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CASE REPORT

A Challenging Case of Adolescent Tracheal Stenting for Mediastinal Mass

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ABSTRACT

Obstruction of the trachea and bronchus is very rare in adolescent patients. Tracheo-bronchial obstructions are life-threatening and can be averted with artificial prostheses such as airway stents, which prevent airway collapse and relieve obstruction. Providing anesthesia for tracheobronchial stenting procedures is demanding and poses greater risk to the patients. In very complicated cases of tracheobronchial obstructions, jet ventilation and extracorporeal membrane oxygenation may be required as a last resort.

Keywords: Difficult airway, adolescent, airway stents, bronchoscopy

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INTRODUCTION

Obstruction of the trachea and bronchus is a very uncommon entity in adolescent patients. However, such tracheobronchial obstructions are associated with increased morbidity and mortality.[1] Tracheobronchial obstructions can be averted using artificial prostheses like airway stents. Such airway stents prevent airway collapse and thereby help to relieve airway obstruction. Obstructions involving the trachea or carina are more demanding for the anaesthetist and pose greater risk to the patient. In such challenging airway scenarios, high-frequency jet ventilation (HFJV) or extracorporeal membrane oxygenation (ECMO) may represent a feasible means of maintaining oxygenation and ventilation.

CASE PRESENTATION

A 15-year-old boy, whose body weight was 50 kg, presented with a history of progressive breathing difficulty for one week. He had an episode of unresponsiveness a week back, following which he was revived, resuscitated, intubated, and ventilated in a local hospital. Computed tomography imaging (CT) revealed an anterior and superior mediastinal mass measuring 7.2 x 12.5 x 4.3 cm, extending cranially to the thyroid lamina, caudally abutting the aortic arch, and posteriorly abutting the upper 1/3rd of the oesophagus (Figure 1).

A provisional diagnosis of thymoma with myasthenia gravis was made, but later it was ruled out on the basis of normal anti-cholinesterase antibodies. The patient was then taken up for tracheal stenting after obtaining informed consent and due risks explained under general anaesthesia. After all necessary monitors were connected, an arterial line was secured under local anaesthesia as well, considering repeated arterial blood gas (ABG) sampling being required during the procedure. The patient was then induced with ketamine, fentanyl, and sevoflurane, following which a 2.5-sized I-gel® was inserted and fixed. Anaesthesia was maintained with sevoflurane and spontaneous ventilation was ensured throughout the procedure. A flexible video bronchoscope (outer shaft diameter 4.0 mm, channel diameter 1.5 mm; Karl Storz®) was introduced to assess the length and diameter of the stenosed portion, and narrowing of the tracheal mid-segment due to external compression from the mass was noted. A decision was made to proceed with tracheal stenting. A guide wire was passed and left in situ; the bronchoscope was then retrieved, and a self-expanding metallic stent (SEMS) assembly

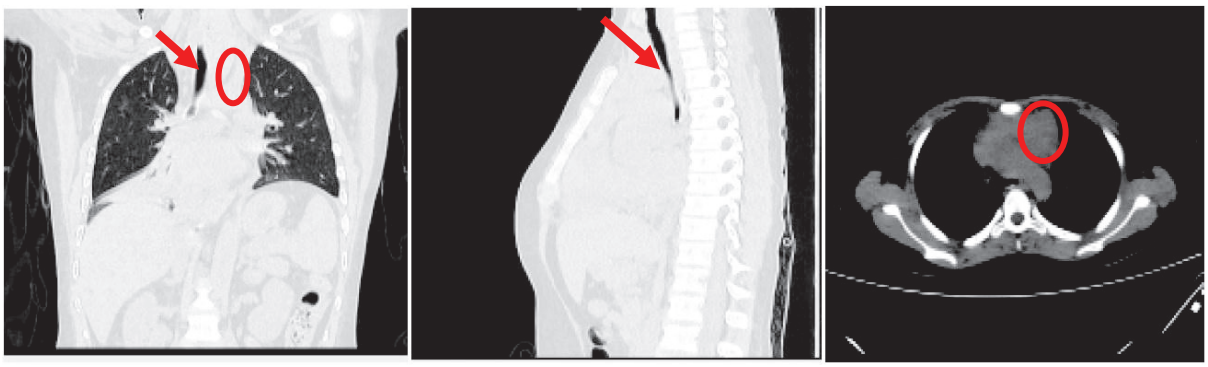


Figure 1: Computed tomography images showing a soft-tissue density, ill-defined anterior mediastinal mass compressing the trachea (circled in red) and the left main bronchus (arrow showing tracheal narrowing).

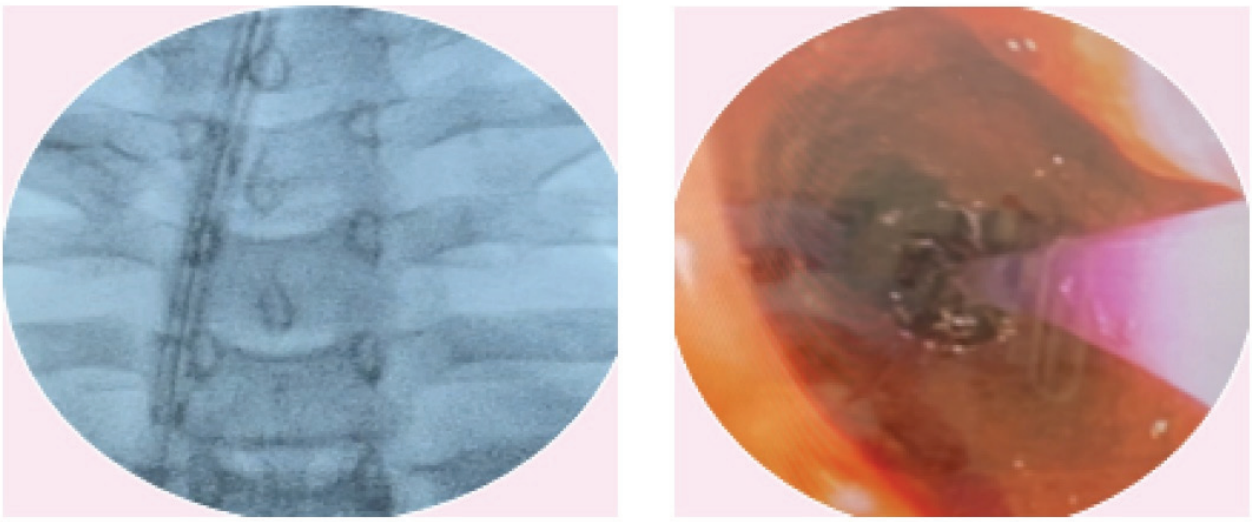


Figure 2: **(a)** C-arm image showing the guide wire and stent in situ; **(b)** Bronchoscopic image showing stent in place.

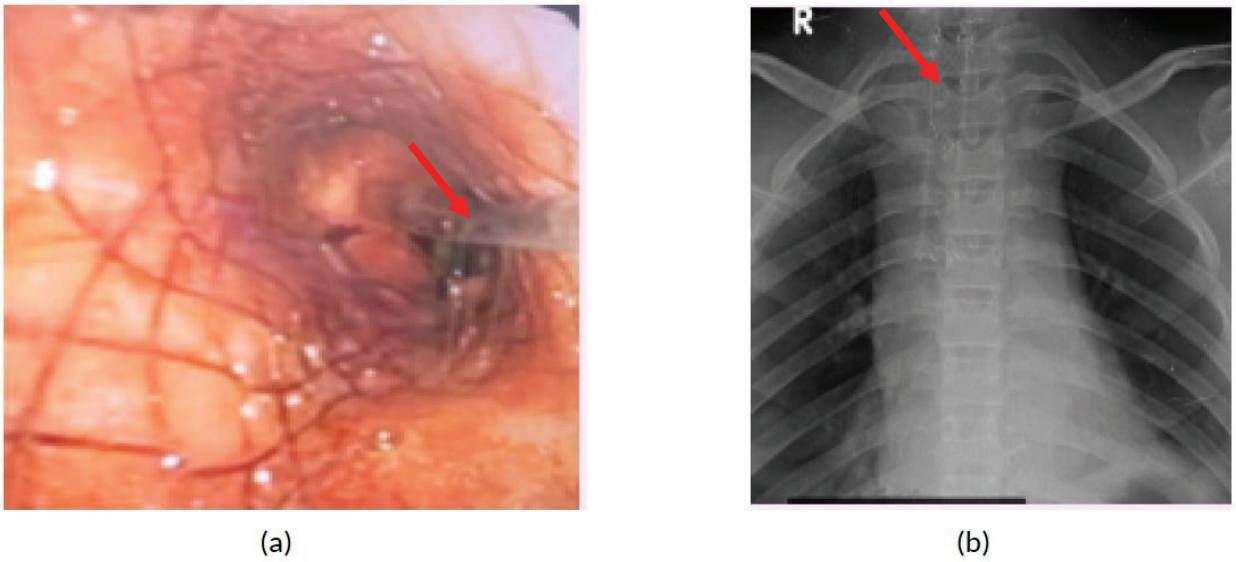


Figure 3: **(a)** Bronchoscopic image showing tracheal stent and guide wire in situ (red arrow); **(b)** Post-operative X-ray confirming the position of the intra-tracheal stent.

60 x 16mm was railroaded over the guide wire and deployed 1cm above the carina (Figures 2 and 3). Position of the stent was confirmed by C-arm. The patient tolerated the procedure well, and post-stenting oxygen support was weaned off, with saturation maintained at 97-98% on room air. The patient was discharged a day later and advised for stent removal at a later date.

DISCUSSION

Tracheal stenosis is a complex disease requiring multidisciplinary management. Given the shared airway in tracheobronchial surgeries, effective collaboration and communication between anaesthesiologists and surgeons are essential.[2] Airway stenting procedures require anaesthesia providers to safely induce and maintain anaesthesia, ensure

effective gas exchange, and also anticipate life-threatening post-operative complications. Adolescents occupy a transitional zone as they adapt to growth.[3] A flexible bronchoscope was preferred over a rigid one in this case, as it helps reduce surgical stimulus, allowing for spontaneous breathing and eliminating the need for muscle relaxants. They are also easier to insert through an LMA, reducing surgical stimulus, improving FiO_2 control, lowering the risk of stent migration, and facilitating stent repositioning if necessary.[4] The use of LMAs has broadened the options for safe anaesthesia, facilitated upper airway access, and enabled ventilation through stenosis using small-bore catheters. Procedural limitations may be influenced by the presence of distal lesions and the type of instrumentation necessary for stent deployment or retrieval. Depending on the anaesthetic plan, the patient may either remain spontaneously ventilating with a volatile agent or be ventilated using positive pressure following the administration of neuromuscular blocking drugs. Fine-bore conduits can facilitate different ventilation modes such as jet and high-frequency ventilation depending on procedural requirements.[5]

We used an I-gel®, a supraglottic airway device, for airway management in this patient with severe stenosis, where endotracheal tube (ETT) placement was challenging due to significant airway narrowing. Supraglottic airways have been shown to improve postoperative outcomes by reducing operative time, Intensive Care Unit (ICU) admission rates, hospital stay, and incidence of postoperative dysphonia.[6] They also facilitate the introduction of a bronchoscope for assessment of the vocal cords, reducing the incidence of usual adverse effects of ETT intubation like sore throat, hoarseness, dysphagia, dysphonia, laryngospasm, and cough. Furthermore, they enable airway control without compromising the subglottic region. In this case, the patient was maintained on spontaneous ventilation without muscle relaxants, reducing the risk of further airway narrowing and complete airway collapse.

Nitinol stents (StenTys®), made of nickel–titanium alloy, are commonly used to manufacture self-expanding metallic stents; their elasticity and shape memory enable deployment via flexible bronchoscopy, avoiding the need for rigid techniques. Nitinol stents exert strong radial force, providing effective airway support.[7] It is produced slightly larger than the target vessel, so that they expand post-deployment to apply a low, continuous outward pressure while resisting external compression.[8] Despite high nickel content, Nitinol demonstrates excellent corrosion resistance and bio-compatibility, comparable to other implant materials.

Stents can be easily inserted, safely left in situ, and provide prolonged relief from airway obstruction due to various aetiology.[9] Using a flexible bronchoscope through an I-gel® allowed smooth stent insertion, controlled FiO_2 and minimal airway trauma. The procedure was completed successfully, with the patient on spontaneous ventilation and without muscle relaxation.

CONCLUSION

Airway stenting involves a shared airway; hence, communication between the surgeon and the anaesthestist is of paramount importance. Airway stents can be inserted easily and safely left in situ for prolonged periods to relieve major airway obstruction from a variety of causes. In this case, a flexible video bronchoscope was used instead of a rigid bronchoscope because it inserts easily through a

laryngeal mask airway (LMA), causes minimal surgical stimulation, allows controlled FiO_2, and facilitates stent repositioning. Maintenance of spontaneous ventilation, with avoidance of neuromuscular blockade, was a key anaesthetic strategy that helped prevent airway narrowing and subsequent obstruction, contributing to the successful management of the case. This case report discusses the successful management of airway stenting in an adolescent using a supraglottic airway device.

AUTHORS' CONTRIBUTIONS

Concept and design: BH

Literature review: SK

Compilation of manuscript: RC

Manuscript editing and proofreading: BH, SK, RC

DECLARATION OF CONFLICTS OF INTEREST

The authors declare no competing interests.

DECLARATION OF PATIENT'S CONSENT

Informed written consent was obtained to use images of the patient, procedure, and related complications for publication.

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