Partial Thyroidectomy: Illustrated Reflections for Surgical Residents

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This pictorial article has been written by an attending endocrine surgeon and illustrated by a surgical resident to provide a simplistic platform for surgical residents to approach the anatomical knowledge and technical knowledge needed for performance of a partial or total thyroidectomy. This short article will not replace the need for detailed study of thyroid anatomy before performing thyroid surgery for resident surgeons but will hopefully provide a helpful starting point for the resident to start a study of the anatomy and techniques needed to perform a thyroidectomy.

Thyroid surgery provides an excellent example of an operation in which the surgical resident needs to not only understand completely the detailed preoperative evaluation algorithms needed but also needs to integrate this knowledge with intricate anatomic detail and surgical technical skill. Residents will find that proper tying techniques will be absolutely necessary for this operation; the small thyroidal vessels do not allow for undue tension created by the inexperienced knot tier; thus finesse in knot tying is important. Properly prepared residents will find thyroid surgery not only to be gratifying in multiple levels but will also find that thyroid surgery will push their technical skills and knowledge to its limit. Details of the thyroidal vascular and pertinent neuroanatomical natural variants for the external branch of the superior laryngeal nerve, recurrent laryngeal nerve, and thyroidal vessels are not addressed in this monograph but should be separately studied. Of course, every attending surgeon will have small differences in their preferences, and these should be incorporated into the resident’s repertoire, which allows the resident to come up with their unique way of doing things when they move onto becoming an independent surgeon.

1. Knowledge of preoperative evaluation: It is recommended that the resident come into the operating room having intimate knowledge of the patient’s medical history and thyroid condition, the reason for operation, size and side of any nodules, and the thyroid function status of the patient. Previous neck operations, status of vocal cord function, and status of viable parathyroids should be noted. The resident should understand how the patient’s thyroid condition manifested, what evaluation was performed, and why the decision was made to bring the patient to the operating room. Imaging studies should be reviewed. If ultrasound is available to the resident, a preoperative ultrasound should be performed by the resident to allow clinical correlation and to strengthen the resident’s clinical ultrasound skills. The surgical resident should communicate clearly with the anesthesia staff any concerns about airway issues, and whether muscle relaxation should be used (especially if recurrent laryngeal nerve monitoring is being used).

2. Patient marking: The patient’s neck should be marked preoperatively along natural skin creases if possible while sitting up. Even if natural skin creases cannot be used for incision placement, they can be used as a template for the incision the surgeon makes. Because asymmetric incisions draw more attention to themselves, all thyroid incisions need to be symmetric (even if only 1 side of the thyroid is being removed). Midline structures such as the chin and sternal notch should be marked with a small mark to allow symmetrically placed incisions (Fig. 1). The resident should wear surgical loupes and a headlight given the small surgical field.

3. Patient positioning: The patient should be positioned with a shoulder roll, placed horizontally or vertically in between the scapula. An intravenous bag or small roll is ideal. The head will then be hyperextended and should be well supported using a donut pad. The head of the bed should be placed higher than the body using reverse Trendelenburg. Both arms should be tucked and well padded. Compression booties should be used. No Foley catheter is needed (Fig. 1).

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4. Operative procedure: A transverse incision after a natural crease if possible is made paying attention to maintaining symmetry using the chin and sternal notch marks as midline. Incision sizes vary (often 3 to 8 cm), but in general the

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smallest size incision that makes a safe operation possible is used (Fig. 1). In Fig. 1, a larger neck incision is marked along a natural looking crease, but only a 4-cm incision was made along these lines for this patient’s surgery.

This operation requires finesse and attention to performing every move delicately. Because surgical loupes are used and the operative field is small, taking the eyes off the operative field is a major distraction.
In all thyroid operations (total or partial thyroidectomy), subplatysmal flaps are developed superiorly and inferiorly (Fig. 2).

In Fig. 2, a left partial thyroidectomy is being performed so only the left thyroid is exposed. The 2 strap muscles, the sternohyoid muscle anteriorly and the sternothyroid muscle more posteriorly, are separated and retracted laterally to allow visualization of the thyroid (Fig. 2). The resident surgeon will note that space is tight given the usually small size of incisions. Fixed mechanical retraction is rarely used for thyroid surgery; thus manual retraction is used and will need to be moved as the surgery progresses to allow better visualization of different parts of the field. Care must be taken in placement of any metal retractors to avoid injury to the recurrent laryngeal nerve (RLN). The resident surgeon will surely notice that finger retraction using the index finger of the nondominant hand is important in pulling the thyroid lobe medially (toward the trachea) and allowing visualization of vessels and structures lateral to the thyroid. At the same time as medial traction is placed on the thyroid, lateral retraction is placed on the strap muscles and carotid sheath allowing better visualization of the relationship of the inferior thyroidal vessels to the RLN.

Once the lateral aspects of thyroid gland is exposed, the middle thyroid vein is identified and ligated, which allows the surgeon’s nondominant hand to expose the inferior pole and superior poles of the thyroid.

The inferior pole of the thyroid is exposed revealing the inferior thyroidal artery and vein (Fig. 3). The RLN (here the left RLN) can cross close to the posterior aspect of the inferior thyroidal vessels. Care must be taken to identify the RLN and avoid injury to it. Ligation of the inferior thyroidal vessels should be performed directly at the level of the thyroid capsule. Staying close to the thyroid capsule protects the RLN from injury but also allows preservation of the vascular flow to the inferior parathyroids (Figs. 3, 4). As a general point, all dissection and division of vascular structures should be performed directly at the level of the thyroid capsule to avoid injury to the RLN and external branch of the superior laryngeal nerve (SLN). The RLN courses somewhat obliquely from lateral to medial as the dissection is carried out further cranially. The RLN usually crosses under the inferior thyroidal artery, but it can occasionally travel over the artery, or in between the two branches of the inferior thyroid artery (Fig. 5).

Differentiation of parathyroid from thyroid tissue can be somewhat challenging, although generally the parathyroids are enveloped in fat and are often a tan color. The inferior parathyroid can often be seen after the inferior pole vessels have been ligated. The inferior parathyroid is usually ante-
rior to the RLN, whereas the superior parathyroid is usually in a more posterior position, behind the thyroid gland (Fig. 5).¹

Additional blunt dissection allows continued mobilization of the thyroid, and the superior pole vessels are also divided close to the capsule to avoid injury to the SLN, which has a variety of patterns of travel before insertion into the cricothyroid muscle.

Once the superior and inferior pole vessels have been ligated, the thyroid gland is gently and carefully mobilized further (Fig. 4), which now allows continued visualization of the structures posterior to the thyroid, the ligament of Berry, the RLN, both parathyroids, and the tracheoesophageal groove (Fig. 5). During this part of the operation, delicate dissection is key to avoid tearing of any small branches of the inferior thyroid artery or undue traction on the RLN. As a general rule, cautery is not used during this part of the dissection because cautery injury to the RLN is a real possibility. Anatomic variations of the RLN are many and are not discussed here. Knowledge of these anatomic variations is of utmost importance to avoid injury to the RLN while dissecting in the tracheoesophageal groove and ligament of Berry. The ligament of Berry is a dense condensation of tissue including blood vessels that attach the thyroid to the first and second tracheal rings.

Once the RLN and inferior and superior parathyroids have been identified, careful dissection along the ligament of Berry allows separation of the thyroid from the small

FIGURE 5. Position of the left recurrent laryngeal nerve and parathyroids

FIGURE 6. Left recurrent nerve at risk
vessels crossing the ligament of Berry (Fig. 6). Small clips or fine silk ties can be used to divide these vessels. Care must be taken to stay tight to the thyroid gland. Sometimes thyroid tissue at this location may be found posteriorly behind the RLN, and extreme care must be taken not to injure the nerve. If the thyroid is firmly adherent to the trachea or the ligament of Berry along this region, it is safest to leave a small (1 to 2 mm) bit of thyroid behind rather than avoid injury to the RLN. At the upper most part of the ligament of Berry, the RLN is at its most vulnerable. A fine right angle is often the instrument of choice for taking 1 final bit of the ligament of Berry and avoiding injuring the RLN (Fig. 6). The final connections of the thyroid to the trachea are then sharply divided.

The thyroid isthmus is divided using a Kelly clamp and a silk suture ligature is used to control bleeding in the thyroid remnant (Fig. 7). The isthmus is removed to avoid tumor recurrence in the isthmus and to avoid hypertrophy of any remaining isthmus that may be visible given its location directly over the trachea. The thyroid lobe that has been removed is inspected and handed off the field. The operative field needs to be checked for hemostasis. At this point the trachea, RLN, cricothyroid muscle, SLN, and both parathyroids are exposed and must be treated gently to avoid injury (Fig. 7). If recurrent laryngeal nerve monitoring is used, the integrity of the nerve should be checked. Small points of bleeding along the RLN area can often be controlled with applied finger pressure; no cautery should be used. The viability of both parathyroids needs to be assessed. If either parathyroid is ischemic, it can be removed, minced, confirmed to be parathyroid tissue by frozen section, and then reimplanted into the ipsilateral sternocleidomastoid if viability in its native location is doubtful.

The patient can be placed in Trendelenburg momentarily before starting closure to check for hemostasis, and once hemostasis is verified, the strap muscle layers are approximated individually using absorbable suture. Platysma is closed similarly, and the skin is closed using a subcuticular suture in a cosmetically appealing manner. A sterile dressing is applied.

During emergence from anesthesia, the surgical resident needs to be attentive to the patency of the airway. Retching should be avoided during emergence from anesthesia.

Postoperative management: Keys to postoperative management include elevation of the head of the bed, aggressive treatment of postoperative nausea and vomiting, and close observation to check for airway patency or postoperative complications such as hematoma. Some surgeons measure serum calcium if a total thyroidectomy has been performed.

**REFERENCE**