



Anaesthesia for thyroid surgery: Perioperative management

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ABSTRACT

The aim of this review is to analyse anaesthesiologic preoperative assessment, intraoperative management and postoperative complications of patients with thyroid disease. A special care is paid to difficult airway recognition and resolving this situation. Anaesthetist's and surgeon's point of view of perioperative and postoperative complications is both discussed with special interest on early surgical complications and the need for urgent anaesthetic treatment. Particularly total intravenous anaesthesia and recurrent laryngeal nerve monitoring actually are two end-points in the thyroid surgery.

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1. Introduction

Thyroid diseases which have anaesthetic implications include hypothyroidism, hyperthyroidism and conditions requiring thyroidectomy. Anaesthesia for thyroidectomy may be complicated by airway problems such as retrosternal extension of the gland. The anaesthetist should therefore pay particular care to preoperative airways' assessment and should be able to deal with acute airway complications in the perioperative phase.

2. Preoperative assessment

Identification of abnormalities of thyroid function is due to schedule patients: symptoms and signs of hypo- and hyperthyroidism and evidences of other medical conditions should be sought, particularly cardiorespiratory diseases and associated endocrine disorders. Routine investigations include thyroid function tests, haemoglobin, white cell and platelet count, urea and electrolytes, including serum calcium, chest X-ray and indirect laryngoscopy in order to document any preoperative vocal cord dysfunction.¹ Seeking for some evidence of tracheal compression and deviation a lateral thoracic X-ray is requested instead the only antero-posterior one to show tracheal compression. Other non-routine investigations are useful to value certain cases: computerised tomography (CT) can provide excellent views of retrosternal goitres² and magnetic resonance imaging (MRI) has the advantage

to provide images in the sagittal and coronal planes as well as transverse views³ (Figs. 1 and 2). Preoperative airway evaluation using new multislice 3D CT and high-resolution virtual laryngoscopy based on spiral CT data for patients with severe tracheal stenosis is useful. 3D figures of the trachea and a virtual bronchoscopic movie can be obtained from multislice CT scanning to evaluate the stenotic region and to simulate the virtual movie fibroscopic tracheal intubations. Anaesthesia's choice will be modulated by therecoming's data.

2.1. Retrosternal goitre

Although some retrosternal goitres are large the vast majority can be removed by the cervical route.⁴ The surgeon's manipulation worsens the retrosternal gland by compressing the trachea. Thyroid surgery also occasionally requires mediastinal exploration so that it should be better the endocrine theatre team to perform a sternotomy. Longstanding goitre may perform tracheal deviation and compression which suggest tracheomalacia. Anaesthesia for retrosternal goitre provides a challenge to the anaesthetist during establishment of airway and the incidence of complications can be greatly reduced by adequate preoperative assessment and planning.

3. Thyroid disease and anaesthetic implication

3.1. Hyperthyroidism

Hyperthyroidism results from excessive tissue and circulating concentrations of thyroid hormones. Clinical manifestations

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Fig. 1. Coronal MRI scan of anaplastic thyroid cancer.

suggest increased sensitivity to circulating catecholamines although measured catecholamine levels are within normal limits.

3.1.1. Perioperative considerations

- Determine if hyperthyroidism is under control looking for signs and symptoms of a hypermetabolic state, reviewing thyroid function tests, other pertinent studies, medications and treatment's duration. Propylthiouracil and methimazole are the preferred drugs for preoperative preparation but it takes weeks to render a patient euthyroid. Iodine is often added to thionamide treatment. Beta-blockers reduce heart rate and provide symptomatic relief as well as cardiac protection but do not affect thyroxine production or iodine metabolism and do not prevent thyroid storm.



Fig. 2. Axial MRI scan of anaplastic thyroid cancer.

- Only emergent procedures preclude waiting for a euthyroid state! Rapid preparation may be required: administer a combination of beta-blocker, corticosteroid, thionamide, iodine, and iopanoic acid.
- Be aware that overzealous beta-blockade could precipitate congestive heart failure, bronchospasm and hypoglycaemia in diabetics. Consider corticosteroids because adrenal reserves may be low. A strict monitoring is due to evidence cardiovascular impairment.

3.2. Hypothyroidism

Hypothyroidism may result in depression of myocardial function, decreased spontaneous ventilation, abnormal baroreceptor function, reduced plasma volume, anaemia, hypoglycaemia, hyponatraemia and impaired hepatic drug metabolism.

3.2.1. Perioperative considerations

- The combination of intravenous T3 and T4 is recommended for preoperative myxoedematous coma management to make the patient euthyroid.
- If possible avoid premedication and use regional anaesthesia. T4 may be omitted in the morning of surgery but it is advisable to give the patient's usual morning dose of T3.
- Preventive measures should be adopted to protect against hypothermia. Hypothyroid patients should receive hydrocortisone cover during increasing surgical stress.⁵

3.3. Thyroid crisis

Thyroid crisis still occurs in uncontrolled hyperthyroid patients as a result of a trigger such as surgery, infection or trauma. Supportive management includes hydration, cooling, inotropes and formerly steroids. Beta-blockade by labetalol or esmolol and anti-thyroid drugs is the first-line treatment. An acute thyroid crisis at induction of anaesthesia, which was mistakenly diagnosed as malignant hyperthermia, was successfully treated by boluses of dantrolene 1 mg kg^{-1} . Thyroid hormones sensitise the adrenergic receptors to endogenous catecholamines therefore magnesium sulphate seems to be a useful drug by reducing the incidence and severity of dysrhythmias caused by catecholamines.⁶

4. Anaesthetic technique

4.1. Regional anaesthesia

It is possible to perform thyroidectomy under bilateral deep and/or superficial cervical plexus blocks.⁷ Our opinion with bilateral deep cervical plexus block suggests that it is a dangerous technique concerning to its serious complications. Regional (local) anaesthesia is a useful alternative for particular circumstances, e.g. video-assisted thyroidectomy (VAT) performed under superficial cervical plexus block (mono or bilateral). Cervical epidural anaesthesia is another technique particularly useful if respiratory problems. Close monitoring of haemodynamics, respiratory rate and level blockade is required.⁸

4.2. General anaesthesia

General anaesthesia with tracheal intubation and muscle relaxation is the most popular anaesthetic technique for thyroidectomy. It is wise to select a small-reinforced tracheal tube if there is some degree of tracheal compression. Intravenous anaesthesia and total intravenous anaesthesia (TIVA) become

wider in modern anaesthetic techniques in thyroid surgery. Several intravenous hypnotics and analgesics are currently used for the induction and maintenance of general anaesthesia: propofol and alfentanil have the most suitable pharmacokinetic and pharmacodynamic profiles for administration by continuous infusion. Propofol is the best suited intravenous agent for maintenance of anaesthesia, as it provides a rapid onset of anaesthesia, as shown by its short equilibration half-times ($T_{1/2}$ Ke0) and rapid recovery, as shown by its short context-sensitive half-times. In addition propofol has several advantages over volatile anaesthetics such as a very low incidence of postoperative nausea and vomiting and it could be safely used in patients susceptible to malignant hyperthermia. Propofol and opioids in general as well as propofol and alfentanil potentiate one another when given perioperatively. A similar behaviour in drug interaction can be seen when propofol is combined with remifentanyl, the youngest opioid, which is characterised – in contrast to alfentanil – by an extremely short duration of action and which allows furthermore a rapid and predictable response to alterations in dose.^{9,10}

5. Difficult tracheal intubation in thyroid surgery

The anaesthetist should expect that 6% of tracheal intubations for thyroid surgery will be difficult. The evaluation of factors linked to difficult endotracheal intubation (DEI) is limited to a few studies. In the study of Bouaggad¹¹ with multivariate analysis, two criteria were recognised as independent for DEI (Cormack Grade III or IV and cancerous goitre) and it concludes that a large goitre is not associated with a more frequent DEI. However, the presence of a cancerous goitre is a major factor predicting DEI caused by tracheal invasion and tissue infiltration by the carcinoma associated with fibrosis which may reduce the mobility of laryngeal structures and make the laryngoscopic view more difficult. Whenever supposing that the airway will be lost if anaesthesia is induced, awake fiberoptic intubation is the method of choice.

6. Intraoperative neuromonitoring

The incidence of temporary unilateral vocal cord paralysis resulting from damage to the recurrent laryngeal nerve (RLN) is 3–4%. Permanent unilateral vocal cord paralysis occurs in <1% of patients and bilateral vocal cord paralysis should be extremely rare. Injury to the recurrent laryngeal nerve may occur by several mechanisms including ischaemia, contusion, traction, entrapment and actual transection. There is a greater risk of nerve damage during surgery for malignancy and reintervention. Attempts to protect the recurrent laryngeal nerve during thyroidectomy involve detecting vocal cord movement after nerve's stimulation. Intraoperative electro-physiological monitoring concerns the use of a tracheal tube with integrated EMG electrodes positioned at the level of the vocal cords. When the RLN has been identified, the nerve is stimulated until an evoked EMG is obtained. In addition to the atraumatic dissection of the RLN, intraoperative neuromonitoring has become accepted practice during surgery in this area.

A quantitative neurophysiological evaluation of the RLN is based on the recording of evoked potential at the vocalis muscle. Thus neuromuscular blockade may interfere with intraoperative neuromonitoring of the RLN. In the study of Marush et al. the influence of muscle relaxation on neuromonitoring of the recurrent laryngeal nerve was investigated. The main findings were that neuro-monitoring of the RLN is applicable despite muscle relaxation <90%

and that the laryngeal muscles exhibited a shorter response time than the adductor pollicis and quickly recovered.¹²

7. Postoperative complications

7.1. Haematoma

Postoperative haemorrhage is potentially catastrophic when someone is operating on the neck but it could be avoided by fair haemostasis. The anaesthetist may be asked to maintain the patient's intrathoracic pressure positive for 10–20 s in order to assess haemostasis before wound closure.¹³ Clip removers usually were kept at the bedside to enable rapid relief of a haematoma. Fast decision-making is important and early re-intubation is recommended. The later intubation is obviously performed the more difficult it becomes as the haematoma expands and compresses the airway.

Respiratory obstruction may be caused by laryngeal and pharyngeal oedema as a result of venous and lymphatic obstruction by the haematoma rather than direct tracheal compression.

7.2. Tracheomalacia

Tracheal collapse following thyroidectomy results from prolonged compression of the trachea by a large, neglected goitre, particularly within the confines of the thoracic inlet.¹⁴ It is a life-threatening complication,¹⁵ which should be considered before extubation, and management strategies should be available. Management of tracheomalacia requires urgent re-intubation, possibly tracheostomy and some forms of tracheal support such as ceramic rings.

7.3. Laryngeal oedema

Laryngeal complications of tracheal intubation can be seen during the postoperative indirect laryngoscopy which is performed to identify recurrent laryngeal nerve damage. Oedema and traumatic lesions were noted in 4.6% of patients.¹⁶ While trauma to the larynx from the tracheal tube will cause minor swelling, laryngeal oedema is a rare cause of post-thyroidectomy respiratory obstruction.

7.4. Hypocalcaemia

After thyroidectomy for large multinodular goitre the incidence of temporary hypocalcaemia occurs in 20% of patients about 36 h postoperatively. This might be reduced by more careful inspection of the thyroid capsule.¹⁷

7.5. Postoperative nausea and vomiting

Patients undergoing thyroidectomy are at high risk for the development of postoperative nausea and vomiting (PONV). Combination antiemetic therapy with granisetron plus droperidol or granisetron plus dexamethasone is highly effective in preventing PONV.¹⁸

7.6. Postoperative pain

Patients usually tolerate thyroidectomy very well and require minimal postoperative analgesia. They often complain of a stiff neck because of the position during surgery rather than pain from the site of the incision. Concerning these considerations it is successful to combine NSAIDs and acetaminophene. We

recommend while performing TIVA the adoption of post-operative pain protocols to be started within the intervention.

8. Conclusion

Anaesthesia for thyroid surgery requires an anaesthetist who is experienced in the recognition, assessment and management of a potentially difficult, shared airway, in a patient who may also have significant co-morbidity. We believe that TIVA is the first choice technique for thyroid surgery in order of its fast and gentle recovery from anaesthesia and concerning the lower incidence of postoperative nausea and vomiting. Neuromonitoring during thyroidectomy is effective in providing identification and function of laryngeal nerves. The anaesthetist is strictly involved in this technique being responsible of the right positioning of the endotracheal tube and the management of the neuromuscular blockade.

Conflict of interest

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Ethical approval

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