Case Report

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Anaesthetic Management of Post-intubation Tracheal Stenosis using a Supraglottic Airway: A Case Report

Anaesthesia Section

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Patients who have undergone prolonged intubation may develop Tracheal Stenosis (TS). Patients with TS may experience a range of symptoms, including shortness of breath, noisy breathing, and changes in voice. This case reports on the anaesthetic management of a 21-year-old male who presented with these symptoms and was confirmed to have stenosis at the levels of C7 and C8. The patient's condition was probably related to a long intubation period because of respiratory failure, and he had an airway obstruction risk due to the TS. Anaesthesia was induced with propofol, and the patient was not given any muscle relaxants. The patient's ventilation was facilitated through a Laryngeal Mask Airway (LMA) during stenting of the tracheal lesion by interventional radiology. The patient's haemodynamics and oxygenation remained stable, and the airway was managed with a guidewire placed in the larynx and balloon dilation of the tracheal lumens, followed by successful deployment of the stents without interruption of ventilation. The patient tolerated the procedure well and recovered smoothly without any signs of airway complications. The novelty of this case lies in the successful maintenance of spontaneous ventilation without neuromuscular blockade during tracheal stenting, ensuring airway safety in a high-risk stenotic lesion. This case illustrates the critical role of good anaesthetic planning and intra- and interdisciplinary coordination in caring for patients with critical TS undergoing interventional procedures.

Keywords: Airway obstruction, Difficult airway, Laryngeal mask airway, Spontaneous ventilation, Tracheal stenting

CASE REPORT

A 21-year-old man presented with the chief complaint of progressive difficulty in breathing associated with stridor for 15 days. He had worsening respiratory symptoms, including a persistent cough and a change in his voice. The symptoms started gradually, were initially mild, and progressively worsened over time, with increasing difficulty in breathing and loud stridor as the condition deteriorated. He had no history of fever, chest pain, or haemoptysis, and there were no recent symptoms suggestive of a respiratory infection.

He was fully awake, conscious, and oriented at presentation. Although he was able to speak, his voice was hoarse and strained, reflecting the increased effort required for phonation. He had a history of glyphosate poisoning approximately one year prior. At that time, he was admitted to intensive care for treatment and was on a mechanical ventilator for over six days due to aspiration pneumonia. After extubation, his condition gradually improved, even though he was kept in the hospital for another 10 days before discharge, as there was no significant improvement during the last 10 days. He had no symptoms of airway problems for several weeks after discharge.

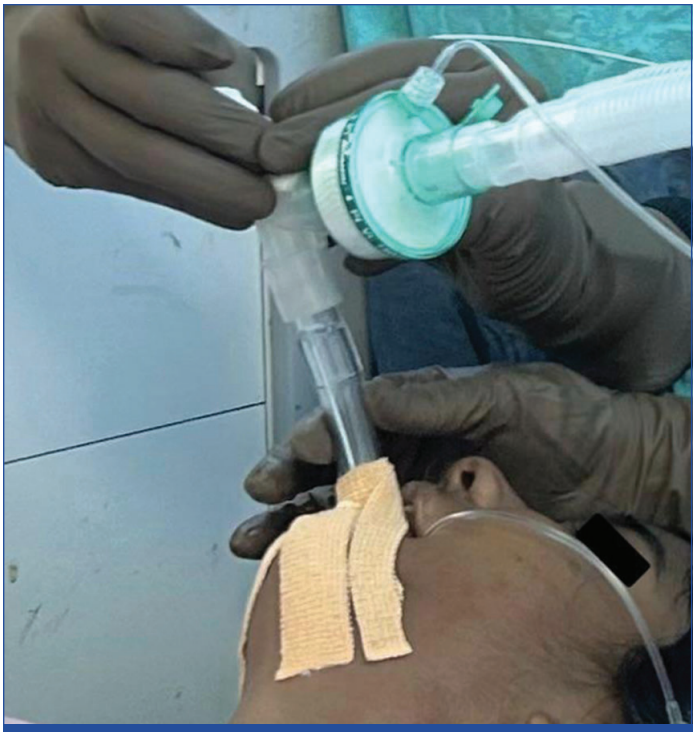
A physical examination revealed mild suprasternal retraction and inspiratory stridor, most of which were aggravated by exertion. The patient's airway was evaluated with assessment of mouth opening, which was found to be adequate; neck range of motion was normal; and there was no external neck swelling. Upon arrival at the hospital, the patient's blood pressure was 116/80 mmHg, and the pulse was 98 bpm with regular rhythm. The patient's oxygen saturation was 99% on supplemental oxygen at 6 L/min, and it dropped to 92% on room air. The findings of the systemic examination were normal apart from the above.

There were no abnormalities in any of the baseline laboratory investigations (e.g., complete blood count, renal and liver function tests, electrolytes). The electrocardiogram revealed a normal sinus rhythm. The chest X-ray findings showed a slightly narrowed upper trachea. Computed Tomography of the neck and chest revealed a focal concentric tracheal stenosis (TS) at the level of the C7–C8 vertebrae. There was significant luminal narrowing contributing to the patient's symptomatic airway compromise. The distal airway was unaffected, indicating that the TS was due to post-intubation. The patient underwent elective tracheal stent placement via interventional radiology. One of the reasons a Supraglottic Airway (SGA) was chosen was that the patient was expected to be difficult to intubate with an endotracheal tube and that it would be necessary to keep the patient spontaneously breathing throughout the procedure.

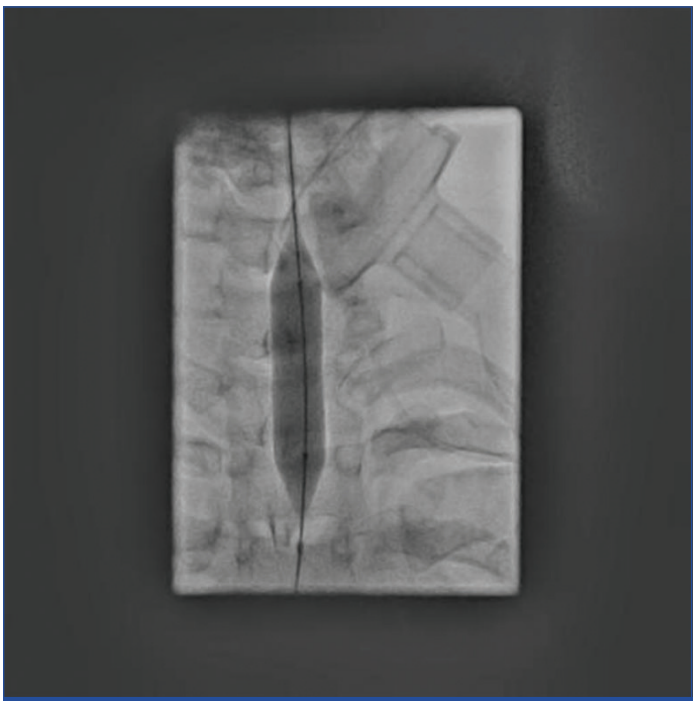
After standard patient monitoring was established, the patient was pre-oxygenated with 100% oxygen. Before starting anaesthesia, glycopyrrolate 0.2 mg, midazolam 1 mg, and fentanyl 100 µg were injected intravenously as a premedication regimen. Induction of anaesthesia was achieved with propofol at 2 mg/kg; this was feasible because mask ventilation was confirmed prior to induction. Since it would be necessary to keep the patient spontaneously breathing throughout the procedure, muscle relaxant was avoided. A size 4 ProSeal LMA was inserted following induction of anaesthesia.

The patient was kept spontaneously breathing and breathing was assisted as required with continuous capnography monitoring. General anaesthesia was maintained with sevoflurane at 1 to 1.5 Minimum Alveolar Concentration (MAC) in a mixture of oxygen and air, thus providing enough anaesthesia while still allowing the patient to make spontaneous ventilatory efforts. Analgesia was secured with fentanyl titration as necessary during the surgical procedure.

During the procedure, a guidewire was introduced through the L-connector of the breathing circuit, ensuring that ventilation was not interrupted [Table/Fig-1]. The stenotic stricture (internal diameter of 3 mm extending over a length of 8mm) was passed over with the help of a Cobra catheter and a double-length Terumo guidewire, followed by balloon dilatation with a 12×40 mm balloon to facilitate trachea stent deployment [Table/Fig-2]. The patient remained haemodynamically stable, and oxygen saturation remained within baseline ranges throughout the procedure. At the end of the procedure, anaesthesia was discontinued by withdrawing sevoflurane, and the patient's emergence from anaesthesia was smooth. Spontaneous ventilation was restored at a level that allowed LMA removal, without signs of acute airway obstruction.



[Table/Fig-1]: Terumo guidewire inserted through the L-connector of the breathing circuit.



[Table/Fig-2]: The 12×40 mm balloon dilatation to facilitate tracheal stent deployment. (The stenotic segment was of 3mm internal diameter extending over a length of 8 mm)

DISCUSSION

This patient had significant post-intubation TS, at the C7-8 level, progressive dyspnoea and stridor, with marked airway compromise. The focus of the anaesthesia plan was to avoid airway collapse during induction. Spontaneous ventilation with inhaled anaesthesia without neuromuscular blockade, in conjunction with the use of an SGA, provides constant oxygenation and minimises the chance of airway collapse. This is supported by the findings of Chen Y et al., that induction in patients with high levels of TS can cause an immediate obstruction to the airway, particularly when muscle relaxants have been given prior to securing the airway [1]. Youn AM et al., reported that patients may appear to exhibit no signs of preoperative morbidity when TS is severe, again highlighting the importance of utilising symptoms when developing a risk stratification plan [2]. Premalatha S and Kala B emphasised that tracheal pathologies are a distinct subgroup of difficult-airway patient situations, where complications can begin during induction itself [3].

Anaesthesiologists face multiple challenges when managing the airway of patients with TS. These include managing the airway, ensuring adequate oxygenation, and coordinating the timing of joint airway procedures. The primary issues are loss of the airway after induction because of reduced muscle tone, inability to pass an endotracheal tube distal to the stenosis, and exacerbation of oedema due to repetitive instrumentation [2,4,5]. In the current case, these risks were reduced by avoiding neuromuscular blockade and using spontaneous ventilation. Youn AM et al., reported on failed intubation attempts despite excellent laryngoscopy views resulting from resistance below the vocal cords. Chen Y et al., in their report, presented situations where an endoscope or bronchoscope could not negotiate past a severely narrowed trachea [1,2]. Mallick S et al., and Wang R similarly noted that maintaining adequate oxygenation during critical stages of airway surgery is one of the most important problems that anaesthesiologists deal with during the perioperative period, often determining what type of airway technique is used [6]. Premalatha S and Kala B reported on a case of TS due to snakebite, where emergency management required a smaller-than-usual-size endotracheal tube due to the technical nature of intubating through a compromised airway [3].

The fact that the airway is handled cooperatively presents an additional complexity during interventional procedures such as tracheal stenting. In this particular case study, continuous assistance with an SGA and a continuous flow of oxygen provided through an L-connector allowed for the maintenance of ventilation while at the same time permitting both the placement of the guidewire and the balloon dilation to be accomplished without interruption of ventilation [7,8]. Humane S et al., have described ventilation strategies including Fogarty catheter assistance during reconstructive airway surgeries, as well as the use of various other techniques for providing ventilation, such as cross-field ventilation. These findings illustrate the need for flexibility in airway management relative to intraoperative situations [9]. Furthermore, Wang R demonstrated that LMAs are viable temporary airway devices in TS surgeries because they provide sufficient ventilation, oxygenation, and access to the trachea for the procedures being performed. These findings reinforce the need for close communication and collaboration between the surgeon and anaesthesiologist when dealing with the airway [4].

Monteiro J and Aishwarya A performed a detailed preoperative airway assessment with awake fibreoptic laryngoscopy and rigid bronchoscopy in a patient who had had previous tracheal surgery. Unlike our patient, Monteiro J and Aishwarya A used a rigid bronchoscope to guide intubation with a smaller size tube and only mild (Grade 1) TS. Their case illustrates that the choice of anaesthetic technique should be individualised based on the severity and location of the stenosis [10]. Mallick S et al., Monteiro J & Aishwarya A clearly demonstrate the importance of conducting a thorough preoperative airway evaluation and using imaging and endoscopic techniques for this purpose, as well as involving multiple disciplines in developing a plan to anticipate potential intraoperative difficulties and postoperative airway requirements [6,10]. In addition to demonstrating that controlled ventilation can be performed safely with airway assessment, Mallick S et al., also convey that decisions about postoperative ventilation must be individualised. In some cases, the patient may require continued mechanical ventilation, while extubation can occur safely in the operating room for other patients [6].

Although fibreoptic intubation is considered the gold standard, as suggested by Mallick S et al., this method may be unsuccessful in cases of severe luminal narrowing, thus requiring an alternative approach. Jet ventilation can result in barotrauma and inadequate ventilation in patients with critical TS. The option of maintaining

spontaneous ventilation through an SGA is a safer and more controlled alternative for this patient. The appropriateness of SGAs as effective adjuncts to airway management protocols for patients with TS has been previously discussed by Wang R et al., [4,6].

In addition to being a preventable complication, post-intubation TS is also a complication that can present challenges in managing. According to Youn AM et al., several contributing factors exist for the development of post-intubation TS. Some of these include prolonged duration of endotracheal intubation, high cuff pressures, and multiple airway interventions [2]. Humane S et al., demonstrated that patients requiring prolonged mechanical ventilation due to toxicology exposures are at high risk of developing progressive subglottic TS necessitating multiple procedures or definitive surgical procedures. To minimise the development of TS due to endotracheal intubation, preventive strategies such as strict monitoring for cuff pressure, minimising the duration of intubation, and minimising airway trauma should be used [9]. In addition to developing effective care plans based on individual patient needs and utilising appropriate communication between multidisciplinary healthcare teams, Mallick S et al., have shown that successful outcomes will rely on thorough preoperative and intraoperative planning and readiness for difficult ventilation when performing tracheal reconstructions secondary to periods of prolonged mechanical ventilation. This case example serves as a reminder that anaesthesiologists must anticipate potential challenges that may arise as a consequence of airway issues by modifying their anaesthesia plan according to the situation and working together with all members of the surgical team to ensure a safe perioperative environment for patients with critical TS [6].

CONCLUSION(S)

Handling TS patients under anaesthesia requires very careful preparation of the anaesthetic plan since these patients are highly prone to airway collapse at the time of induction or intervention. One of the pivotal steps to reduce the risk of a disastrous airway obstruction is to keep the patient breathing spontaneously and not use muscle relaxants. In some situations, SGA devices may be a safer, more efficient alternative to endotracheal intubation, especially when the airway is shared. The anaesthesiologists and the team members must maintain constant communication throughout the procedure to ensure a continuous oxygen supply and a successful conclusion. The present case report demonstrates that airway management can be performed safely if anaesthesia is based on understanding the pathophysiology and the plan of care is highly individualised in patients with critical tracheal narrowing.

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