Review article

Postoperative complications and preventive strategies of complications following thyroidectomy

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Abstract

Goiter is the most common condition encountered in surgical endocrinology, and thyroidectomy is considered the mostly done endocrine surgical procedure worldwide. In the modern era, thyroidectomy is considered one of the safest surgical procedures. However, complications from thyroidectomy can significantly impact a patient's quality of life. Although the mortality rate following thyroidectomy is rare, the occurrence of major complications is still seen. Those complications include postoperative bleeding, hypocalcaemia, vocal cord palsy, injury to the superior laryngeal nerve, hypothyroidism, thyrotoxic storm, and postoperative infection. Changes in voice and difficulty in swallowing are complications that require further investigation and clarification. Identification of predictive factors of post-operative complications and adherence to preventive strategies will improve the outcome of thyroidectomy.

Introduction

Thyroidectomy is an elective surgical treatment modality done for symptomatic thyroid swellings.[1] These swellings are attributed to many underlying pathological conditions such as thyroid cancer, toxic adenoma, goiter with compressive symptoms, multinodular goiter, Graves' disease without adequate response to medical treatment or for whom medical management may not be advised, such as those attempting to become pregnant.[2] The surgery performed for those thyroid swellings varies from total thyroidectomy to hemithyroidectomy and all these categories of surgical procedures are classified under thyroidectomy.[2]

In the modern era, thyroidectomy is one of the safest surgical procedures, yet there are complications of thyroidectomy that have significant implications on

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the quality of life of a patient. Even though death rates are rare after thyroidectomy, the potential for occurrence of major complications such as post-operative bleeding, vocal cord palsy, and hypocalcemia are still common.[3] The change in voice and swallowing difficulty are complications that need more assessment and elucidation.

Fassas, 2021 has reported an overall complication rate following thyroidectomy of 3.28% based on a study carried out in the USA. The documented complication of thyroidectomy vary from immediate post-surgical to long-term and permanent complications (Neto et al., 2012). Major complications such as postoperative bleeding, hypocalcemia, and laryngeal palsy have been reported as recently as in the past few years, despite the gradual decline in trend.[4] Fernando et al, 2017 documented in their article "Thyroidectomy is a very safe surgical procedure with extremely low complication rates quoted by centres with large patient numbers e.g. hypoparathyroidism of less than 2%, injury to recurrent laryngeal nerve 1%, mortality less than 1%". Postoperative voice change and swallowing disability after thyroidectomy have led to poor quality of life after thyroidectomy.[5]

Post operative bleeding

Bleeding after thyroidectomy is a life-threatening emergency.[6] According to Edafe et al, which analyzed 1913 patients retrospectively who underwent thyroidectomy during the period of 7 years, documented a reoperation rate of 1.3%, of which 96% of bleeding occurred within 24 hours. It is evident that patients who had total thyroidectomy had more reoperation rates for bleeding compared to hemithyroidectomy. In a meta-analysis done by Liu et al, 2017, older age, history of Graves' disease, total thyroidectomy, and revision surgery have been identified as risk factors for post-surgical bleeding. Malignant tumors and drainage device use were not associated with post-thyroidectomy haemorrhage.[7] BMI has not shown a significant association with postoperative bleeding.[6] Even though some evidence suggests a reduction of postoperative bleeding with the usage of a harmonic scalpel, it has controversial benefits of usage.[8] Edafe et al, 2020 have proposed an intra-operative protocol (ITSRED Fred) to practise during surgery to minimize the risk of postoperative bleeding (Table 1).

Hypoparathyroidism

Hypocalcemia is the most common complication associated with thyroidectomy and the high risk is associated with total thyroidectomy and completion of thyroidectomy.[9] Furthermore, some of those patients will develop permanent hypocalcemia, and they may require lifelong monitoring and supplementation.

There are three different types of hypocalcemia described in the literature. They are transient biochemical hypocalcemia, symptomatic hypocalcemia, and permanent hypocalcemia. British Association of Endocrine and Thyroid Surgeons has defined biochemical hypocalcemia following thyroidectomy as ionized calcium level of less than 1.2 mmol/L or corrected level of calcium less than 2.10 mmol/L which is measured on the first postoperative day.[10] According to the systematic review done by Mc MURran et al, 2020 transient biochemical hypocalcemia was documented in 3.2 to 82.6 percent, and symptomatic hypocalcemia is found in 0 to 50 percent. According to the same, permanent hypocalcemia was seen in 0 to 14.5 percent.[10]

Table 1. ITSRED Fred protocol

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Table 4. ITSRED Fred Protocol for preventing post-surgical neck haematoma after thyroid and/or parathyroid surgery

	Parameters
I	Irrigation of wound with water—to clear field and look for minor bleeding points [11, 25]
T	Time—wait a few minutes
S	Systolic blood pressure to be >100 mm Hg at time of closure
R	Relieve neck extension—either by deflating bag under shoulders, removing sand bag, or flexing the neck
E	Elevate venous pressure—either by Valsalva manoeuvre [25, 26], head-down position, or both [27]
D	Do not drain it, deal with it and consider sealants such as fibrillar [25, 26]
Fred	Flaps—evaluation of bleeding under subplatysmal flaps prior to closure

Commonly described predictors for post-operative hypocalcemia include post-operative parathyroid hormone (PTH) level and type of thyroidectomy. Low post-operative PTH levels and transient biochemical hypocalcemia show a statistically significant association.[10] Considering the available resources in Sri Lanka, routine measurement of post-operative PTH level cannot be practiced routinely. It has not shown a statistically significant association between pre-operative PTH level and post-operative transient biochemical hypocalcemia in most studies.[10] The association between pre-operative vitamin D level with post-operative hypocalcemia is still controversial. Identification of the parathyroid glands in the surgical specimen has shown a significant association with the occurrence of postoperative hypocalcemia.[11] Most of the studies have not shown a statistically significant association between the age of the patient, sex of the patient, and indication for thyroidectomy with the occurrence of postoperative hypocalcemia. Considering the above facts, it is evident that most of the predicting factors of hypocalcemia are not manipulable to reduce the occurrence of hypocalcemia. Different methods of identification of the parathyroid gland during the surgical procedure have been described in the literature. According to a meta-analysis done in 2022, the usage of Near-infrared (NIR) autofluorescence imaging during thyroidectomy is a valuable method in the identification of the parathyroid gland.[11] Usage of Intraoperative Indocyanine Green (ICG) Angiography (Figure 1) has been documented as an effective method of identification of the parathyroid glands during the surgical procedure.[12] According to a study done by Monib et al, 2020, Methylene Blue spray has shown promising evidence for the identification of the parathyroid glands.[13]

Recurrent laryngeal nerve palsy

Recurrent laryngeal nerve palsy has been documented as a commonly occurring complication following thyroidectomy. It can be temporary vocal cord palsy which has been documented as 2-26% or it can be permanent palsy which can be in the range of 0.3-6%.[14] During revision surgery, the rate of vocal cord palsy is as high as 14%.[14] Visualization and preservation of the recurrent laryngeal nerve during thyroidectomy is the GOLD standard to prevent vocal cord palsy.

Intraoperative identification of nerves during thyroidectomy has shown significant improvement with the development of laryngeal nerve monitoring techniques. Recurrent laryngeal nerve can be monitored intraoperatively as continuous nerve monitoring or intermittent nerve monitoring.[15] During the surgical procedure, intraoperative monitoring of the nerve using the nerve monitor prevents thermal and traction injuries.[16] This type of monitoring plays an important role in revision thyroidectomies, thyroidectomy done for malignancies, and patients with preoperative vocal cord palsy.

During the surgical procedure, intermittent and continuous nerve monitoring will monitor the recurrent laryngeal nerve and will detect signal loss. In contrast, continuous nerve monitoring will help to minimize traction and thermal injury by detecting them intraoperatively.[21] Further, continuous nerve monitoring helps the functional intraoperative real-time monitoring of the entire nerve with detailed EMG documentation for reference.[16] Intraoperative nerve monitoring (Figure 2) can be used as a supporting method of identification of nerve to the gold standard method minimizing the risk of damaging the recurrent laryngeal nerve specifically where the nerve is at high risk.

Wound infection, seroma formation, voice change without recurrent laryngeal nerve palsy, post-operative swallowing difficulty, hypertrophic scars, and keloid scars are referred to as other complications following thyroidectomy.[17] There had been some unusual complications such as tracheal and esophageal perforation, esophageal-cutaneous fistula, accessory nerve palsy, deep-seated hematoma, tracheomalacia, and Horner's syndrome.[18]

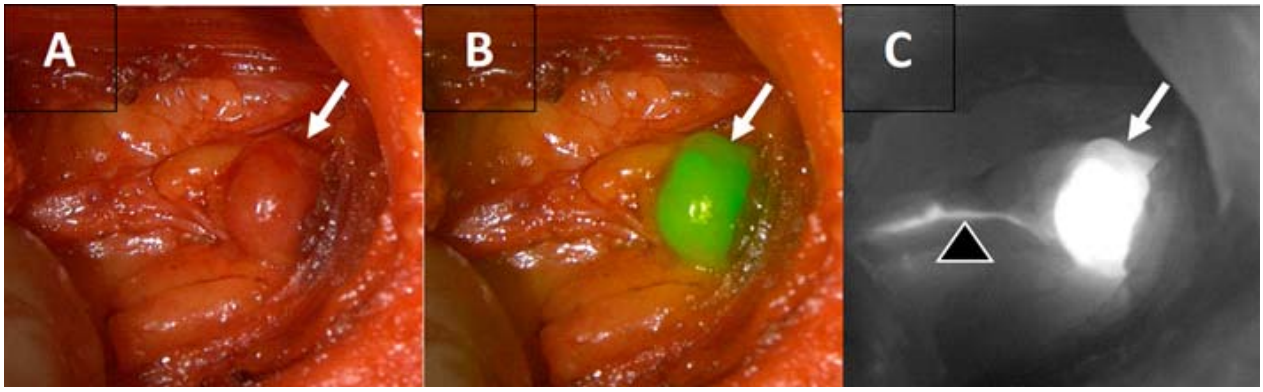

Figure 1. Parathyroid gland fluorescence following injection of ICG and excitement with NIR light.

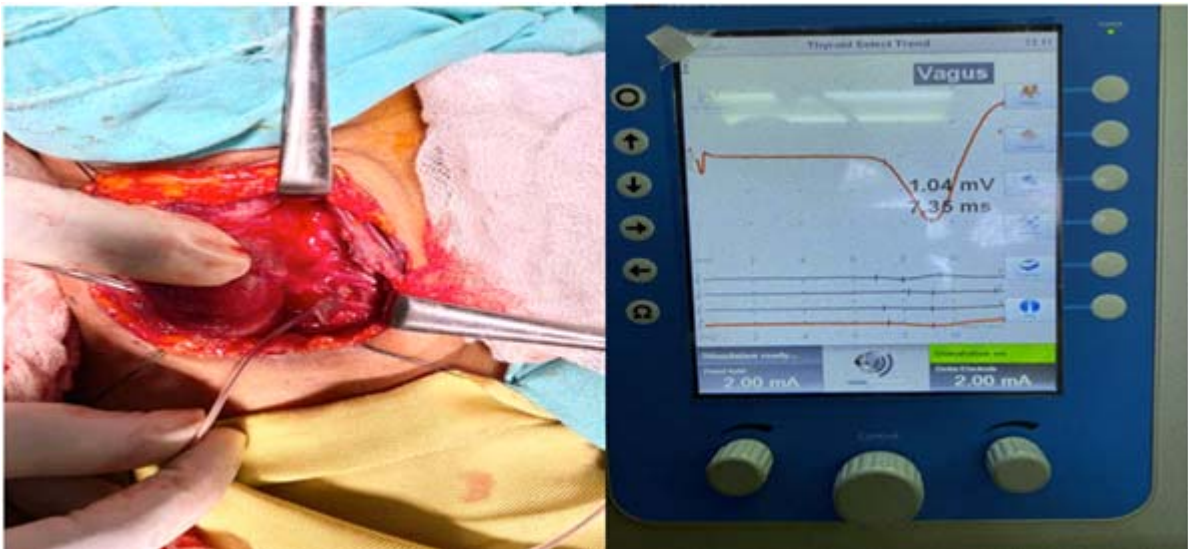

Figure 2. Intraoperative monitoring of vagus nerve.

Dysphagia

Dysphagia following thyroidectomy is a common postoperative complication that in the short-term or long-term leads to a significant change in the quality of life of those who have undergone thyroidectomy. Dysphagia related to thyroidectomy can be related to nerve damage or appear after uncomplicated thyroiddectomy.[20]

Both the superior laryngeal nerve (SLN) and the recurrent laryngeal nerve (RLN) are involved in swallowing mechanisms. The internal branch of the SLN provides sensitive innervation of the supraglottic space and vocal folds. Its lesion can determine, in some cases, dysphagia and aspiration.[9] while the external branch (EBSLN) provides the motility of the cricothyroid muscle, which improves the tension of the vocal folds, but its damage is followed from various rates of swallowing symptoms.[2]

Posterior branches of the recurrent laryngeal nerve are responsible for the motility of the cricopharyngeal muscle. It explains why the patients who underwent unilateral RLN paralysis suffer from swallowing impairment in about 30% of cases.[18]

Swallowing disorders can appear after a thyroid surgical procedure even in the absence of clear surgery complications such as nerve palsy.[19] These complaints, with still unclear causes, are usually transient and occur early after the surgical procedure.[6] It has been reported that in some cases discomfort persists long after the surgical procedure.[4] The causes invoked are orotracheal intubation, surgical manipulation, scar and adhesions of the skin flap with the superficial cervical fascia, and psychological reaction to the surgery.[4] To date, the injuries to the extrinsic perithyroidal neural plexus, which innervates the pharynx are unevaluable with actual tools. The thin anastomoses connecting the RLN and the external branch of the SLN, or the sympathetic cervical chain with both the RLN and SLN, seem to be involved in swallowing disorders.[3] Understanding the pathophysiology of swallowing difficulty following thyroidectomy and meticulous dissection preserving appropriate neural networks will improve the outcome surgical procedure related to swallowing.

Conclusion

Even though mortality related to thyroidectomy is rare in the modern surgical era, complications related to thyroidectomy are associated with significant morbidity and reduction of the quality of life of patients. Adherence to the available preventive strategies is the responsibility of the surgical team to give the most favourable outcome to the patient.

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