

# An Overview of Thyroidectomy Complications Management: Literature Review

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## Abstract

**Background:** Thyroid gland disorders can vary from neoplastic, inflammatory, and endocrine anomalies with 11% of the general population are affected. Thus, the management of such disorders is important and is a must for clinicians to decide the appropriate plan, either conservative or surgical. Objectives: In this review, we aimed to assess literature linked to thyroid surgery, indications and complications, and recent updates to the procedure. Methodology: PubMed database was used for articles selection, papers were obtained and reviewed. PubMed database was used for articles selection, and the following keys terms: thyroid surgery, postoperative complications, and endoscopic procedure. Conclusion: The best treatment for postoperative complications of thyroid surgery is prevention. Prophylactic drains prevent neck hematomas from expanding and compromising the airway. Meticulous knowledge of thyroid anatomy would decrease the chances of accidental parathyroidectomy, or vessel injury, or recurrent laryngeal nerve injury.

**Keywords:** Thyroid surgery, complications of thyroid surgery, endoscopic thyroid surgery.

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## Introduction

The thyroid gland is one of the most important glands in the body, with very common disorders affecting it. These can range between neoplastic, inflammatory, and endocrine anomalies with 11% of the general population are affected. (Sun et al., 2013) Thus, the management of such disorders is important and is a must for clinicians to decide the appropriate plan, either conservative or surgical. Forming the main management in many diseases, thyroid surgeries are one of the most commonly used therapies, but complications are numerous (Abbas, et al., 2019; El-kordy, et al., 2019; Tadayon, et al., 2018; Kanjekar, 2019). Moreover, the complications rate is variant, up to 50% in some complications (hypocalcemia), and even some are fatal. Thus, clinicians aim to prevent permanent injuries and lower the associated morbidity and mortality. As a result, (overall) experience, anatomical knowledge of structures, nerve sites, parathyroid glands are an important set of skills to help to achieve these goals. In this paper, we aim to review thyroid basics, indications for surgery, surgery types, their complications, and how to manage them.

## Methodology

PubMed database was used for articles selection, and papers were obtained and reviewed. PubMed database was used for articles selection, and the following keys terms used in mesh: (“Thyroid surgery”[Mesh]) AND (“Postoperative complications ”[Mesh]) AND (“endoscopic procedure”[Mesh])). In regards to the inclusion criteria, the articles were selected based on the inclusion of one of the following topics; thyroid surgery, indications, types, complications, management of complications. We excluded all other articles which did not have one of these topics as their primary endpoint.

## Review:

The thyroid is an endocrine gland, situated in the anterior neck, inferior to the thyroid cartilage, between C5 and T1 vertebral planes. The thyroid gland begins its journey at the foramen caecum of endoderm origin, then go downstream through the thyroglossal duct till finally resting in the anterior neck. It is for this reason that ectopic thyroid tissue is often discovered post-thyroidectomy. Of note, the parafollicular cells within the thyroid are of

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neuroendocrine origin. (Costante and Meringolo, 2020) Other important anatomical relations of the thyroid gland include those within the pretracheal fascia: the trachea, esophagus, and pharynx.

#### Vasculature of the Thyroid

Due to its important hormones, the gland is highly vascularized mainly with superior thyroid artery arising early on from the external carotids; and inferior thyroid artery from the thyrocervical trunk of the subclavian artery. The thyroid itself is anteromedial to the carotid sheath itself. The corresponding superior and inferior thyroid veins flow into the internal jugular and brachiocephalic veins, respectively. (Carter et al., 2017) In a percentage of the population; a middle thyroid vein also drains into the internal jugulars. (Carter et al., 2017) In a tenth of the population, the thyroid ima artery arises directly from the brachiocephalic trunk to supply the anterior thyroid and isthmus. This artery is important clinically, because an inexperienced surgeon might not identify it, then cut it and risk bleeding. (Krudy et al., 1980)

#### Innervation of the Thyroid

There are two sets of nerves of importance to thyroid surgery. Firstly, two recurrent (inferior laryngeal) nerves run within the tracheoesophageal space and pass inferiorly to the thyroid gland to innervate the larynx. (Ng et al., 2020) These nerves can be mistaken for vessels in surgeries and inadvertently ligated and thus damaged. While unilateral damage would cause hoarseness, a bilateral injury is a medical emergency presenting with dyspnoea and loss of phonation. Secondly, the superior laryngeal nerves branch off its origin in the vagal nerve as it leaves the skull, traveling with internal carotid before entering the superior pole of the thyroid. This nerve is responsible for voice pitch, and injury to its external laryngeal branch would cause reduced strength and quality of voice. (Zhang et al., 2020)

#### Indications for Thyroid Surgery

Indications for thyroidectomy can be grouped into five categories: thyroid carcinoma, toxic nodules, multinodular goiter, Grave's disease, thyroid nodule aspirated with a fine needle with inconclusive results. (Sena et al., 2019; Sugino et al., 2019) Shifting the patient to a surgical option (See Table 1), should not be on a whims notice and senior consultation and patient discussion should be central to the decision making process. Further investigations may be required for certain scenarios, for example; in a patient with thyroid cancer-causing shortness of breath, the investigation of choice is a flow-volume loop. Patients with thyroid disease will commonly present with systemic symptomatology such as weight changes, constipation, feeling cold. The patient may benefit from investigations for blood disorders, or in many cases a family history of bleeding disorders along with other general tests (e.g. CBC).

**Table 1:** Summary of Different Thyroid Surgery Approaches

	Removed	Remaining
Hemithyroidectomy	Isthmus and a unilateral lobe	Unilateral lobe

Subtotal thyroidectomy	Majority of both lobes	Around 5 grams of thyroid tissue
Near-total thyroidectomy	Almost all of both lobes	A small amount of tissue on one lobe or both, containing the superior parathyroid and RLN entry point.
Total thyroidectomy	Entire gland	Parathyroid glands

#### Complications of Thyroid Surgery

Thyroid surgeries done by experienced surgeons have lower rates of complications overall, this is the case for other major invasive surgeries as well. (Sosa et al., 1998) The development of complications is unrelated to same-day discharge, as studies have shown no difference in readmission or complications with discharge on postoperative days 1 and 2. (Hu et al., 2020) These complications are more related to patient characteristics such as male gender, older age, large thyroid gland, and high blood sugar levels. (Chen et al., 2019; Salem et al., 2019) It would be useful to discuss three life-threatening emergencies in post-thyroidectomy patients of neck surgery: severe hypocalcemia, neck hematoma, and bilateral vocal cord paralysis.

Firstly, an event of severe hypocalcemia should not be taken lightly as this could rapidly and inevitably result in cardiac arrest. Hypocalcemia is a consequence of parathyroid glands removal during thyroidectomy. Another method of injury is through dissection and interruption of parathyroid blood supply, and literature has shown effective methods for preserving inferior parathyroid glands by meticulous preservation of their blood supply. (Dzodic and Santrac, 2017)

**Table 2:** Half-life of Thyroid and Parathyroid Hormones

	Half-life
T3	~24 hours
T4	5–7 days
Calcitonin	60–90 minutes
PTH	~5 minutes

Parathyroid hormone has a short half-life of around five minutes (Table 2), giving the advantage of checking on the parathyroid gland intra-operatively. (Calò et al., 2013) Parathyroid hormone is expected to decrease by 70% in post-operative total thyroidectomy. (Lončar et al., 2020) Moreover, PTH levels are reliable predictors for persistent hypoparathyroidism in this group of patients. (Lončar et al., 2020) If found to be completely depleted, then the glands should be harvested and auto transplanted, as this would prevent postoperative hypocalcemia. (Teshima et al., 2018) Other hormones can be indicative of remnant thyroid tissue or medullary thyroid neoplasia in calcitonin elevation (Table 2). (Costante and Meringolo, 2020)

Hypoparathyroidism has a known association with cardiovascular autonomic neuropathy, episodes of hypocalcemia are detrimental if the former condition develops. (Tabacco et al., 2019)

In suspected hypocalcemia, the clinician shall order corrected calcium and check on the patient for anxiety, paraesthesia, perioral numbness, and facial or carpal spasms. Vitals should be monitored fastidiously along with ECG, before proceeding to take a quick history and specific examination. The physician shall try to illicit hemifacial spasm by tapping anterior to the tragus or inflating an arm cuff to demonstrate carpal spasm. Management of this condition includes administration of intravenous calcium gluconate and normal saline, thereafter repeat tests for corrected calcium. In addition to hypocalcemia, the patient usually has a reduced conversion of vitamin D to 1, 25 dihydroxycholecalciferol, thus, when the patient stabilizes switch to oral calcium and vitamin D supplementation. Long term complications of low calcium may include renal impairment, neuropsychiatric issues, and gastrointestinal symptoms. (Ponce de León-Ballesteros et al., 2020)

Secondly, neck hematomas are life-threatening as they expand rapidly and compress the trachea leading to airway obstruction. These bleedings can be caused by either venous or arterial damage after clip instability. In recently extubated patients, even an episode of strenuous coughing could cause clip instability. Meticulous hemostasis should be achieved intraoperatively, a suitable method is to perform Valsalva maneuver following a Trendelenburg's positioning, as potential bleeding occurs before the surgical site closing and can be managed effectively. (Ozdemir et al, 2017) Prophylactic drains are often installed to prevent airway compression by hematoma, which is crucial in patients with risks such as old age, male gender, Grave's disease, large glands, hypertension, antithrombotic medication, and neck dissection. (Chen et al., 2019; Salem et al., 2019; Fan et al., 2019) Other methods for intraoperative hemostasis are through energy-based devices, which have been proven effective in vascular sealing and reducing post-operative bleeding events. (Siu et al., 2019; Konturek et al., 2020)

The surgeon should check the patient for any signs of airway distress, if there is little to no swelling at the neck, then they should initiate a small dose of intravenous steroids with nebulized adrenaline, while the patient is sitting upright. However, considering patients with obvious clinical distress like; swollen neck, short of breath, inspiratory stridor, and decremting oxygen saturation; fastidious management by opening the wound and decompressing the airway should be done. If there is a gush of blood but the patient is still in respiratory distress, then cutting sutures by feeling along the trachea is the next step to access the airway. Securing the airway is always prioritized in these complications, and can be adequately achieved by emergent tracheostomy. Falling oxygen saturation is associated with distress and often not reliable a measure, therefore, we do not depend on saturation level to initiate treatment. In cases of suspected hematoma with tracheal compression, the surgeon should be prepared to open the wound in the ward, stabilize the airway, and transfer the patient for operative management.

Thirdly, a bilateral vocal cord paralysis is an inevitable complication of careless surgery. (Mahoney et al., 2020) This

paralysis occurs due to a bilateral injury to the recurrent laryngeal nerves through either dissection or transection. Therefore, it is now advisable to use intraoperative neuromonitoring in thyroid and parathyroid surgeries, as it has shown promising results in decreasing intraoperative bilateral nerve injuries. (Staubitz et al., 2020; Zhu et al., 2020) Furthermore, intraoperative neuromonitoring is recommended even in endoscopic thyroidectomy, as recurrent laryngeal nerve palsy could still occur as a complication of this approach. (Zhang et al., 2020)

This injury can be permanent, the problem becomes noticeable post-operatively as the patient is visibly breathless, with no neck swelling suggestive of other causes such as hematoma. It is always preferable to request an ear-nose-throat surgeon for assistance. Tilt the head of the bed to 90 degrees, order intravenous steroids, and nebulized epinephrine, as this will provide valuable time for checking the airway with a nasopharyngoscope and thereafter securing an airway. It is necessary to have tracheostomy equipment nearby as a precaution measure, especially if the patient is in obvious distress in the ward. If the cords are paralyzed you can intubate directly, which can be confirmed with a nasopharyngoscope and informing an anesthesiologist.

In addition to the life-threatening complications above, other complications can occur in many patients. These include hypothyroidism in almost half of all post-thyroidectomy patients within 10 years and commonly transient hypoparathyroidism. However, a small number of patients may have permanent damage. (Hedley et al., 1983) There are other complications related to surgery such as chyle leak, stitch granuloma, infection, and anesthetic complications. (Beninato and Laird, 2020)

## Conclusion

While thyroidectomy risks complications, these are unrelated to hospital conditions and often result from multifactorial patient characteristics. While there are a variety of complications, most are rare and uncommon, and focus on preventing life-threatening complications should be prioritized by clinicians. Thorough knowledge of anatomy, identification of structures, and taking safety measures like intraoperative neuromonitoring can help in decreasing morbidity and mortality in such common surgeries.

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