

Neck Exploration and Subtotal Parathyroidectomy

Naira Baregamian

Introduction:

This chapter focuses on subtotal parathyroidectomy for hyperparathyroidism. Nearly 15-20% of patients with primary hyperparathyroidism will present with 4-gland hyperplasia and require subtotal parathyroidectomy if indications for surgery have been met. Most patients with primary hyperparathyroidism are asymptomatic or with minimal symptoms. These patients present with hypercalcemia detected on routine blood work and inappropriately elevated parathyroid hormone level during further work up. Secondary causes of hypercalcemia must be excluded. The parathyroid diseases are described further in [Approach to Parathyroid Disease](#).

Neck exploration and subtotal parathyroidectomy are performed in the following steps:

- Skin, platysma, and strap muscle incision
- Medial rotation of the thyroid glands
- Exploration and location of the recurrent laryngeal nerve and the parathyroid glands
- Removal of the appropriate amount of parathyroid tissue
- Hemostasis and closure

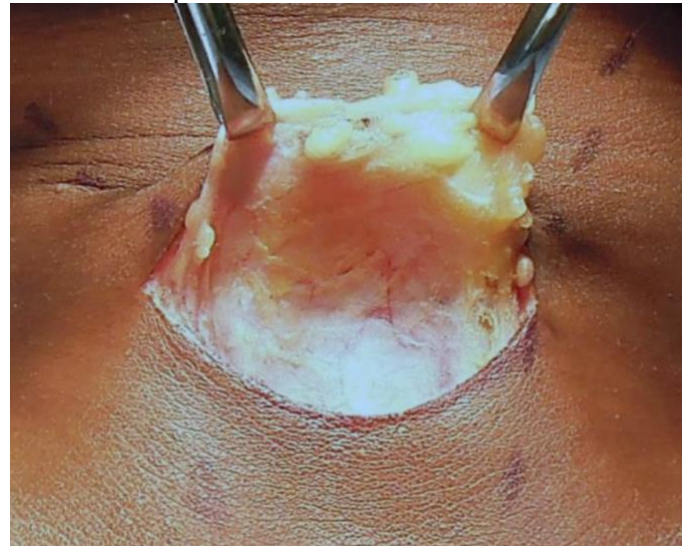
Steps:

1. In planning a bilateral neck exploration and subtotal parathyroidectomy, a slightly longer transverse incision (about 4cm) may be planned to optimize exposure. A longer incision is especially helpful in the re-operative setting, difficult anatomy, presence of a large multinodular goiter, or deep short neck.



Neck incision, as seen on postoperative day 4.

2. Generous superior and inferior subplatysmal flaps are developed to aid in adequate exposure. The strap muscles are separated at their midline and the plane between them and the thyroid gland is developed.



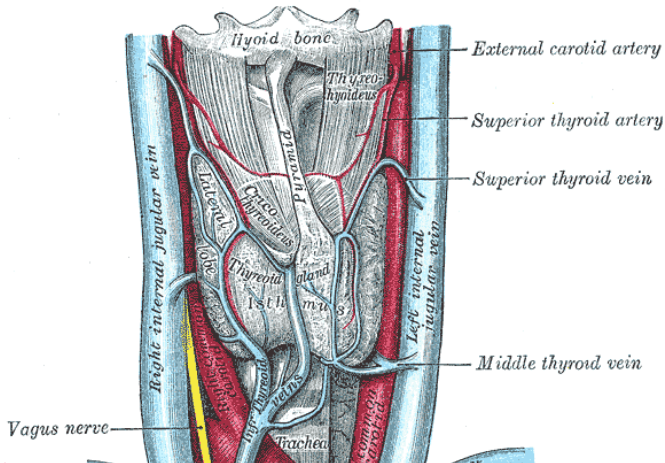
The plane deep to the superficial layer of the deep cervical fascia is dissected caudally and cranially (shown) to the level of the suprasternal notch and the cricoid cartilage. Extend the dissection for several cm laterally in both directions as well. Source: Eugenio Panieri and Johan Fagen-
<https://vula.uct.ac.za/access/content/group/ba5fb1bd-be95-48e5-81be-586fbaeba29d/Thyroidectomy.pdf>

3. When mobilizing thyroid lobes medially to visualize underlying parathyroid glands, dividing the middle thyroid vein will significantly improve both the easier visualization and exploration of the neck for the eutopic and

Neck Exploration and Subtotal Parathyroidectomy

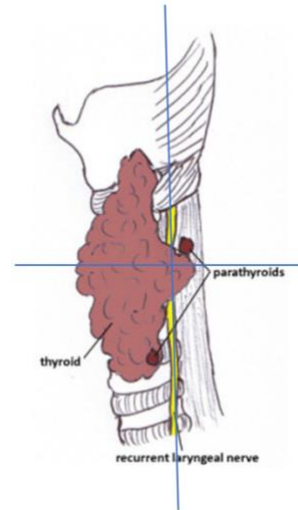
Naira Baregamian

ectopic parathyroid glands. In rare instances, parathyroid glands are well visualized and easily accessible without dividing the middle thyroid vein.

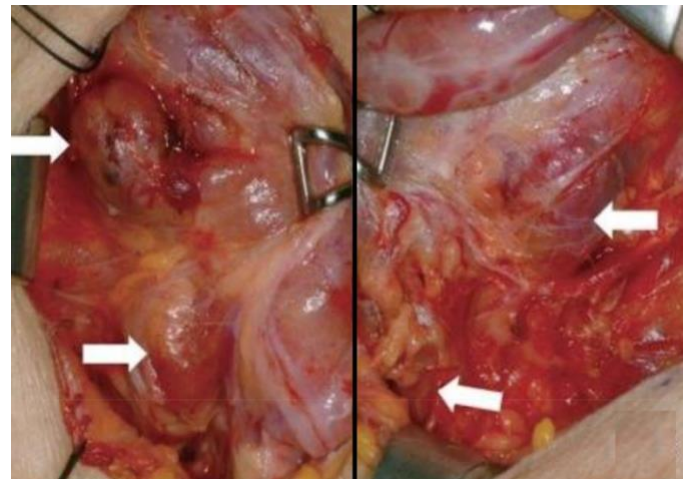


The middle thyroid vein will be the first large vein you encounter when dissecting along the anterior surface of the thyroid gland. Once it is divided, it is possible to rotate the thyroid gland medially even as you preserve its blood supply via the inferior and superior thyroid vessels.

4. Dissect the capsule of the thyroid gland and rotate it medially to locate the superior and inferior parathyroid glands in their typical location posterior to the thyroid gland. Identification of the recurrent laryngeal nerve is a critical step in parathyroidectomy. Superior glands tend to lie posterior, superior and lateral to the nerve, while the inferior parathyroid glands are anterior, inferior and medial to the recurrent laryngeal nerve.



The location of the parathyroid glands relative to landmarks seen during neck exploration. The horizontal line goes through the tubercle of Zuckerkandl, the most posterolateral part of the thyroid gland. The vertical line is an imaginary line drawn along the course of recurrent laryngeal nerve. Note that the superior parathyroid glands can be cranial to the entrance of the nerve into the larynx, even though this anatomic relation is preserved. Source: <http://www.endocrinesurgery.net.au>, used with permission.



In this patient with secondary hyperparathyroidism, all four parathyroid glands can be seen after medial mobilization of the right (Left photo) and left (Right photo) thyroid lobes. They are in their normal location, shown by the White arrows. Source: Min Song Kim et al.

<https://doi.org/10.21053%2Fceo.2019.01340>

5. If operating for primary hyperparathyroidism, remove the gland(s) which are clearly hypertrophied. As explained previously, if you do not have intraoperative parathyroid hormone assay analysis, you must inspect all 4 glands, as

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/)



Neck Exploration and Subtotal Parathyroidectomy

Naira Baregamian

more than one will be hypertrophic in 15-20% of cases.

6. If operating for secondary or tertiary hyperparathyroidism, decide whether to perform 3.5-gland resection or 3-gland resection. This decision depends entirely on the size, position, and blood supply of the remaining parathyroid gland. Typically, the smallest and most normal appearing of the parathyroid glands is selected for subtotal resection and is marked either with a clip or non-absorbable colored suture for future identification. If the blood supply or very small size of the normal parathyroid gland do not allow subtotal resection without compromising its viability, then leaving a marking stitch or metal clip will suffice.



Completed subtotal parathyroidectomy: based on the anatomy, the surgeon decided to do a subtotal resection of the left inferior gland. Source: Min Song Kim et al. <https://doi.org/10.21053%2Fceo.2019.01340>

Three procedures are commonly performed for secondary and tertiary hyperparathyroidism:

- Total parathyroidectomy with or without autotransplantation,
- Subtotal parathyroidectomy
- Limited parathyroidectomy- in case of tertiary hyperparathyroidism.

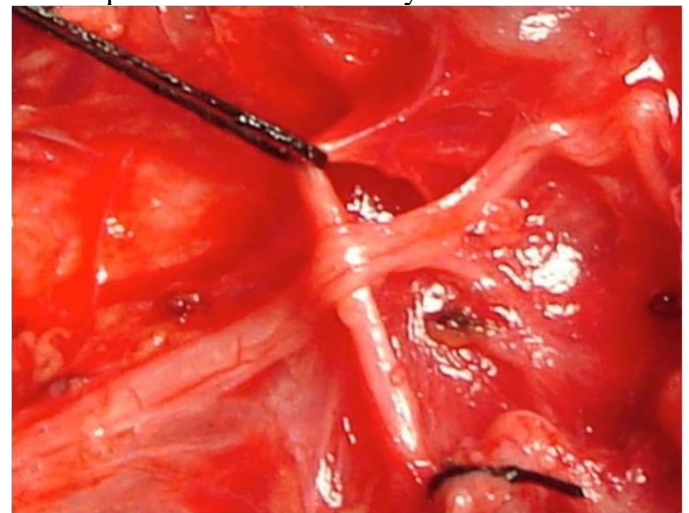
The decision to select one of the above-mentioned procedures lies with treating surgeon preference, available institutional resources and should be tailored to each patient's treatment plan, including access to high-calcium bath dialysis, oral calcium pills, vitamin D and access

to calcimimetics in cases of postprocedural hypoparathyroidism or failure to cure, respectively.

7. Be very careful to assure hemostasis before closure. Patients with secondary hyperparathyroidism on dialysis are especially prone to postoperative neck hematoma.
8. Reapproximate the strap muscles and the platysma and close the skin.

Pitfalls

- Intraoperative hemorrhage- blood staining of the tissues makes it much harder to distinguish between parathyroid tissue and normal fat. Be meticulous. Bipolar diathermy is especially useful for bleeding that is near the recurrent laryngeal nerve.
- Recurrent laryngeal nerve injury- this is less common than during thyroidectomy, but still a risk. The nerve must be visualized and its relation to any parathyroid tissue assessed. At times it can be quite close to the tissue you want to resect.



Photograph showing the relationship between the recurrent laryngeal nerve and the inferior thyroid artery (artery retracted by a Black suture). The artery may have a single or multiple branches, which may pass anterior or posterior to the nerve, or both. As the inferior thyroid artery is the blood supply of both the superior and inferior parathyroid glands, this relationship is especially important. Source: Chintamani <https://doi.org/10.1007/s12262-017-1691-2>

OPEN MANUAL OF SURGERY IN RESOURCE-LIMITED SETTINGS

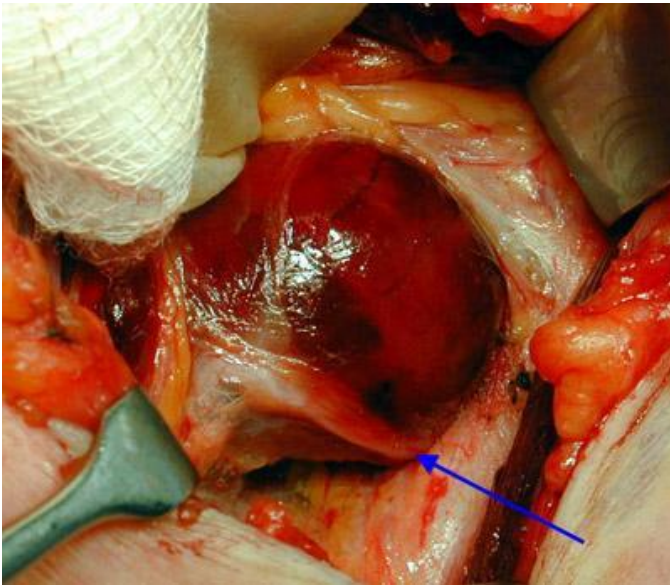
www.vumc.org/global-surgical-atlas

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



Neck Exploration and Subtotal Parathyroidectomy

Naira Baregamian

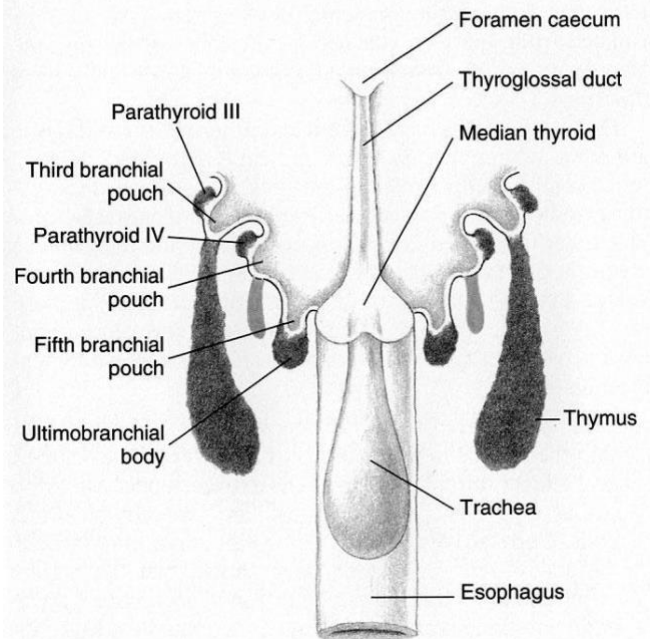


A parathyroid adenoma that is dangerously close to the recurrent laryngeal nerve (Blue arrow.) Careless technique or less than meticulous dissection would lead to nerve injury and hoarseness of voice.

Source: <http://www.endocrinesurgery.net.au>, used with permission.

- Concurrent thyroid and parathyroid pathology: If the patient has a multinodular goiter, parathyroid identification can be even more difficult. Thyroid gland mobilization and/or concurrent thyroidectomy may have to be planned, if indicated. Preoperative ultrasound examination by the surgeon can help prepare for this situation. If feasible, a partial thyroid lobectomy can be performed in place of a total lobectomy to incorporate an area containing a nodule suspicious for an ectopic parathyroid gland and submitted to pathology for further analysis.
- Failure to localize all four glands: Embryology of parathyroid glands dictates ectopy and difficulty in intraoperative localization of ectopic parathyroid glands. Ectopic positions can range from high cervical position, inside carotid sheath, intrathyroidal, within the tracheoesophageal groove, retroesophageal, mediastinal or intrathymic. Identifying the parathyroid vascular stalk and where parathyroid blood supply is coming from in relation to the recurrent laryngeal

nerve can be very helpful in identifying which gland, superior or inferior, is being resected.



Embryology of the pharynx, 6th to 7th week of development. The inferior parathyroids originate in the third branchial pouch and the superior parathyroids originate in the fourth branchial pouch. Both migrate downwards into the neck: as the inferior parathyroids have farther to travel, they are more prone to migrate to an ectopic location. Source:

<http://www.endocrinesurgery.net.au>, used with permission.

- For a missing superior gland, inspect:
 - The tracheoesophageal groove both above and below the thyroid gland,
 - Inside carotid sheath,
 - Inside the thyroid capsule (subcapsular gland),
 - Above the superior pole of the thyroid lobe- examine for a high cervical ectopic gland, or perform thyroid lobectomy. If the inferior parathyroid gland has already been identified, a transcervical thymectomy can be performed as well.
- For a missing inferior gland, inspect:
 - Thyrothymic ligament and cervical horn of the thymus, the most common ectopic location for inferior gland,
 - Inside the carotid sheath,
 - Below the inferior pole after taking down inferior pole vessels,

OPEN MANUAL OF SURGERY IN RESOURCE-LIMITED SETTINGS

www.vumc.org/global-surgical-atlas

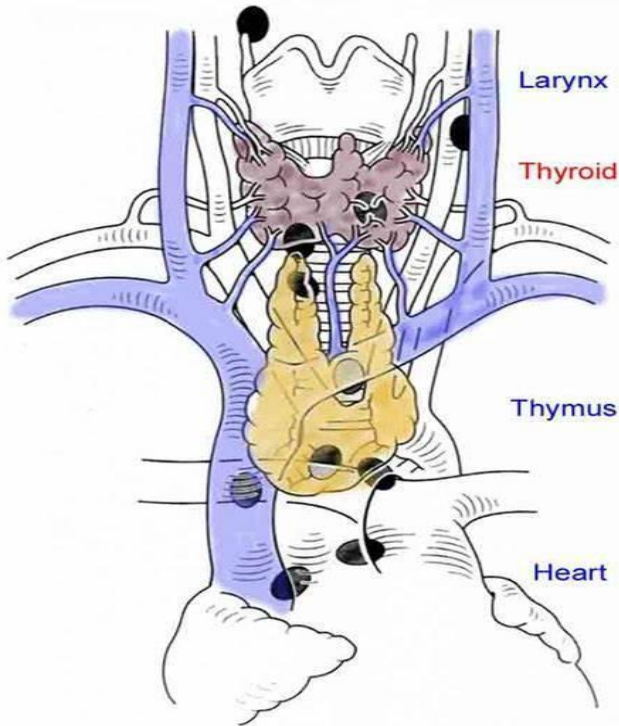
This work is licensed under a [Creative Commons Attribution-ShareAlike 3.0 Unported License](https://creativecommons.org/licenses/by-sa/3.0/)



Neck Exploration and Subtotal Parathyroidectomy

Naira Baregamian

- Inside the thyroid capsule (subcapsular gland),
- Inferior tracheoesophageal groove,
- As many of the following positions as you can access:



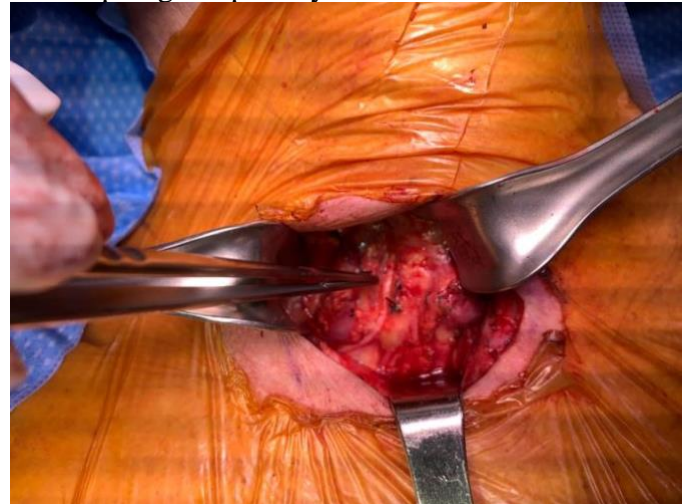
Potential ectopic parathyroid locations, for both superior and inferior glands. Source: <http://www.endocrinesurgery.net.au>, used with permission.

- If all of these measures fail, perform transcervical thymectomy first and bisect the thymus to confirm the presence of parathyroid tissue. If the gland is not apparent in these tissues, then perform thyroid lobectomy ipsilateral to the missing gland.
- Devascularization of the remnant parathyroid tissue: For primary hyperparathyroidism, parathyroid autotransplantation into sternocleidomastoid muscle should be undertaken. In the secondary or tertiary hyperparathyroidism, autotransplantation into the brachioradialis muscle (contralateral to the arteriovenous fistula,) Should be performed. Other options include the pectoralis and deltoid muscles. The reigning principle is to ensure creation of a muscle pocket, placement of the

morcellated parathyroid tissue and closure of the overlying fascia with colored non-absorbable suture in a figure-of-eight to avoid spillage of parathyroid tissue and cells and successful autotransplantation

Resection of Parathyroid Carcinoma:

For surgical treatment of parathyroid mass, consider obtaining “4D” CT imaging in addition to US (and SESTAMIBI scan if available) to best delineate anatomic boundaries of the mass, dissection planes and potential areas of tracheoesophageal invasion that may require multidisciplinary intraoperative approach. En bloc resection of a parathyroid mass invading local structures should be undertaken. Make every effort through meticulous dissection to preserve the recurrent laryngeal nerve and parathyroid capsule to avoid spillage of parathyroid cells.



Right Parathyroid Carcinoma Abuts the Right Recurrent Laryngeal Nerve.



Resected specimen, right parathyroid carcinoma.

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/)



Neck Exploration and Subtotal Parathyroidectomy

Naira Baregamian



En Bloc Resection of a right parathyroid carcinoma invading the right thyroid lobe. Black silk suture denotes the course of the dissected and preserved right recurrent laryngeal nerve.

Naira Baregamian, MD, MMS, FACS
Vanderbilt University
Tennessee, USA