Case Report

Airway Management by I-Gel for Open Tracheal Resection and Reconstruction Via Combined Cervicotomy and Sternotomy Surgical Approach: A Case Report

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ABSTRACT

Surgical resection and tracheal reconstruction are the most effective treatment options for airway stenosis. Tracheal surgery is challenging and requires a multidisciplinary approach and a highly specialized team of anesthesiologists and thoracic surgeons that are "sharing the airways". Several airway management tools, different devices, and various approaches can be required to ensure ventilation and gas exchange. We describe the case of a patient affected by tight tracheal stenosis, submitted to tracheal resection and reconstruction via combined cervicotomy and sternotomy surgical approach. Airway management was successfully performed by i-gel® (Intersurgical, UK) supraglottic device.

Keywords: Airway management, i-gel airway, supraglottic airway, thoracic anesthesia, tracheal resection, tracheal stenosis

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INTRODUCTION

The most common indications for tracheal resection and reconstruction are symptomatic concentric stenosis, idiopathic or iatrogenic, related to prolonged intubation or post-tracheotomy. Other causes include neoplasm, airway trauma, burns, and irradiation.[1] Tracheal surgery is particularly challenging and requires a highly specialized team of anesthesiologists and thoracic surgeons. Airway management is characterized by a multidisciplinary approach and close cooperation between surgeon and anesthesiologist that are "sharing the airways". The goal is to ensure adequate surgical access to the trachea and simultaneously sufficient ventilation and gas exchanges. Several airway management tools (fiberoptic bronchoscope, video laryngoscope, laryngoscope) and different devices (supraglottic airway devices SADs, mono and double-lumen endotracheal tubes) may be necessary.[2] Three different approaches can be made: a preoperative conduct for the initial management of the airways, an intraoperative approach through the distal stump of the resected trachea and postoperative management. As a precautionary measure, patients can remain intubated with an uncuffed nasal endotracheal tube for the first 24-48 hours.[3] Numerous techniques to ensure ventilation and gas exchange can be used, according to the level of the stenosis – jet ventilation, high-frequency ventilation, cross-field ventilation, spontaneous ventilation, intermittent apnea technique, one lung ventilation and extracorporeal circulation techniques.[4] In this clinical case, we report the airway management of tracheal resection and

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reconstruction by i-gel® (Intersurgical, UK) supraglottic device.

Case Report

A 68-year-old woman (BMI 38.2, arterial hypertension, ischemic heart disease, cerebral hemorrhage, ASA III) affected by post-tracheostomy tracheal stenosis was scheduled for tracheal resection via collar neck incision (Kocher cervicotomy). The stenosis was "A-shape", located 3.5 cm from the glottic plane and extended for 10 mm [Figure 1]. The residual lumen was 3 mm. After facial mask preoxygenation with FiO_2 1 for 2 minutes, general anesthesia was induced with propofol 1.5 mg/kg, fentanyl 2 μg/kg and rocuronium bromide 0.6 mg/kg. Maintenance of general anesthesia was achieved with desflurane (minimum alveolar concentration MAC-1) and continuous infusion of remifentanil, using a target-controlled infusion (TCI) system in effect-site target mode with an Alaris® PK Syringe Pump (Minto pharmacokinetic set). Our plan for airway management consisted of i-gel® laryngeal mask size 4 positioning and pressure-controlled ventilation with following settings: FiO_2 0.5, 16 breaths per minute, tidal volume 350 ml, positive inspiratory pressure 15 cmH_2O, PEEP 5 cmH_2O, plateau pressure less than 25 cmH_2O, and peak inspiratory pressure limited to 30 cmH_2O. A nasogastric tube was inserted through the gastric access of the mask. Due to the deep intrathoracic mediastinal localization of the stenosis, conversion from cervicotomy to median sternotomy was necessary. After tracheal resection, a standard cross-field ventilation through the distal stump of the resected trachea by a sterile 6 mm-tube was ensured and a termino-terminal anastomosis was performed. Although the head-tilted back position and the surgical procedures performed on the neck and the sternum, no dislocations or ventilatory problems occurred during the intraoperative period. At the end of surgery, a bronchoscopic inspection of the anastomotic tract was performed through the i-gel® and two chin-to-chest sutures maintaining neck flection were placed in order to protect the anastomosis. Emergence of anesthesia was uneventful and the i-gel® was removed. The patient was admitted to Intensive Care Unit (ICU) in spontaneous breathing without need of mechanical ventilation or oxygen supply during the whole postoperative period. No respiratory complications such as laryngeal edema and glottic dysfunction or anastomotic complications were reported. Written informed consent was obtained for this report.

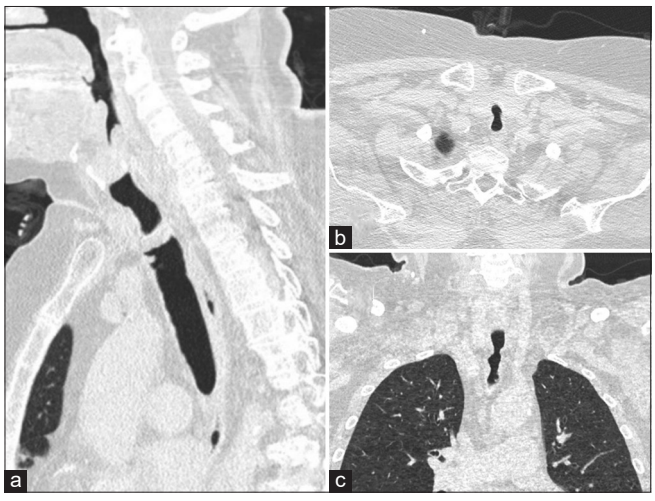

Figure 1: Chest CT scan image; CT sagittal (a), axial (b), and coronal (c) views showing the tracheal stenosis

DISCUSSION

Surgical resection and tracheal reconstruction are the most effective treatment options for airway stenosis. These lesions can cause tracheal constriction and progressive airway obstruction that can be life-threatening when effective ventilation is not established after the induction of general anesthesia. Our standard anesthetic technique consists in induction of general anesthesia and nasotracheal intubation with a micro laryngeal Endotracheal Tube (ETT) by fiberoptic bronchoscope. The tip of the tube is usually positioned below the stenotic segment. After resection of the stenotic tract, the tube is retracted above the vocal cords and a sterile ETT is inserted by the surgeon in the distal trachea. Cross-field ventilation with intermittent apnea periods is performed. At the end of surgery, an uncuffed nasotracheal tube is placed by a tube exchange catheter and as a protection left *in situ* for 24 hours. In the present case, the stenosis was located 3.5 cm from glottic plane and the residual lumen was 3 mm: ETT placement and cuff inflation above the level of stenosis could have been difficult due to the tight stenosis and could be associated with a high risk for dislocation, bleeding, perforation of the trachea, or loss of the airway control.[5] Moreover, patients could experience hypoxia due to the numerous intubation attempts.

Unlike the tracheal tube, SAD can not bypass tracheal stenosis, but they may have several advantages in this situation.[6] A supraglottic device allows control of the airway without interfering with the subglottic region and permits a fiberoptic bronchoscopy to check the vocal cords and tracheobronchial tree while the patient is ventilated.[7] Besides, the stenosis manipulations can be deferred until surgical exposure of the trachea is complete. Once the anastomosis is performed, SADs do not cause mechanical stress to the freshly sutured airway and reduce the risk of coughing at anesthesia

emergence.[8] For these reasons, the employment of the i-gel® was planned. The patient underwent mechanical ventilation after supraglottic airway device positioning and the breathing indices were good during the whole procedure.

The use of supraglottic airway devices and high-frequency jet ventilation in open tracheal surgery has been reported in a few isolated reports.[5,7,8] A retrospective study of 54 patients showed that the LMA can be a feasible alternative to the tracheal tube for airway management and conventional ventilation during open tracheal surgery.[9] I-gel® has been successfully employed in a patient with a previously reported difficult with inserting an ETT due to subglottic stenosis scheduled to undergo a laparoscopic cholecystectomy. This device was inserted without difficulty, provided a good seal, and allowed controlled ventilation with acceptable peak pressures throughout the operation, including during pneumoperitoneum.[10]

To our knowledge, this is the first report of i-gel® employed with pressure-controlled ventilation and as the only device for the airway management of tracheal resection and anastomosis via combined cervicotomy and sternotomy surgical access. I-gel® is a supraglottic device that has an integrated bite block without an inflatable cuff. Advanced supraglottic airway devices such as I-gel® may be more advantageous in tracheal surgery because of higher seal pressure, wide breathing lumen that also allows fiberoptic bronchoscopy examination, and the presence of an additional channel for insertion of the gastric tube. These features make i-gel® a suitable device in situations where a narrow endotracheal tube is inadvisable or too difficult to be employed.

In summary, airway management in patients with subglottic resection and anastomosis requires a careful preoperative program, a multimodal approach, and good communication and cooperation between the thoracic surgeons and the anesthesiologists. In this experience i-gel® provided a safe and efficacious solution during surgery guaranteeing adequate airways management and effective ventilation. The strategy used in this report can be an option for the management of patients with tight tracheal stenosis that cannot safely be intubated via conventional technique.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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