Case Report

Anaesthetic management of a rare case of Grade 3 Tracheal stenosis - A case report

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Abstract

Any site in the upper airway can get obstructed and cause noisy breathing as well as dyspnea. These include nasal causes such as choanal atresia or nasal stenosis; pharyngeal causes including lingual thyroid; laryngeal causes such as laryngomalacia; tracheobronchial causes such as tracheal stenosis; and subglottic stenosis. Subglottic Stenosis presents challenges to the anesthesiologist. Therefore, It is imperative to perform a detailed history, physical examination, and characterization of the extent and severity of stenosis. Rigid endoscopy is essential for the preoperative planning of any of the surgical procedures that can be used for correction. Choice of operation is dependent on the surgeon's comfort, postoperative capabilities, and severity of disease. Multi speciality approach along with ENT surgeon, Cardiothoracic surgeon, pulmonologist is key to efficient perioperative management of the patient. Thorough pre operative planning and having alternate methods for securing the airway are mandatory

Keywords:tracheal,stenosis,management.

Introduction

Tracheal stenosis is a rare but a life-threatening condition and is caused by congenital problems, postintubation injury, trauma, tracheal tumor, and compression of the trachea by tumor. Although accurate prevalence of this condition is unknown, an incidence of 4.9 cases per million per year is estimated for postintubation tracheal stenosis[1]. A stenosis commonly occurs at the cuff of the tube (intrathoracic trachea) or at the level of the tracheostomy stoma (extrathoracic trachea).

Anesthesia of a patient with tracheal stenosis is challenging for anesthesiologists. Depending on the severity and location of the stenosis and the type of surgical procedure, there may be a variety of choices for perioperative airway management such as a facemask, laryngeal mask airway, an tracheal intubation tube, cardiopulmonary bypass, and extracorporeal membrane oxygenation[2,3,4,5]. The American Society of Anesthesiologists practice guidelines for management of the difficult airway primarily focus airway problems caused at the extrathoracic airway and may not be helpful, particularly for managing patients with intrathoracic tracheal stenosis[6].

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In this case scenario, we present a patient with severe intrathoracic tracheal stenosis, who required surgery for a lumbar fracture in the prone position. Various airway management strategies and the actual management used are discussed.

Case report

A 21-year-old female patient, presented with chief complaints of gradually progressive shortness of breath and stridor for past 2months. In an attempted suicide, the patient consumed chlorpyrifos (organophosphate) 3 months back, for which she was treated at elsewhere facility with endotracheal intubation for 12 days. Within a month of her discharge, she presented to our institute with noisy breathing and voice change. HRCT of the chest and thorax demonstrated tracheal stenosis at D1-3 level (Figure A). She was admitted and planned for resection and end to end anastomoses under general anaesthesia.

Pre anaesthetic examination

Patient was hemodynamically stable with a pulse rate of 115/min, BP- 110/70 mm Hg. She had stridor and dyspnea with respiratory rate 20/min, and was using accessory muscles of respiration. Her body weight was 40kgs, and her height was 154 cms. Her blood investigations revealed a Hb of 7.1 gm %, MCV-62.8 FL, MCH-18.1pg, MCHC- 28.9 gm/dl. Peripheral smear showed hypochromic, microcytic anemia with poikilocytes. Two units of whole blood was transfused for correction of hemoglobin levels. . Radiological ivestigations – chest xray and hrct were taken.

Fig A:HRCT of the chest and thorax demonstrated tracheal stenosis at D1-3 level

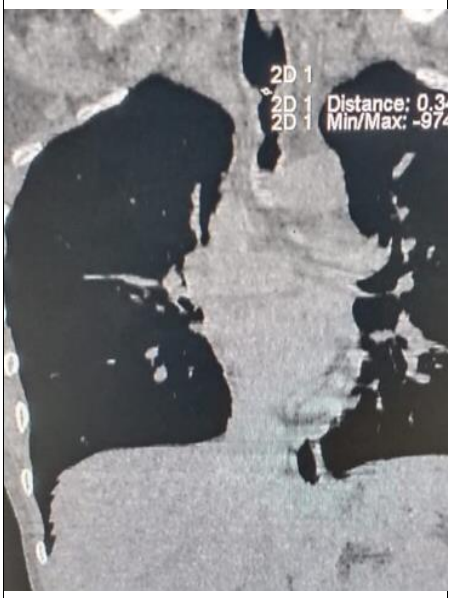

Fig B:HRCT with short segment tracheal narrowing in the subglottic region at the level of D2-D3 measuring 4 mm at the narrowest portion opposite D2 level

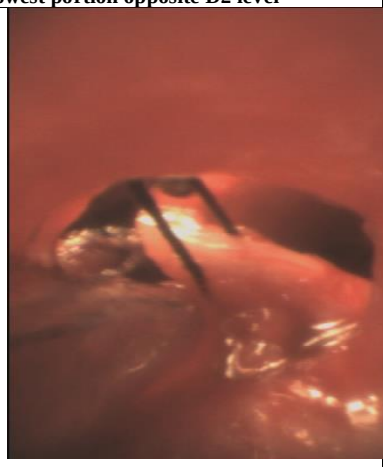

Fig C,D,E: Preparation of tube: An uncuffed portex oral endotracheal tubes of size 3.5mm was extended by attaching a 4.5 mm tube to the proximal end to achieve adequate length.

HRCT showed short segment tracheal narrowing in the subglottic region at the level of D2-D3 measuring 4 mm at the narrowest portion opposite D2 level. (FIGURE B)

Preoperative preparation for airway management

Oro and nasopharyngeal airways, face mask of appropriate size, supraglottic airways(LMA), flexible intubating fiberscope, undersized endotracheal tubes, reinforced tubes, bougies, airway exchange catheter and emergency tracheostomy kit were kept ready.,

Intra-operatively

Patient was shifted to operation theatre and in supine position pulse oximeter, NIBP, 5lead ECG, intra-arterial blood pressure and CVP monitors were connected.

Awake intubation was done by performing after standard glossopharyngeal nerve, superior laryngeal nerve and trans-laryngeal blocks with support of sevoflurane with MAC value of 2%. In addition, 2 puffs of 10% lignocaine were given into the nose and nasopharynx.

Preparation of tube: An uncuffed portex oral endotracheal tubes of size 3.5mm was extended by attaching a 4.5 mm tube to the proximal end to achieve adequate length (Figure D, FIGURE G, FIGURE H).

Injection Propofol 0.5mg/kg (20mg) was administered intravenously and patient was intubated with the above prepared ETT (figure D) under direct laryngoscopy and gently manoeuvred to pass through the stenotic trachea. Transnasal fiberoptic bronchoscopy was performed to confirm the passage of the tube through the glottis and engaging

through the stenotic subglottic trachea (Figure E). . Closed breathing circuit was connected and patient was maintained in spontaneous respiration with oxygen, nitrous oxide mixture with FiO_2 0.5 and Sevofluorane @ 2 vol% until sternotomy and tracheal dissection was performed. Immediately following incision on the distal end of stenosis, a cuffed reinforced ETT of size 6 mm was passed into the distal end and secured to the trachea by the surgeons (surgical cross-field intubation) and this port was now used for ventilating the patient in a closed breathing circuit. Muscle relaxants were then administered. Following resection of the stenotic segment and suturing of the posterior wall of trachea with interrupted sutures, another reinforced ETT of size 6 mm was advanced orally and replaced the previous tube through the surgical site.
Intraoperative arterial blood gas analysis showed acidosis and was corrected accordingly. The patient was electively ventilated for 24 hours post operatively and was extubated. At 1 year post surgery, the patient was doing well with no stridor and respiratory distress.

Rigid bronchoscope is the definitive tool for observing the location of lesion, diameter of the airway lumen , length of stenosis. Computed Tomography also provides an image of the narrowing, especially if lumen is too narrow to allow for a bronchoscope to pass through.Open surgery with resection and anastomoses was regarded as the gold standard of treatment for tracheal stenosis to avoid recurring problems.

Discussion

The causes of adult tracheal stenosis are trauma, chronic inflammatory diseases, benign neoplasm, malignant neoplasm and collagen vascular diseases. The most common cause of tracheal stenosis continues to be trauma, which can be internal or external. Therapeutic strategies for these patients include surgical resection combined with appropriate reconstruction and interventional bronchoscopic procedures, but each has its own merits and limitations. For a short (<1 cm), membranous stenosis without damage to the cartilages, laser incisions followed by gentle dilatation or tracheal stent is the safe and complete treatment. But for complex tracheal stenosis, longer with circumferential hourglass-like contraction, scarring or malacia, surgical sleeve resection and end-to-end anastomosis are considered the standard curative treatment (Vergnon et al., 2000). Laser tracheoplasty under bronchoscopic guidance has been proposed as a reliable method for treating benign tracheal tumors. However, if a tumor almost occludes the airway and causes severe respiratory insufficiency, any manipulation of the airway would precipitate increased oxygen consumption leading to further hypoxia and probable cardiac arrest. After careful consultation, we believed that laser tracheoplasty or tracheal stent would be unsuccessful for our two patients with critical tracheal stenosis, therefore we decided to carry out emergent surgery just under cardiopulmonary bypass.
The symptoms of central airway stenosis are distressing. Generally, when the patient presents stridor and tachypnea, the tracheal stenosis has reached about 50% of the tracheal diameter. When the patient has extreme respiratory insufficiency the tracheal stenosis has reached a critical level of 75% or more. For the latter, surgery and the anesthetic airway management are very difficult. Besides the degree of tracheal stenosis, the stenosed position is also important for anesthesia. For upper tracheal stenosis, a tracheal tube can be inserted below the stenosis under local anesthesia or cervical nerve block; for mild mid-level tracheal stenosis, a small tracheal tube can be inserted past the stenosis by the help of fiberoptic scope; for severe mid-level tracheal stenosis, a tracheal tube can be intubated rapidly above the stenosis first, then a smaller aseptic tracheal tube is placed in the main bronchus by the surgeon and single lung ventilation applied to maintain oxygenation during surgery. After tracheoplasty, the main bronchus tube is removed and a tracheal tube is placed at a suitable level. For the most severely obstructed patients with critical tracheal stenosis and at risk for complete respiratory failure at any time, conventional anesthetic technique would be catastrophic if attempts are made to insert a small tube which may cause complete obstruction of the airway. In many of these patients, the anatomy of the stenosis is such that they can only ventilate when breathing spontaneously.
Blind anesthesia induction and intubation can depress the patient's auto-compensation, which could result in severe consequence of cardiac and respiration arrest, especially in patients who have had hypoxia because of the increase in oxygen consumption (Mentzelopoulos et al., 1999). How to establish safe and efficient gas exchange is the key to the successful management of the patients with critical tracheal stenosis and to survival. It is reported that cardiopulmonary bypass is widely used in non-cardiac operations (Belmont et al., 1998; Chuqhtai et al., 2002; Goh et al., 1999). It could allow gas exchange and good surgical access for the tracheal operations and avoid aggravating hypoxia and carbon dioxide accumulation which may result in cardiac arrest during normal anesthesia and tracheal intubation.
Our two patients were both with critical lower tracheal stenosis which required extraordinary anesthetic techniques. We inserted a tracheal tube up the stenosis for the first patient, but high airway pressure and severe hypercarbia developed (the $PaCO_2$ reached 130 mmHg). Extracorporeal circulation was initiated with cannulation in the femoral artery and femoral vein immediately. To that patient, extracorporeal circulation was a lifesaving method. For the second patient, we drew lessons from the first case, established femoral-femoral cardiopulmonary bypass prior to induction of anaesthesia under local anesthesia, then intubated above the tracheal tumor orally under general anesthesia induction. After the surgeons had resected the tracheal stenosis and reconstructed the trachea with the support of normothermic extracorporeal circulation, we adjusted the tracheal tube depth to allow two lungs ventilation and then weaned the patient from cardiopulmonary bypass.
Although bypass may be the only safe and practical method of induction and maintenance of anesthesia for operation on the trachea if the lumen diameter is compromised severely (Mentzelopoulos et al., 1999; Belmont et al., 1998), systemic anticoagulation increases the risk of bleeding postoperatively especially for those patients who need extensive dissection and a prolonged time of extracorporeal circulation. In our first case, the patient required a second operation to be performed because of incision bleeding 48 h after the first operation.
In summary, surgical resection is lifesaving for the patients with critical lower tracheal stenosis and how to ensure effective gas exchange is crucial to the anesthetic management. Extracorporeal circulation by the femoral artery and femoral vein cannulation is an effective method of gas exchange even if the trachea is totally obstructed. Before the induction of anesthesia, the site and degree of obstruction should be carefully assessed and the set up for cardiopulmonary bypass should be considered to avoid exposing the patient to increased risks of conventional anesthesia.

Conclusion

Multi speciality approach along with ENT surgeon, Cardiothoracic surgeon, pulmonologist is key to efficient perioperative management of the patient. Thorough pre operative assessment, anticipating airway challenges and constant communication with the surgeon and immediate rescue resources are necessary to ensure successful management of the patient.
Sub glottic Tracheal stenosis presents a challenge to the anaesthetist for securing an airway access during the surgery. Thorough pre operative planning and having alternate methods for securing the airway are mandatory

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