

Algorithm for airway management in benign intra-tracheal lesions

ABSTRACT

The authors have conducted a retrospective analysis based on two cases of patients with intra-tracheal pathologies who received treatment from the same surgeon at a tertiary referral center. The effective management of airways in patients with intra-tracheal lesions necessitates close collaboration between surgeons and anesthesiologists. Factors such as the size, location, rigidity of the tumor, and the remaining tracheal lumen space should be carefully considered. In situations where there is near complete obstruction of the trachea and a substantial risk of worsened respiratory function, resorting to cardiopulmonary bypass or extracorporeal membrane oxygenation is advisable. This pilot study aims at devising an algorithm for the airway management of intra-tracheal lesions, although a larger case cohort is needed to assess its applicability and effectiveness.

Key words: Airway obstruction, emergency ENT, endoscopy, general ENT, trachea

Introduction

Intra-tracheal tumors can be either benign or malignant, with a higher prevalence of malignant cases. Benign variants, including hemangioma, hamartoma, and papilloma are rare and occur with lower incidence rates.^[1] An extremely uncommon benign intra-tracheal tumor is primary Schwannoma, with an incidence of 0.2%.^[2] In its early stage, this tumor is uncharacteristic and can lead to obstruction of the tracheal lumen as it grows.^[1] Tracheal Schwannoma is more prevalent in females, with no specific age preference, and localizes most frequently to the lower third of the trachea, followed by the upper third.^[3]

To provide a better understanding and more effective management of benign intra-tracheal lesions, the authors

aim to extrapolate an algorithm based on their experience in managing a case of primary tracheal Schwannoma and a case of multiple foreign bodies within the trachea. The proposed algorithm will serve as a valuable guide for accurate diagnosis and appropriate airway management in such cases.

Case Presentation

Case 1

An 18-year-old female presented with inspiratory stridor, cough, dysphonia, and neck pain. She had experienced shortness of breath for the past six months, worsening upon minimal exertion. The patient had no known food or drug allergies and had no significant past surgical or family history.

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How to cite this article: El Hadi N, Hosri J, Tulimat T, Hadi U. Algorithm for airway management in benign intra-tracheal lesions. Saudi J Anaesth 2024;18:438-41.

Access this article online	
Website: https://journals.lww.com/sjan	Quick Response Code 
DOI: 10.4103/sja.sja_975_23	

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Submitted: 22-Dec-2023, **Accepted:** 26-Dec-2023, **Published:** 04-Jun-2024

Patient's vital signs were normal except for tachycardia. She was alert, oriented, and cooperative while sitting in a comfortable position. Examination revealed subcutaneous tender emphysema in the neck and axilla bilaterally. Complete blood count, chemistries, and coagulation profile were within normal limits. CT scan and MRI of the chest revealed a well-circumscribed intra-tracheal soft tissue polypoid lesion obstructing 80% of the tracheal lumen.

The patient's respiratory status progressively worsened, which required life-saving surgical exploration and airway control using femoro-femoral cardiopulmonary bypass under local anesthesia. On rigid bronchoscopy, a lesion with firm consistency nearly obstructing the tracheal lumen was encountered. When attempting to debulk the mass, only 10% could be resected due to the difficulty in maintaining appropriate oxygenation while on cardiopulmonary bypass [Figure 1a].

The surgical pathology confirmed the diagnosis of schwannoma, and the patient subsequently underwent laryngotracheal resection a few days after the diagnostic operation. This case was presented to highlight the role of cardiopulmonary bypass in the airway management of intra-tracheal lesions obstructing more than 80% of the tracheal lumen.

Case 2

A 53-year-old male patient known to have laryngeal tumor status postchemoradiotherapy followed by laryngectomy and tracheostomy, presented with multiple pieces of glass in the tracheostomy. CT scan of the chest revealed three glass fragments around the endotracheal tube in the trachea and one large fragment in the right main bronchus. Given the high risk for bleeding, dislodgement of the foreign body, airway injury, and CO₂ retention from bronchoscopy with jet ventilation, extracorporeal membrane oxygenation (ECMO) with removal of the foreign bodies via rigid bronchoscopy was performed.

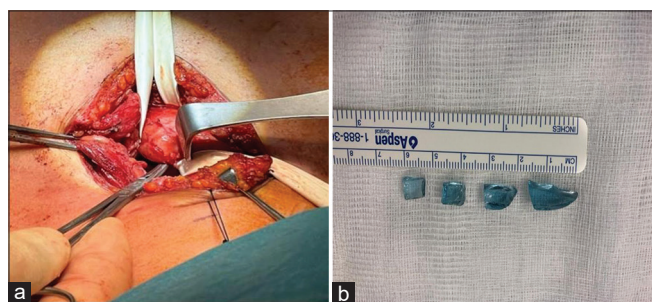


Figure 1: (a) Intraoperative image showing a tracheal mass invading the posterior tracheal wall. (b) Postoperative image highlighting the sizes of the four glass fragments retrieved from the patient's airway

After placing the patient on ECMO, the previous endotracheal tube was removed. Then using the rigid bronchoscope and optical forceps, three pieces of glass were successfully removed from the trachea proximal to the carina, and one piece from the right main bronchus [Figure 1b]. A number 8 endotracheal tube was reinserted into the stoma. This case was presented to highlight the role of ECMO in the airway management of intra-tracheal lesions below the sternal notch.

Discussion

Symptoms of intra-tracheal masses become evident when the obstruction reaches 75% or more of the tracheal lumen. Resection becomes challenging for masses occupying 80% to 90% or more of the lumen, particularly near the carina, due to anesthesia difficulties.

When securing the airway in patients with intra-tracheal lesions, surgeons must consider the size, location, quality of the tumor, and the size of the tracheal lumen.^[4] For tumors located in the upper part of the trachea, tracheostomy tube insertion under local anesthesia, a smaller endotracheal tube, or a laryngeal mask airway may be considered with caution to avoid tumor contact.^[3]

When the tumor is close to the carina and occupies less than 75% of the lumen, placing an endotracheal tube carries the risk of single lung ventilation.^[4] One treatment option involves a small-diameter tube placed below the mass with a fiberoptic bronchoscope guiding the tube tip under vision with risks of bleeding and mass dislodgement.^[5] The second method uses a 6mm endotracheal tube tip or a laryngeal mask airway above the mass, although it can lead to ventilation disruption and unexpected life-threatening scenarios.^[6] In both approaches, temporarily removing the microlaryngeal tube and inducing apnea may be needed due to the challenges of introducing the endoscope into the narrowed airway while the tube is in place. To facilitate this process, a high-flow nasal oxygen cannula can be employed during airway surgeries to prolong the apnea time and ensure adequate oxygenation.^[7]

For tracheal mass biopsy, cardiopulmonary bypass can be employed without the need for endotracheal intubation, especially for cases with evident airway patency. Tubeless techniques under apneic episodes may be considered in select patients.^[7] Tritube can be used for managing near-total airway obstruction caused by a mid-tracheal mass.^[8] Although it may secure the airway beyond the lesion, it comes with challenges related to safe anesthesia, requiring careful selection, and pre-operative planning.^[8]

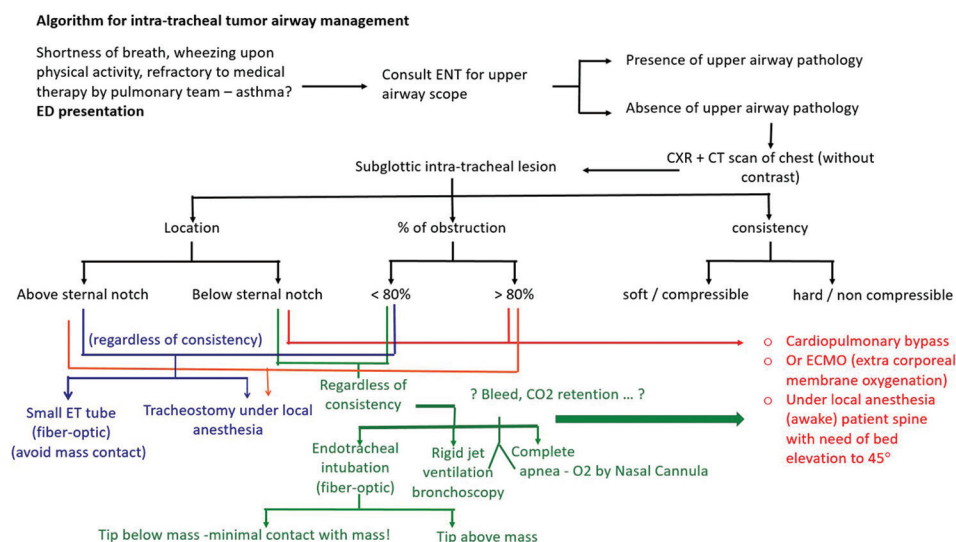


Figure 2: Algorithm for airway management of intra-tracheal lesions

Lower intra-tracheal lesions complicate surgical resection and anesthesia. Cardiopulmonary bypass has been recommended for selected patients with thoracic malignancies.^[9] Others advocate cardiopulmonary bypass as a safer method for near-total airway obstruction and difficult airways, despite the risks of excessive bleeding due to anticoagulation.^[10]

The authors propose an algorithm for airway management of intra-tracheal lesions, emphasizing the need for a multidisciplinary approach when dealing with similar cases [Figure 2].

Conclusion

Airway management in patients with intra-tracheal lesions necessitates careful consideration, taking into account the size, location, consistency, and degree of obstruction. The presented algorithm is based on the experience of a single surgeon in managing two cases of intra-tracheal lesions. While this serves as a pilot study to generate the proposed algorithm for airway management, it is important to recognize the need for further validation with a larger number of cases to assess its efficacy and applicability in a broader patient population.

Ethical standards

The Institutional Review Board of the authors' institution determined that review and approval by the IRB are not required.

Authorship contribution

Usamah Hadi contributed to the study conception and design; Nadine El Hadi and Tamam Tulimat participated in

data collection; Jad Hosri, Nadine El Hadi, and Usamah Hadi drafted the manuscript. All authors reviewed the results and approved the final version of the manuscript.

The manuscript has been read and approved by all the authors, the requirements for authorship have been met, and each author believes that the manuscript represents honest work.

Declaration of patient consent

The authors declare that they have obtained consent from patients. Patients have given their consent for their images and other clinical information to be reported in the journal. Patients understand that their names will not be published and due efforts will be made to conceal their identity but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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