South Afr J Anaesth Analg. 2022;28(5 Suppl 1):S193-196
https://doi.org/10.36303/SAJAA.2022.28.5.2880

South Afr J Anaesth Analg
ISSN 2220-1181 EISSN 2220-1173

FCA REFRESHER COURSE

Anaesthesia for retrosternal thyroidectomy

T Kleyenstuber

Department of Anaesthesia, School of Clinical Medicine, Faculty of Health Sciences, Rahima Moosa Mother & Child Hospital, University of the Witwatersrand, South Africa
Corresponding author, email: *t.kleyenstuber@gmail.com, thomas.kleyenstuber@wits.ac.za*

Keywords: anaesthesia, retrosternal thyroid, thyroidectomy

Introduction

Thyroidectomy is one of the commonest endocrine surgeries performed globally.[1,2] The introduction of general anaesthesia, infection prophylaxis and basic cautery during the mid-19th century significantly reduced the mortality from thyroid surgery, which was historically greater than 40%.[3] Modern-day thyroidectomy has a mortality rate of 0.065%. Cervical haematomas, complications from prolonged intubation, tracheal injury and heart failure account for most deaths, typically in patients of advanced age, with large goitres and upper airway complications.[4] Even in specialised endocrine surgery units, major complications such as cervical haematomas, hypoparathyroidism and recurrent laryngeal nerve (RLN) injuries still occur.[4]

Amongst the anaesthesia community, it is widely believed that endotracheal intubation is difficult and tracheomalacia is common in patients with retrosternal goitres (RSG).[5-7] This perception likely stems from anecdotal case reports, but is not supported by larger series or prospective studies.[5-10] Furthermore, there is little consensus amongst experts on the ideal approach to airway management in patients with RSG and obstructive symptoms.[11]

Goitre pathology

The term goitre refers to an abnormally enlarged thyroid gland, and goitres are either smooth or nodular in appearance.[12] Globally, the commonest cause of goitres is iodine deficiency. Autoimmune diseases such as Grave's disease and Hashimoto's thyroiditis are the most typical cause in industrialised countries. Multinodular goitres may have a genetic predisposition. Other causes include tumours (benign and malignant) as well as infiltrative diseases.[12,13]

Clinical presentation

Most patients with goitres are asymptomatic and biochemically euthyroid.[12,13] However, Hashimoto's thyroiditis and severe iodine deficiency are the commonest causes of hypothyroidism in patients with goitres and hyperthyroidism is often the presenting feature in patients with Grave's disease or toxic multinodular goitres.[13]

Goitres grow slowly over decades and significant obstructive symptoms typically only present during the fifth or sixth decades of life. The obstructive symptoms gradually worsen as the compression of surrounding structures slowly progresses. Haemorrhage into a nodule may however present acutely due to a rapidly enlarging gland.[13]

The trachea is the structure most often compressed by an enlarging thyroid gland. Cervical nerves as well as the oesophagus may also be affected. Retrosternal extension can exert a mass effect on the structures in the anterior mediastinum.[12,13] However, even large RSG do not routinely present the attending anaesthetist with the concerns associated with large (non-thyroid) anterior mediastinal masses.[6,7,14] A possible explanation for this is that RSG are tethered to the structures in the neck and therefore exert less pressure on intra-thoracic structures.[12] Retrosternal extension may, however, cause positional dyspnoea which is elicited when specific movements force the enlarged thyroid into the thoracic inlet. Tracheal narrowing may cause exertional dyspnoea or be associated with stridor or wheeze at rest. Coughing is another common symptom that may be positional.[13] Other possible obstructive symptoms and signs are listed in Table I.

Table I: Obstructive symptoms and signs associated with thyroid goitres[1,7,12,13]

Symptom/sign	Comment
Dyspnoea	Exertional or positional
Stridor or wheeze at rest	Significant tracheal narrowing
Cough	Common, often positional
Choking sensation	Common
Hoarseness	Recurrent laryngeal nerve compression
Dysphagia	Less common, gland tends to enlarge in anterior direction
Phrenic nerve palsy	Uncommon due to lateral position of nerves
Horner's syndrome	Uncommon due to posterior-lateral position of cervical sympathetic chain
Superior vena cava syndrome	'Thyroid cork' effect on thoracic inlet, more common with RSG

Surgical indications and approaches

Common indications for thyroidectomy are malignancy, obstructive symptoms, RSG, persistent or recurrent hyperthyroidism, Hashimoto's thyroiditis, and cosmetic reasons.[12] In most cases, a cervical approach is sufficient. Less than 15% of patients require a manubriotomy, sternotomy or thoracotomy. The more invasive approaches expose the patients to greater intra- and postoperative risks.[12]

Preoperative anaesthetic assessment

The preoperative assessment of patients presenting for thyroidectomy should focus on assessing the patient's thyroid status, the presence and severity of obstructive symptoms, comorbidities and relevant baseline investigations.[1,12]

Thyroid status

Patients presenting for elective thyroidectomy should be clinically and biochemically euthyroid and if necessary, should have their treatment optimised by an endocrinologist.[1] Some patients may require thyroid hormone replacement and others may be on thioamide therapy. β-blocker therapy may be necessary to further control symptoms of hyperthyroidism.

Obstructive symptoms and airway assessment

Tracheal compression and deviation are common in patients with large goitres or RSG.[6,8,10] It is a widely held, longstanding belief that deviation or compression of the trachea[8,9] and/or the presence of large RSG predict difficult intubation.[5,7] The incidence of difficult intubation in patients presenting for thyroid surgery ranges from 5.3% to 12.7%,[8,15] Different study methodologies may explain the wide discrepancy. In their prospective study of 320 patients presenting for thyroid surgery, Bouaggad et al.[8] evaluated intubation difficulty with the validated intubation difficulty scale (IDS)[16] and identified an incidence of 5.3%. An incidence of 12.7% was described by Chaves et al.[15] in a retrospective review of 512 medical records of patients presenting for elective thyroid surgery. The authors defined difficult intubation as the need for more than three attempts or a change in equipment by the attending anaesthesiologist. A further prospective study of 324 patients presenting for thyroid surgery by Amathieu et al.[9] determined that the incidence of difficult intubation was 11.1%. This study also utilised the IDS to classify intubation difficulty but the persons performing the intubations were not all specialised anaesthesiologists.

Interestingly, both prospective studies identified the presence of recognised anatomical predictors of difficult intubation (Mallampati class III/IV, reduced thyromental distance, reduced neck mobility) as risk factors for difficult intubation in thyroid surgery patients.[8,9] Other risk factors identified by Bouaggad et al.[8] as part of their initial univariate analysis were Cormack and Lehane grade III/IV, body mass index (BMI), tracheal deviation, tracheal compression, dyspnoea and cancerous goitres. Following the multivariate analysis, only cancerous goitres (odds ratio [OR] 1.95) and Cormack–Lehane grade III/IV (OR 2.87) were associated with difficult intubation. Amathieu et al.[9] also identified reduced mouth opening and retrognathia but not cancerous goitres or BMI as potential risk factors.

Neither thyroid surgery,[9] nor the presence of a large goitre[8] seem to be associated with increased difficulty in intubation. Furthermore, Bennet et al.[5] discovered only six cases of difficult intubation or tracheomalacia in a retrospective literature review of 1 969 patients with RSG. Even in the presence of tracheal compression, several authors have reported uncomplicated endotracheal tube insertion through the narrowed tracheal segment.[5-8]

Dempsey et al.[6] performed a retrospective review of 19 patients with massive RSG (goitre extending down to the aortic arch or beyond) who presented to a dedicated head and neck surgery unit. Tracheal narrowing and deviation were present in all patients, and 10 patients had symptoms of airway obstruction. In 18 patients, direct laryngoscopy and intubation were uneventful following intravenous induction. Muscle relaxant was administered after the ability to bag-mask ventilate had been established. Intubation failed in one patient following a gas induction. A successful awake fibreoptic intubation (AFOI) was later performed in this patient but post-intubation direct laryngoscopy revealed a Cormack–Lehane grade II view. In all patients, the size of the endotracheal tube was based on the patient's size and not the narrowest tracheal diameter, even in the 10 patients in whom the narrowest lumen measured less than 10 mm. Ventilation was not difficult in any of the 19 patients.

The results of a recent retrospective study by Pan et al.[10] echo those of Dempsey et al.[6] The authors also describe the successful use of video laryngoscopy as a feasible technique in patients with massive RSG.[10]

Dempsey et al.[6] describe the anaesthetic management of patients with massive RSG by experts in a dedicated head and neck unit. The low complication rate associated with their preferred technique (intravenous induction followed by direct laryngoscopy and intubation) is likely the result of excellent teamwork by a group of experts in a dedicated and familiar environment. However, even amongst experts, opinions often differ. Cook et al.[11] presented a complicated case of airway obstruction secondary to a large RSG to international experts in airway management and requested their opinions on the best airway management approach. Opinions differed significantly and were also contradictory. AFOI, intubation following intravenous induction and neuromuscular blockade, intubation following inhalational induction in a spontaneously breathing patient, and even sedated intubation, were all offered as best approaches. Almost all experts recommended the use of a rigid bronchoscope as a back-up plan and two experts included cardiopulmonary bypass in their plan B. There was little consensus on a suitable extubation strategy.

AFOI in patients with significant airway obstruction can be technically challenging as the patients may be significantly distressed and less cooperative. Furthermore, the passage of

the fibrescope may completely obstruct the airway and thereby worsen the patient's distress.[7,12] Local anaesthetic topicalisation of the airway or the administration of sedatives may further worsen the obstruction.[12]

Based on the literature discussed above, the following conclusions can be drawn:

- RSG often cause tracheal deviation and compression, but not all patients with RSG have obstructive symptoms.
- RSG are unlikely to cause cardiovascular compromise as may be the case with non-thyroid anterior mediastinal masses.
- The presence of an RSG, with or without obstructive airway symptoms, by itself is unlikely to cause difficult laryngoscopy or intubation.
- Classical anatomical predictors of difficult intubation, unrelated to the thyroid pathology, also predict difficult laryngoscopy and intubation in patients presenting for thyroid surgery.
- Malignant thyroid tumours may invade the trachea and surrounding structures and may cause greater difficulty with airway management.
- Tracheal narrowing caused by benign goitres is not fixed and will usually allow the passage of regular-sized endotracheal tubes.

Based on these conclusions, the following recommendations can be made:

- For all patients presenting for thyroidectomy, the attending anaesthetist should have a meticulous airway management plan and at least one back-up plan in place.
- These plans should be based on the perceived difficulty of face mask ventilation, intubation, use of a rescue airway device and front of neck access.
- In patients presenting for resection of a benign RSG, intravenous induction followed by routine, direct or video laryngoscopy and intubation is an appropriate technique in experienced hands.
- AFOI should be considered in patients with RSG who also have other traditional predictors of difficult airway management.
- The use of unfamiliar techniques may overly complicate difficult airway management plans.
- In patients with tracheal narrowing due to a benign goitre, the endotracheal tube size should be based on patient size, rather than the narrowest tracheal diameter identified on imaging.
- A suitable extubation strategy should always be planned and may have to be revised during the surgery.

Investigations

Preoperative investigations for patients with RSG should include a thyroid function test and baseline serum calcium. X-rays and computerised tomography (CT) will show the size and extent of the goitre as well as the severity and location of airway distortion or narrowing. Other mass effects should also be identified. Flexible nasoendoscopy is useful for assessing distorted upper airway anatomy and vocal cord dysfunction.[1,12] Flow volume loops correlate poorly with symptom severity and degree of airway distortion or obstruction identified on CT scan.[12]

Intraoperative anaesthetic management

The airway management concerns in patients with RSG have been highlighted above. Once the patient has been intubated, intraoperative management is the same as for routine thyroidectomies. A review by Farling[17] describes the relevant anaesthetic considerations in detail.

Postoperative complications

The prevalence of postoperative tracheomalacia in patients with RSG is very low.[5-7,10] A retrospective review of 919 patients with RSG identified only two cases. Both cases were diagnosed intraoperatively.[7] Good communication between anaesthetist and surgeon should avoid failure to recognise these rare cases before attempted extubation.

Retrosternal extension of a goitre may require a surgical approach that is more invasive than the routine cervical incision. This exposes the patient to greater risk.[12] Even in specialist units, complications such as postoperative bleeding and RLN injury are more frequent with retrosternal thyroidectomies.[6] The incidence of transient hypocalcaemia is also increased.[18]

Conclusion

Patients with RSG who present for thyroidectomies require meticulous preoperative assessment. Tracheal compression and deviation are common and many patients with RSG will have symptoms of airway obstruction. Despite this, intravenous induction followed by routine, direct or video laryngoscopy and intubation seems to be an appropriate technique in patients who do not have additional risk factors for difficult airway management. However, all cases should be individualised, and the attending anaesthetist should prepare for and discuss at least one back-up plan with the entire theatre team. Even in the presence of retrosternal extension, the incidence of tracheomalacia remains very low. The other, potentially life-threatening postoperative complications are, however, more common.

ORCID

T Kleyenstuber https://orcid.org/0000-0001-5219-3869

References

1. Bajwa SJS, Sehgal V. Anesthesia and thyroid surgery: The never ending challenges. Indian J Endocrinol Metab. 2013;17(2):228. https://doi.org/10.4103/2230-8210.109671.
2. Dionigi G, Dionigi R, Bartalena L, et al. Current indications for thyroidectomy. Minerva Chir. 2007;62(5):359-72.
3. Dorairajan N, Pradeep PV. Vignette thyroid surgery: a glimpse into its history. Int Surg. 2013;98(1):70-75. https://doi.org/10.9738/CC185.1.
4. Gómez-Ramírez J, Sitges-Serra A, Moreno-Llorente P, et al. Mortality after thyroid surgery, insignificant or still an issue? Langenbecks Arch Surg. 2015;400(4):517-22. https://doi.org/10.1007/s00423-015-1303-1.
5. Bennett A, Hashmi S, Premachandra D, Wright M. The myth of tracheomalacia and difficult intubation in cases of retrosternal goitre. J Laryngol Otol. 2004;118(10):778-80. https://doi.org/10.1258/0022215042450751.

6. Dempsey G, Snell J, Coathup R, Jones T. Anaesthesia for massive retrosternal thyroidectomy in a tertiary referral centre. Br J Anaesth. 2013;111(4):594-9. https://doi.org/10.1093/bja/aet151.
7. Gilfillan N, Ball CM, Myles PS, et al. A cohort and database study of airway management in patients undergoing thyroidectomy for retrosternal goitre. Anaesth Intensive Care. 2014;42(6):700-8. https://doi.org/10.1177/0310057X1404200604.
8. Bouaggad A, Nejmi SE, Bouderka MA, Abbassi O. Prediction of difficult tracheal intubation in thyroid surgery. Anesth Analg. 2004;99(2):603-6. https://doi.org/10.1213/01.ANE.0000122634.69923.67.
9. Amathieu R, Smail N, Catineau J, et al. Difficult intubation in thyroid surgery: myth or reality? Anesth Analg. 2006;103(4):965-8. https://doi.org/10.1213/01.ane.0000237305.02465.ee.
10. Pan Y, Chen C, Yu L, Zhu S, Zheng Y. Airway management of retrosternal goiters in 22 cases in a tertiary referral center. Ther Clin Risk Manag. 2020;16:1267. https://doi.org/10.2147/TCRM.S281709
11. Cook T, Morgan P, Hersch P. Equal and opposite expert opinion. Airway obstruction caused by a retrosternal thyroid mass: management and prospective international expert opinion. Anaesthesia. 2011;66(9):828-36. https://doi.org/10.1111/j.1365-2044.2011.06650.x.
12. Wong P, Chieh Liew GH, Kothandan H. Anaesthesia for goitre surgery: A review. Proc. Singapore Healthc. 2015;24(3):165-70. https://doi.org/10.1177/2010105815596095.
13. Ross DS. Clinical presentation and evaluation of goitre in adults. UpToDate. Waltham, MA: UpToDate. Available from: http://www.uptodate.com/contents/clinical-presentation-and-evaluation-of-goiter-in-adults. Accessed 29 Aug 2022.
14. Ku CM. Anesthesia for patients with mediastinal masses. In: Slinger P, editor. Principles and practice of anesthesia for thoracic surgery. New York, NY: Springer; 2011. p. 201-10. https://doi.org/10.1007/978-1-4419-0184-2_14.
15. Chaves A, Carvalho S, Botelho M. Difficult endotracheal intubation in thyroid surgery: a retrospective study. Internet J Anesthesiol. 2009;22(1).
16. Adnet F, Borron SW, Racine SX, et al. The Intubation Difficulty Scale (IDS): Proposal and evaluation of a new score characterizing the complexity of endotracheal intubation. Anesthesiology. 1997;87(6):1290-7. https://doi.org/10.1097/00000542-199712000-00005.
17. Farling P. Thyroid disease. Br J Anaesth. 2000;85(1):15-28. https://doi.org/10.1093/bja/85.1.15.
18. Abboud B, Sleilaty G, Mallak N, Abou Zeid H, Tabchy B. Morbidity and mortality of thyroidectomy for substernal goiter. Head Neck. 2010;32(6):744-9. https://doi.org/10.1002/hed.21246.