full extent of the gland cannot be clearly seen with ultrasound or confidently palpated on physical examination, cross sectional imaging should be performed to demonstrate possible substernal extension that would require sternotomy for safe excision.

Patients with large goiters must be counseled about potential for postoperative bleeding, injury to recurrent laryngeal nerves, and hypoparathyroidism, all of which are legitimate surgical risks in massively enlarged thyroid glands. Potential lifelong need for thyroid hormone should also be reviewed, and preoperative assessment of thyroid function is critical for safe anesthesia and surgery.

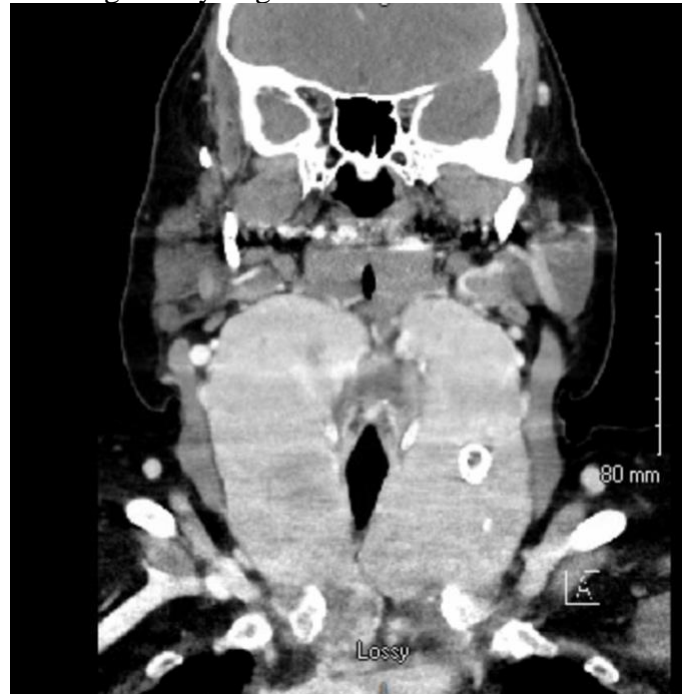
The general steps to perform a thyroidectomy for a multinodular goiter include:

- Creating a transverse cervical incision at the level of the thyroid isthmus
- Developing subplatysmal flaps and separation of strap muscles to create a working space
- Isolation and division of the superior pole vessels of the larger side of the thyroid gland
- Medial rotation of the thyroid and ligation of the middle thyroid vein

- Clear identification of the recurrent laryngeal nerve
- Dissection of the gland away from the nerve, including ligation of inferior pole vessels preserving inferior parathyroid glands
- Division of the ligament of Berry and removal of the lobe from the tracheal attachments.
- Repeat the procedure for the contralateral lobe, only after ensuring recurrent laryngeal nerve is intact and functional.

Steps:

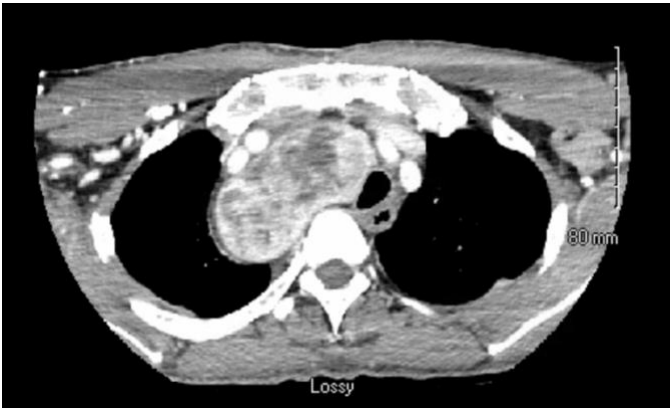
1. Preoperative evaluation of a thyroid goiter must include thyroid function tests and ultrasound to begin assessment of the degree of enlargement. Thyroid enlargement can extend in numerous directions, each of which create unique surgical challenges. The thyroid gland can extend superiorly, vascular collaterals that can be dangerously large and difficult to visualize.



This CT scan (coronal view) shows a very large goiter with massive superior extension, making superior pole vessel isolation technically challenging.

Thyroidectomy for Multinodular Goiter

Kristin L. Long



This CT scan (axial view) demonstrates the severe extent of substernal extension that can occur in large thyroid goiters. As the gland extends well below the clavicles and widens in size once in the thoracic cavity, cervical excision was felt to be unsafe and this patient required a sternotomy.

2. Unilateral goiter enlargement rarely creates significant airway compromise, however bilateral enlargement can severely narrow the trachea, complicating endotracheal intubation. Ultrasound can be used to assess the trachea for compression in asymptomatic patients, however many patients with massive goiters present with respiratory compromise.



This CT scan (axial view) demonstrates severe narrowing of the tracheal lumen from a large goiter, causing notable shortness of breath for the patient. Intensive preoperative preparation from an anesthetic standpoint is required, including likely awake fiberoptic intubation as was necessary in this case.



Airway compromise can be unexpected, as well, noted in this ultrasound image taken in a low resource setting, showing another example of extreme tracheal narrowing requiring higher levels of anesthesia care.

3. Once general endotracheal anesthesia is obtained, the patient is positioned in a supine position, with a shoulder roll to extend the neck. The head should be supported and arms tucked at the patient's side. Adequate IV access is critical given potential for blood loss. If the goiter is extremely large and surgery is anticipated to take more than 2 hours, a foley catheter and orogastric tube should be considered.



Thyroidectomy for Multinodular Goiter

Kristin L. Long

Patient in Semi-Fowler, also called “Beach Chair” position. Raising the head and torso like this decreases venous distention and bleeding. The surgeon must be cautious to avoid venous air embolism: in case of any injury to large veins, air can be drawn into the venous system when the patient is in this position.

4. Once sterile prep is complete, a large transverse cervical incision should be made over the thyroid isthmus. This is carried down to the platysma, and subplatysmal flaps are created. Large goiters may cause attenuation of the strap muscles, which may be separated or divided if necessary. Likewise, large anterior jugular veins and collaterals should be identified and tied off if necessary.

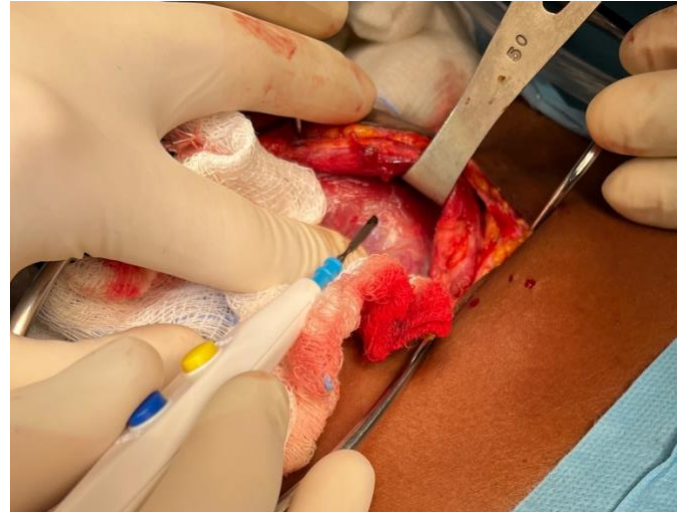


A transverse incision through the skin (shown) and platysma is made at least two fingerbreadths above the sternal notch.



Sub-platysmal flaps are raised superiorly to the level of the cricoid cartilage and inferiorly to the level of the suprasternal

notch (shown.) The sternothyroid and sternohyoid (“strap”) muscles, seen in the center of the incision, are often very thin due to the enlarged thyroid underneath.



This photo, with the patient’s head to the upper left, shows anterior retraction of the sternothyroid and sternohyoid (“strap”) muscles and capsular dissection of the thyroid gland. It is important to enter into this plane immediately upon separating the strap muscles, and to remain in this plane, separating muscle tissue from the capsule as you proceed laterally.

5. Once the gland is exposed and strap muscles retracted away, the superior pole vessels should be isolated and tied securely. There are often several large posterior vessels in very large thyroid lobes, which can be difficult to identify. Gentle downward retraction of the superior pole of the thyroid and meticulous dissection will allow this to be done safely, and these large vessels often require several ties or clips.



OPEN MANUAL OF SURGERY IN RESOURCE-LIMITED SETTINGS

www.vumc.org/global-surgical-atlas

This work is licensed under a [Creative Commons Attribution-ShareAlike 3.0 Unported License](https://creativecommons.org/licenses/by-sa/3.0/)

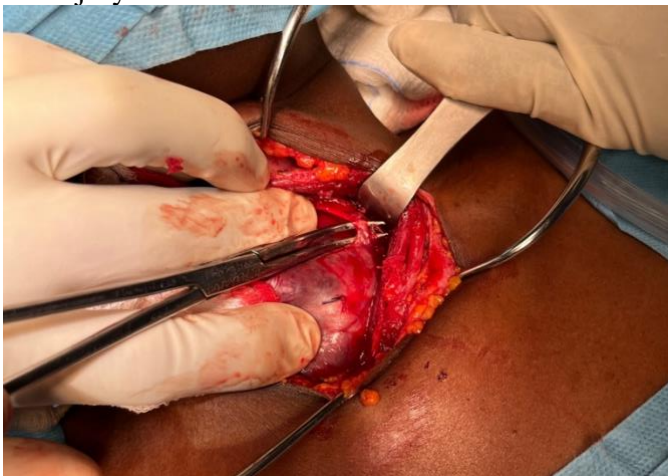


Thyroidectomy for Multinodular Goiter

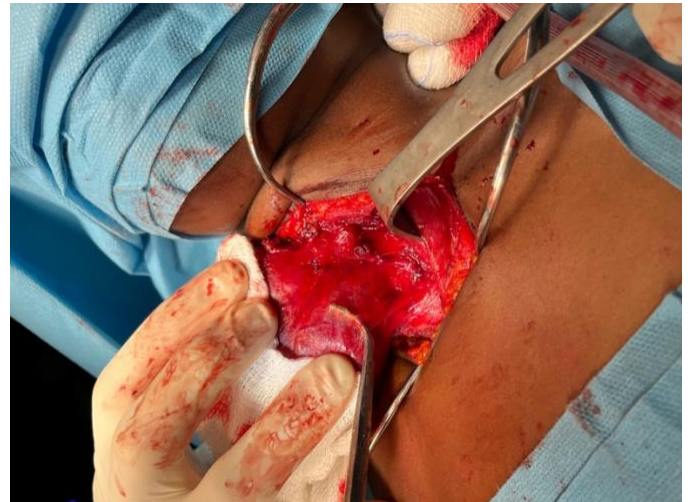
Kristin L. Long

In this photo, the upper pole vessels of the left thyroid lobe are individually ligated adjacent to the parenchyma of the gland.

6. After securely dividing superior pole vessels, the thyroid lobe should be medially rotated, middle thyroid vein divided, and the recurrent laryngeal nerve clearly identified and protected. On the left side, the nerve is usually encountered in the tracheoesophageal groove, running nearly straight up and down after recurring around the aortic arch. On the right side, the nerve path can be more variable, as the recurrence is around the subclavian artery, resulting in a more lateral to medial path to the trachea. Nerves may also have more than one branch, and identifying the nerve low in the neck and tracing it in its entirety towards the point of insertion helps to minimize injury to smaller branches.



As you dissect within the capsular plane of the thyroid, one large vein will pass through the capsule as you rotate the gland medially: this is the middle thyroid vein. This structure may be encountered either before or after ligation of the upper pole vessels, depending on how laterally it is positioned.



As you continue to dissect laterally, rotate the gland towards the midline. You will find the capsular plane is now pulled upwards with the gland. Stay in this plane by gently inserting a right angle clamp next to the parenchyma of the gland. This maneuver causes the tissue around the capsule to fall away, including the recurrent laryngeal nerve and the parathyroid glands.

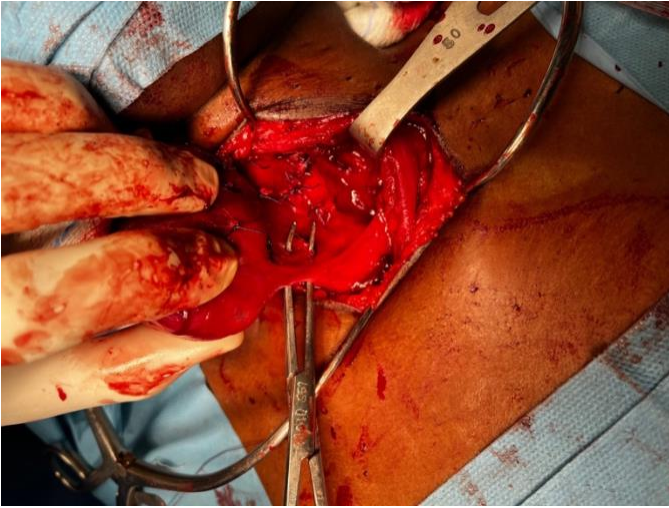


A large left thyroid goiter retracted medially, with the recurrent laryngeal nerve (Black arrow) clearly visible during its dissection away from the gland.

7. Dissection should proceed to isolate and divide the inferior pole vessels, with great care to stay directly on the thyroid capsule and protect the inferior parathyroid glands.

Thyroidectomy for Multinodular Goiter

Kristin L. Long



Division of the inferior thyroid vessels usually occurs in the later stages of the operation, after mobilization of the gland and visualization of the recurrent laryngeal nerve and parathyroid glands.

8. Once the gland has been completely dissected away from the recurrent laryngeal nerve and medialized, the ligament of Berry should be divided carefully. The lobe should then be removed from the tracheal attachments. In many cases, the isthmus can be divided and each lobe sent as a separate specimen to optimize working space.
9. After the first lobe is removed, the recurrent laryngeal nerve should be confirmed intact, and then dissection can proceed to the contralateral side, mirroring the dissection performed on the first side.
10. After the gland has been removed in its entirety, meticulous attention to hemostasis should occur, including anesthesia-performed Valsalva maneuvers to increase venous pressure and test integrity of vessel ligatures. Particular attention should be paid to the superior pole vessels, pyramidal lobe region, and inferior pole/thyroid ima vessels.
11. Parathyroid glands should be assessed if visualized, and if bruised or devascularized, they should be minced into a slurry and reimplanted in a well-vascularized muscle pocket (usually sternocleidomastoid muscle) as an autotransplant.

12. The thyroid specimen should be placed in saline to soak, and then visually assessed for any possible retained parathyroid glands along the capsule so that these could be reimplanted if identified.



A large left thyroid lobe after excision.

- Once meticulous hemostasis is obtained, a drain is often placed for very large goiters, particularly in lower resource settings. Bulb suction overnight can help to minimize seroma formation and identify hematoma/chyle leak should it occur in the immediate perioperative period. A drain should be secured with a nylon suture at the skin.
13. To close the thyroidectomy incision, the strap muscles are re-approximated with absorbable braided suture, as are the platysmal flaps. The skin edges can be closed in several different ways, however absorbable monofilament suture is often preferred.

Pitfalls

- Failure to obtain imaging and definitively assess the extent of thyroid enlargement can lead to significant intraoperative challenges, particularly if the patient requires thoracic exposure with substernal extension. Extent of thyroid enlargement may or may not be visible externally.

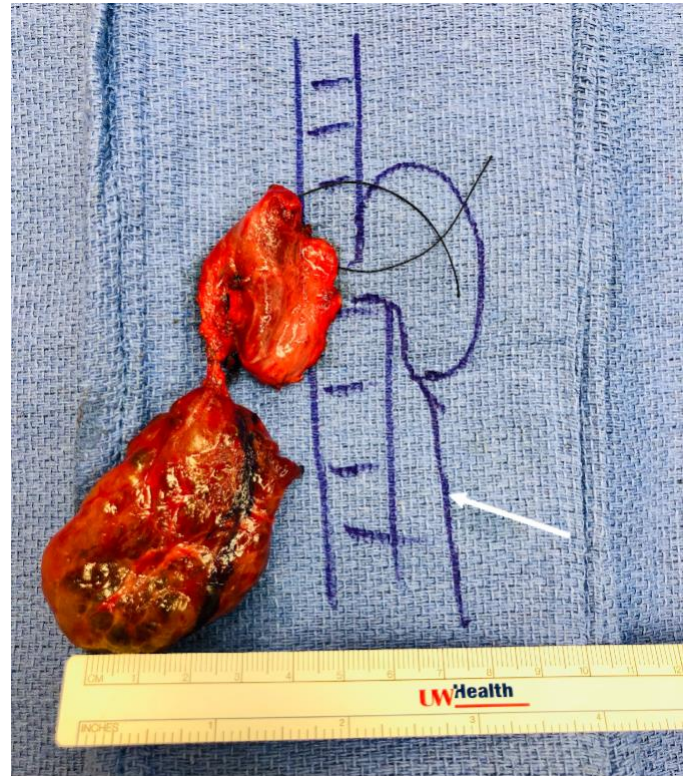
Thyroidectomy for Multinodular Goiter

Kristin L. Long



The first figure shows the patient's external appearance, with no visible goiter. The second photo shows the CT scan (axial view), with extensive substernal extension requiring sternotomy to resect.

- Failure to identify and clearly protect the recurrent laryngeal nerve, which can often be in unusual locations with thyroid extension, including stretched over thyroid parenchyma, as seen in the figure below.



Here, in this right thyroid lobectomy specimen, the dark blue line drawn on the thyroid specimen and shown by the white arrow represents the path of the right recurrent laryngeal nerve, which was draped over the large posterior nodule.

- Lack of hemostasis can lead to a life-threatening, airway-compromising hematoma. In particularly large multinodular goiters, there are often multiple, aberrant collateral vessels and several maneuvers to assess hemostasis must be performed at case completion.
- If available, neuromonitoring of the recurrent laryngeal nerve should be performed to eliminate the dreaded complication of a bilateral injury, which could cause respiratory compromise.

Kristin L. Long, MD MPH
University of Wisconsin School of Medicine and Public Health
USA

September 2023