

Challenges in airway management in patients undergoing thyroid surgeries—a case series

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ABSTRACT

Airway management in patients undergoing thyroid surgery poses unique challenges due to potential anatomical distortions caused by thyroid enlargement. Difficult intubation in such cases occurs in 2–12.7% of patients, with a failure rate of up to 0.5%. This case series highlights varied clinical scenarios of thyroid-related airway difficulties and underscores the importance of individualized anaesthetic strategies. We present four distinct cases of patients with large thyroid swellings, each illustrating different aspects of airway compromise and anesthetic management. A 56-year-old woman with a massive longstanding goiter underwent successful awake fiberoptic intubation and thyroidectomy, with postoperative tracheomalacia requiring delayed extubation after 48 hours. 40-year-old woman with bilateral thyroid enlargement and minimal compressive symptoms underwent conventional intubation following induction, with an uneventful perioperative course. A 55-year-old woman with longstanding multinodular goiter developed acute airway compromise. Difficult intubation was managed using video laryngoscopy and bougie, followed by delayed extubation for tracheomalacia. A 64-year-old woman with massive thyroid enlargement causing tracheal deviation and vascular compression underwent successful nasal fiberoptic intubation, uneventful surgery, and safe extubation. This series highlights that the complexity of airway management in thyroid surgery varies significantly based on goiter size, anatomical distortion, and airway involvement. Awake fiberoptic intubation remains a cornerstone technique in managing difficult airways, especially in the presence of tracheal compression or deviation. Video-assisted devices and a multidisciplinary approach enhance safety and outcomes. An individualized, well-planned anesthetic approach based on thorough preoperative assessment is crucial in minimizing morbidity and ensuring safe airway management in thyroid surgery.

Keywords: Airway management, thyroid surgeries, fibreoptic intubation

INTRODUCTION

Managing the airway in individuals with significant thyroid swelling can pose a challenging task for anesthesiologists. Surgeries for these types of swellings can range from relatively simple procedures, such as nodulectomy or thyroidectomy, to more complex operations that may require a sternotomy. When patients with such conditions undergo general anesthesia, anatomical variations can pose significant challenges in airway management.¹ An anterior neck mass can limit neck mobility, reduce mouth opening, and cause deviation or compression that narrows the trachea. If the swelling extends past the thoracic inlet, it may also compress the trachea, esophagus, or major mediastinal blood vessels.² Studies have reported that thyroid masses cause tracheal compression in up to 91% of cases, while retrosternal extension occurs with a variable incidence ranging from 0.2% to 45%.³ A long-standing thyroid swelling

is not only a risk factor for a difficult airway but is also linked to complications such as acute airway obstruction, hemorrhage, thyroid dysfunction, infection, tracheomalacia, hypocalcemia, and voice changes.⁴ The occurrence of challenging intubation in cases of thyroid swellings ranges from 2–12.7%, with a failure rate of up to 0.5%.⁵ Consequently, a comprehensive preoperative assessment is crucial to identify any indications or symptoms of a difficult airway. It is essential to thoroughly investigate these aspects and establish a prearranged strategy, including alternative techniques, before proceeding with surgery.

Here we present a case series of anaesthetic challenges faced in airway management of patients (Table) posted for thyroid surgery, each case highlighting a distinct pattern of airway involvement—ranging from minimal compressive symptoms

Table. Comparison of airway management across four thyroid surgery cases

Parameter	Case 1	Case 2	Case 3	Case 4
Age/gender	56/Female	40/Female	55/Female	64/Female
Thyroid size	12×14 cm	7×3 cm	Right: 50×32 mm; left: 54×60 mm; isthmus thickness: 20 mm	9.6×9.7×10.2 cm
CT findings	Tracheal narrowing (AP diameter ~0.5 cm), elongation, and rightward deviation; no retrosternal extension	Enlarged thyroid with heterogeneous attenuation and nodular changes; no significant tracheal compression	Massive thyroid enlargement with rightward tracheal deviation and near-complete compression over 4–5 cm; retrosternal extension present	Large mixed solid–cystic lesion from right thyroid lobe with leftward tracheal deviation; compression of adjacent vascular structures
Primary airway strategy	Awake fiberoptic intubation (6.5 mm ETT) using spray-as-you-go technique	Conventional induction followed by direct laryngoscopy and intubation (7.5 mm ETT)	Video laryngoscopy-assisted intubation with tracheal introducer (bougie) and 6.0 mm ETT	Awake nasal fiberoptic intubation using flexible bronchoscope
Postoperative complications	Tracheomalacia requiring delayed extubation; ICU stay; persistent left vocal cord palsy	None	Tracheomalacia requiring prolonged ventilation and delayed extubation	None

CT: Computed tomography, AP: Anteroposterior, ETT: Endotracheal tube, ICU: Intensive care unit

to severe tracheal deviation, acute airway compromise, and postoperative tracheomalacia—thereby capturing the heterogeneity of airway presentations associated with thyroid enlargement.

CASE 1

56-year-old female, presented with a gradually increasing midline neck swelling for 20 years with the present size of 12×14 cm (**Figure 1**). Patient also complained of pain at the swelling site, hoarseness of voice, difficulty in swallowing and difficulty in breathing which was worse on lying flat. Local examination revealed anterior asymmetrical midline neck swelling extending to submental region above and up to sternum below, laterally extending till the posterior border of sternocleidomastoid muscle bilaterally. Lower border of the swelling noted just above the sternal notch. Patient had negative Pemberton sign, negative Berry's sign, positive Kocher's test. Airway examination showed restricted mouth opening and neck flexion, and Mallampati grade IV.

Computed tomography (CT) of the neck demonstrates marked rightward displacement of the larynx and cervical trachea. No evidence of retrosternal extension is identified. The trachea appears narrowed and elongated in the anteroposterior dimension, with a transverse luminal diameter of approximately 0.5 cm. Video-laryngoscopy done by Ear, Nose & Throat (ENT) surgeon showed larynx pushed to the right and fixed left vocal cord (**Figure 1**).

Fiberoptic-guided awake endotracheal intubation was performed using a 6.5 mm cuffed endotracheal tube with the “spray-as-you-go” technique. Airway topicalization was achieved using 2% Lidocaine, with a total dose carefully titrated to remain within the safe limit of 3–4 mg/kg. Continuous oxygen supplementation was done via side port of the bronchoscope. After Correct placement of the tube in the trachea was confirmed by end-tidal carbon dioxide, Patient was induced with Inj. Propofol 2 mg/kg and relaxed with Inj Atracurium 0.5 mg/kg and was maintained on oxygen, air and isoflurane.

Thyroid abscess was present along with the goiter and about 1000ml of pus drained and then total thyroidectomy was performed. Postoperatively, in view of complication of tracheomalacia, extubation was postponed, and the patient was shifted to intensive care unit (ICU). After 48 h, after confirming positive leak test, extubation was done by the anaesthetist in the presence of ENT surgeon with the backup for tracheostomy. Extubation was uneventful. Repeat video laryngoscopy showed fixed left vocal cord with bowing, mobile right vocal cord, phonatory gap present. Biopsy result was negative for malignancy and indicated nonspecific abscess and colloid goiter. Later patient was discharged with further follow up for speech therapy.

CASE 2

40-year-old female presented with swelling in front of neck since 4 years, and complained of pain during swallowing in the last 15 days. There were no other compressive symptoms. Examination revealed neck swelling, which was

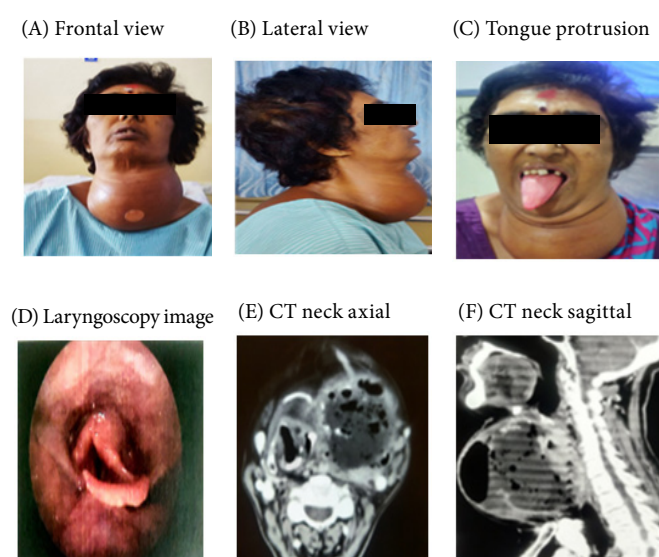


Figure 1. Clinical photographs of (A) Frontal view, (B) lateral view, and (C) tongue protrusion in case 1 with a large anterior neck swelling. (D) Video laryngoscopy image showing distorted laryngeal anatomy. (E) Axial and (F) sagittal computed tomography (CT) images demonstrating a large thyroid mass with significant tracheal compression and deviation.

approximately 7x3 cm bilaterally. It was extending laterally up to sternocleidomastoid muscle, lower border of the swelling was palpable above the suprasternal notch, suggesting no retrosternal extension. Swelling was firm in consistency. Airway examination was normal except for restricted neck flexion.

CT scan of the neck revealed a markedly enlarged thyroid gland with heterogeneous attenuation and areas of nodular enlargement. Video laryngoscopy showed bilaterally mobile vocal cords. As there was no compression noted in the neck X-rays (Figure 2), patient was induced and relaxed after confirming adequate mask ventilation, direct laryngoscopy was attempted, and airway secured with 7.5 mm cuffed endotracheal tube. Intraoperative period was uneventful. After ensuring mobile vocal cords, adequate ventilatory efforts and positive leak test, extubation was done on table.

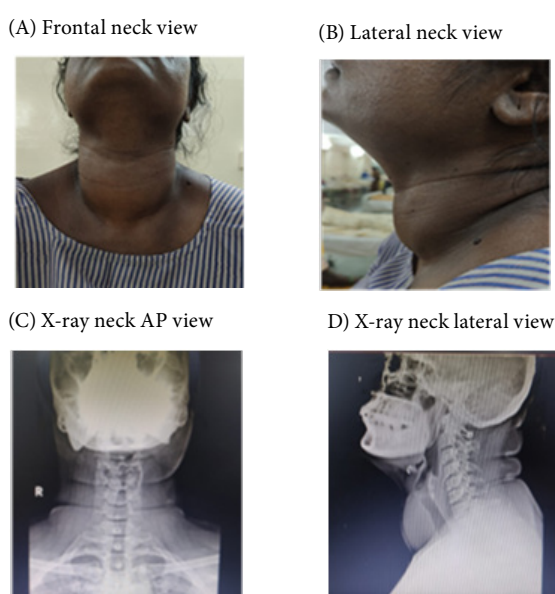


Figure 2. (A) Frontal and (B) lateral clinical photographs showing anterior neck swelling in case 2. (C) Anteroposterior (AP) and (D) lateral neck radiographs demonstrating an enlarged thyroid gland without significant tracheal compression or deviation.

CASE 3

A 55-year-old female had difficulty in breathing for 5 months, aggravated since 4 days and she was rushed to the hospital as it gotten worse for last 3 hours. She had cough with expectoration and fever in the last 4 days, for which she was treated with antibiotics and nebulization at a local hospital and was diagnosed with multinodular goiter with lower respiratory tract infection (LRTI) before presenting to our hospital. She had history of hypothyroidism for 20 years and was treated with levothyroxine regularly. She was asymptomatic till 2 years ago, when she developed a visible neck swelling and was suggested to undergo thyroidectomy. She stopped thyroxine medication 5 months ago after which the goitre increased in size.

CT scan of the neck showed diffuse gross enlargement of both lobes of thyroid (right lobe 50x32 mm; left lobe 54x60 mm; anteroposteriorxtransverse, isthmus thickness 20 mm). Mass effect noted over trachea causing right sided deviation

and near complete compression for length of approximately 4-5 cm from subglottic to upper tracheal region (Figure 3).

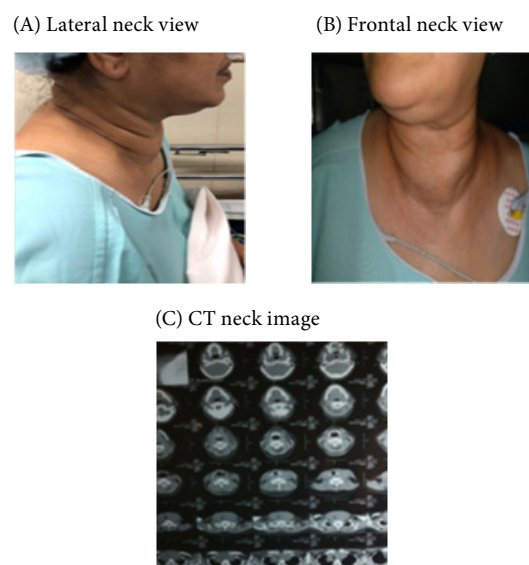


Figure 3. (A) Lateral and (B) frontal clinical photographs showing anterior neck swelling in case 3. (C) computed tomography (CT) image demonstrating diffuse enlargement of both thyroid lobes with marked tracheal deviation and near-complete compression.

On admission, she was immediately nebulized. Her vitals were stable with bilateral rhonchi and both inspiratory and expiratory stridor was heard. She was shifted to the ICU and the need for total thyroidectomy was explained. In this case, the decision to proceed with early surgical intervention was driven by the severity and progression of airway compromise rather than the infection alone. Moreover, the infectious component was being actively managed with antibiotics and supportive therapy, and the patient was hemodynamically stable at the time of intervention. Patient was explained the procedure of awake intubation and the difficulty in securing an airway. The patient underwent a flexible video laryngoscopy by the ENT surgeon which showed a clear view of the glottis with bilateral mobile vocal cords.

A cardiothoracic surgeon was consulted, and preparations were made in case of emergency sternotomy and cardiopulmonary bypass was required. After airway preparation, patient was shifted to the OT, She was placed in a propped-up position. Video laryngoscopy (C-MAC® video laryngoscope, Karl Storz, Germany) done, and vocal cords visualized. A tracheal introducer (bougie) was advanced beyond the vocal cord and a 6.0 mm cuffed endotracheal tube was advanced over it. After confirmation of intubation, patient was induced with inj. propofol 2 mg/kg & relaxed with Inj. Atracurium 0.5 mg/kg. Both lobes were removed, and retrosternal component was delivered by blunt digital dissection. Tracheomalacia was noted by the surgeon and hence patient was not extubated after surgery.

She was shifted to the ICU where she was on mechanical ventilation. On 2nd post operative day a leak test was performed but only 30 ml leak was present. On 3rd post operative day patient had a leak test of 150 ml on pressure support ventilation (PSV). A ventilating bougie inserted through endotracheal tube as a reintubation bridge and extubation was done.

CASE 4

A 64-year-old female presented with complaints of swelling in right side of neck for 15 years, increasing in size since the last 2 years. (Figure 4) Patient had acute onset of pain over the swelling with no history of dysphagia, dyspnoea or hoarseness of voice. On evaluation, patient was euthyroid. Airway examination showed mouth opening more than 3 finger breadths, Mallampati grade IV. Flexion and extension of neck was restricted.

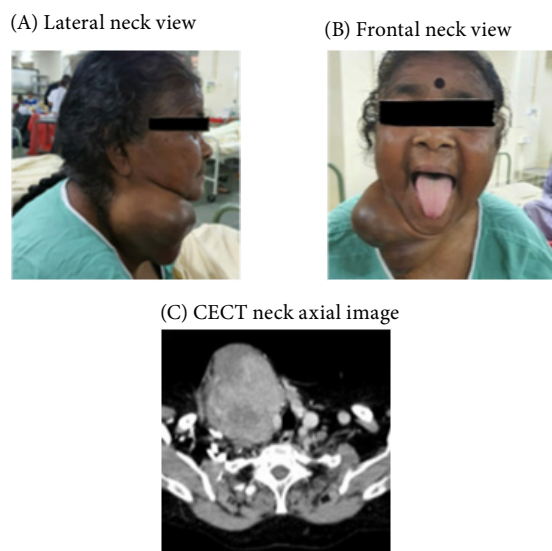


Figure 4. (A) Frontal and (B) lateral clinical photographs showing a large right-sided thyroid swelling with significant anterior neck distortion in case 4. (C) Axial contrast-enhanced computed tomography (CECT) image demonstrating a large thyroid mass causing leftward deviation of the trachea with compression of adjacent soft tissue structures.

The contrast-enhanced computed tomography (CECT) of the neck revealed a large, well-defined mixed solid–cystic lesion measuring approximately 9.6×9.7×10.2 cm, arising from the right lobe of the thyroid. The lesion extended superiorly up to the angle of the mandible and inferiorly to the root of the neck, abutting the right brachiocephalic artery, along with mass effect on the right internal jugular vein and common carotid artery. The trachea was deviated to the left. Bilateral vocal cords were mobile on indirect laryngoscopy. The patient was scheduled for total thyroidectomy. In view of anticipated difficult airway, right nasal intubation guided by single-use flexible bronchoscope was done. Patient underwent total thyroidectomy and right modified radical neck dissection without any intraoperative complications. Patient was reversed and an uneventful extubation was done postoperatively.

DISCUSSION

The management of the airway poses a concern for both the anesthetist and the surgeon when dealing with patients undergoing thyroidectomy. Challenges may arise throughout the preoperative, intraoperative, and postoperative phases. An in-depth pre-anaesthetic assessment, encompassing symptoms, airway evaluation, blood profile, and imaging studies, forms the foundation for effective anaesthetic management.⁶ Thyroid enlargement can induce tracheal compression, deviation, and softening of tracheal rings, potentially leading to tracheal

collapse during anesthesia. However, the impact varies based on factors such as size, duration, pathological type, or invasion into surrounding tissues. Airway ultrasound can provide real-time, bedside evaluation of tracheal diameter, degree of compression, tracheal deviation, and soft tissue characteristics, which may aid in anticipating airway difficulty and planning intubation strategies. It may also be useful in identifying the cricothyroid membrane and guiding emergency airway access if required. Additionally, the retrosternal extension of the thyroid may compress the intrathoracic part of the trachea, posing more intricate management issues.⁷

Managing a difficult airway in patients with thyroid enlargement offers various modalities, contingent on the anesthesiologist's expertise and familiarity. Malhotra and Sodhi⁸ outlined a strategy for airway management in thyroid patients, incorporating options like inhalation induction with sevoflurane, awake fiberoptic intubation (AFOI), tracheotomy, or ventilation using a rigid bronchoscope. In cases of challenging airways with substantial, compressive thyroid masses, maintaining tissue oxygenation through cardiopulmonary bypass has also been documented. In our case scenario 1, the airway obstruction was likely multifactorial, resulting not only from the structural enlargement of the thyroid gland but also from acute inflammatory edema, mass effect from the abscess collection, and possible surrounding tissue involvement, hence we planned AFOI. For small enlargements without deviation or compression, and with a normal airway examination, standard airway management is pursued. In a study by Bouaggad et al.,⁹ easy tracheal intubation was observed in 36.9% of patients, mild tracheal difficulty in 57.8%, while 5.3% experienced moderate to major airway challenges.

Managing the airway in the presence of a substantial retrosternal goiter can be challenging, with the potential for cardiorespiratory collapse. The primary objective of airway management in this scenario is to maintain airway patency while choosing a technique that is likely to secure the airway on the first attempt. In cases of significant airway compression, many airway experts recommend delaying the induction of anesthesia and muscle relaxation until after securing the airway. Among these patients, AFOI is often considered the safest method for airway securing and is frequently the initial choice. Nevertheless, contingency plans are essential in case of intubation failure or inability to bypass the obstruction following AFOI. In a consensus of expert opinions on difficult airway management in patients with a retrosternal goiter, seven out of eight airway management experts selected rigid bronchoscopy as a backup plan.¹⁰

Saxena et al.¹¹ highlighted that utilizing AFOI can effectively minimize bleeding and edema, resulting in a higher likelihood of success in airway management. Sendasgupta et al.¹² and Tan and Esa,¹³ in their respective studies, indicated that AFOI contributes to enhanced hemodynamic stability, improved patient tolerance, and the maintenance of airway patency. Ghai et al.¹⁴ recommended the strategic planning of early fiberoptic intubation when there is suspicion of significant airway obstruction.

Although fiberoptic bronchoscopy (FOB)-assisted intubation may encounter a certain failure rate in challenging airways, with some reports suggesting rates as high as 66%, it is a technique

that demands training and experience. A well-organized execution under the guidance of experienced practitioners has the potential to significantly enhance the success rate.¹⁵

Recent literature indicates that incorporating video-assisted devices into the challenging airway algorithm can enhance patient outcomes and increase the success rate of intubation, as done in our case 3. These devices prove beneficial even in scenarios where alignment of the oral, pharyngeal, and tracheal axis is challenging, offering assistance and facilitating the intubation process.¹⁶ The choice of AFOI in case 1 was guided by the anticipated difficult airway, severity of tracheal compression, and the need to maintain spontaneous ventilation during airway securing. In contrast, in case 3, video laryngoscopy was considered feasible due to the presence of a relatively preserved glottic view on preoperative assessment, as confirmed by flexible laryngoscopy, along with the ability to visualize the vocal cords despite tracheal deviation.

Patients with large thyroid cancer pose complexities in airway management due to both regional invasion and intrathoracic extension, leading to a mass effect on the airway and major vessels. Various approaches for managing tracheal tumors have been reported in the literature, encompassing awake intubation with or without extracorporeal circulation assistance, laryngeal mask airways, tracheal stents, high-frequency jet ventilation, and regional anesthesia, particularly if the airway is not the surgical site. In rare instances, intubation may necessitate diverse positions such as sitting or even lateral decubitus.¹⁷

Most common complications encountered in these patients include laryngeal edema that necessitate immediate re-intubation following extubation. This occurrence is typically indicative of multiple intubation attempts, potential trauma to the vocal cords during intubation, and excessive dissection during surgery. Tracheomalacia is the predominant airway complication seen in patients with long standing goitres as seen in 2 of our cases. Key risk factors associated with the development of tracheomalacia in patients with long-standing goiter include prolonged duration of goiter (particularly >10–15 years), significant tracheal compression and narrowing (especially when the tracheal diameter is reduced to <1 cm on imaging), retrosternal extension, and long-segment tracheal involvement. Chronic external compression is thought to result in weakening of tracheal cartilaginous rings, predisposing to airway collapse following thyroidectomy when the supporting mass is removed. Previous studies have indicated that tracheomalacia is frequently the leading indication for tracheostomy.¹⁸

CONCLUSION

Not all situations warrant a single, universal intubation technique. The careful selection of techniques is determined by evaluating the risk versus benefit of available methods, considering evidence-based studies. Thorough preoperative airway assessment, adequate preparation, and timely decision-making, coupled with skillful management, contribute to the reduction of morbidity and mortality in cases involving difficult airways due to thyroid enlargement. This is underscored by instances where, after the failure of awake fiberoptic intubation, subsequent success has been achieved through direct laryngoscopic intubation. A personalized approach is essential for each case, taking into

account preoperative and intraoperative findings when deciding on tube retention.

ETHICAL DECLARATIONS

Informed Consent

Written informed consent was obtained from the patients included in this report. Signed consent forms are retained by the authors and are available upon request.

Peer Review Process

This report underwent external peer review.

Conflict of Interest

The authors declare no conflicts of interest.

Financial Disclosure

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Author Contributions

Concept: MS, AT, AS, NK; Design: MS, AT, AS, NK; Data Collection and/or Processing: MS, AT, AS, NK; Analysis and/or Interpretation: MS, AT, AS, NK; Literature Review: MS, AT, AS, NK; Writing the Article: MS, AT, AS, NK; Critical Review: MS, AT, AS, NK.

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