Case Report

Emergency airway management of a patient with tracheal stenosis

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Abstract

We are presenting a case of a 26 year old healthy male, who came with gradual worsening of dyspnoea following prolonged intubation and ventilation, after a road traffic accident five months back. On arrival in ER, he was hypoxaemic with severe respiratory distress. He was transferred to the operation room (OR) for emergency tracheostomy. During the transfer, he was placed in an upright position with oxygen at 15 L/M. In the OR, anaesthesia was induced with sevoflurane gradually. Direct laryngoscopy was done which revealed normal vocal cords. A size 4.00 mm ID endotracheal tube was impossible to pass more than 1-2 cm distal to vocal cords. Due to a large leak, size 8 tube was passed below the cords and cuff was inflated slightly to reduce air leak. Oxygen saturation dropped to 95-96% and surgeon was asked to start tracheostomy. Findings included an almost complete subglottic stenosis, 2 cm below the vocal cords. A tracheostomy tube was inserted below the stenotic lesion which was followed by direct laryngoscopy.

Introduction

Tracheal stenosis affects 4-13 % of adults and occurs in 1-8 % of neonates after prolonged intubation in United States.[1] The causes of adult tracheal stenosis include 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 (prolonged endotracheal intubation, tracheostomy, flame burn injury) or external (blunt or penetrating neck trauma).[2] Approximately 90 % of all cases of acquired chronic subglottic stenosis in children and adults result from endotracheal intubation or tracheostomy.[1]

The cuff-pressure of endotracheal tubes plays an important role on the development of tracheal damage in intubated patients. To minimize this injury, use of high volume and low pressure cuff endotracheal tubes are advocated.[3] When the cuff pressure exceeds the mucosal capillary pressure (30 mm of Hg) of the trachea, the mucosa that lies between the cuff of the balloon and the underlying cartilages develops ischaemia. Long standing ischaemia can lead to ulceration and chondritis of tracheal cartilages, followed by fibrotic healing leading to progressive tracheal stenosis. Usual factors responsible for stenosis are: cuff pressure, size of the tube relative to tracheal lumen, duration of intubation, cardiovascular status during intubation, movement of tube during the period of intubation, sex and age of the patient, material of the cuff and the possible adverse effects of steroids. However, tracheal stenosis can also develop by intubation lasting as short as 24 hours only.[4] Therapeutic strategies for these patients include: surgical resection combined with appropriate reconstruction and interventional bronchoscopic procedures (dilation, laser tracheoplasty and tracheobronchial stent), but each has its own merits and limitations.[5]

Case Report

A 26 years old male, truck driver with no known

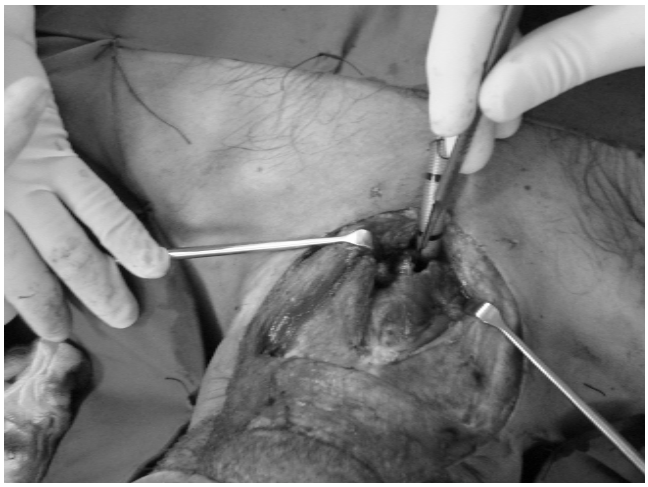

Figure-1: Diagram showing tracheal reconstruction in progress.

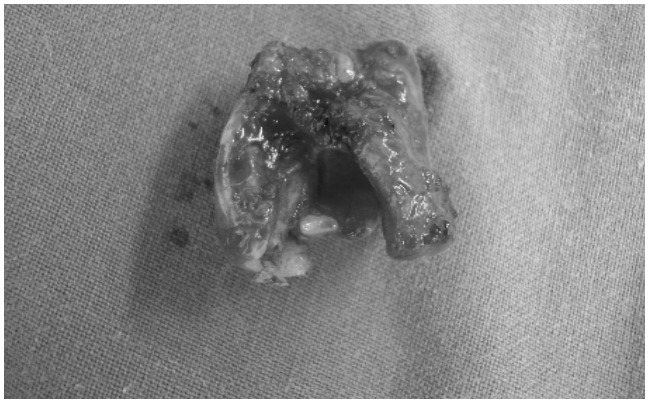

Figure-2: Diagram showing stenosed part of trachea.

comorbids presented with history of worsening shortness of breath for 5 months. This happened following intubation and ventilation for 14 days after a road traffic accident, in which he had sustained a head injury. His shortness of breath increased gradually, ultimately resulting in breathlessness even at rest. When he arrived at the ER, examination revealed a young male, fully conscious and oriented. His vitals included heart rate of 90 beats per minute, blood pressure 125/80 mmHg, afebrile, respiratory rate 30 breaths per minute with stridor. Oxygen saturation was 90-92 % on 15 litres per minute oxygen via face mask. All other systemic examination was unremarkable.

He was shifted to the operation room in emergency in an upright position with oxygen at 15 L/M via face mask. Intraoperative monitoring included ECG, pulse oximetry, noninvasive blood pressure and temperature. In the operating room, he was induced with gradual increment of Sevoflurane, starting from 2 % along with oxygen at 8 litres per minute. In addition, intravenous Fentanyl 50 micrograms and Midazolam 1 mg was also administered. Patient initially continued breathing spontaneously, but later on ventilation became impossible even with the help of a nasal airway. After adequate depth of anaesthesia, direct laryngoscopy was performed and vocal cord was visualized as grade I. Initial attempt with size 6 (ID) endotracheal tube (ETT) was unsuccessful, as it could not be passed 1-2 cm beyond the vocal cords. Size of ETT was reduced to 5 and then 4 but even then it was not possible to pass the tube 1-2 cm below the vocal cords. The ENT surgeon was reluctant to do a tracheostomy under local anaesthesia, without an ETT in place because of possible difficult anatomy. It was decided to pass ETT size 8 which was kept just beyond the cords, and cuff was inflated to minimize air leak. Even with this arrangement, it was barely possible to ventilate and oxygenate the patient. Oxygen saturation dropped to less than 95 % and his other vitals included heart rate of 105 beats per minute and blood pressure of 130/90. Surgeon was asked to start tracheostomy. Findings during tracheostomy included subglottic stenosis about 2 cm below the vocal cords which was almost complete (barely 4-5 mm opening). Tracheostomy with size 7 tube was done distal to tracheal stenosis, after which the patient was placed in supine position. Intravenous Atracurium 15 mg and Fentanyl 25 micrograms were then given and direct laryngoscopy was performed.

The next day, tracheal reconstruction was performed as shown in Figure-1. Anaesthesia through tracheostomy was induced with the inhalational agent: Sevoflurane. Injection Atracurium and Pethidine were then given. Patient was intubated with size 7.5 reinforced tube. Four tracheal rings at the stenotic part of trachea were removed as shown in Figure-2. End-to-end anastomosis was performed. Postoperatively, the patient recovered well and was discharged on the third postoperative day.

Discussion

The symptoms of tracheal stenosis are distressing. Generally, when the patient presents with stridor and tachypnoea, the tracheal stenosis has reached about 50% of the tracheal diameter. Whereas, patients with critical stenosis (75% or more) present with extreme respiratory insufficiency. For the latter, surgery and anaesthetic airway management are very difficult.[6]

Careful physical examination, supported by characteristic flow volume loops should prompt early evaluation by fibreoptic laryngobronchoscopy, enabling treatment options ranging from corticosteroids and antibiotics to tracheal dilatation. While supraglottic airways would be ineffective in such cases, on the other hand, attempted endotracheal intubation might worsen mucosal oedema precipitating a near total obstruction.[7]

Routine anaesthesia induction and intubation in such

cases can depress the patient's auto-compensation, which could result in severe respiratory and cardiac consequences, especially in patients who have had hypoxia because of the increase in oxygen consumption.[8] Besides the degree of tracheal stenosis, the site of stenosed position is also important for the anaesthetist. For upper tracheal stenosis, a tracheal tube can be inserted below the stenosis under local anaesthesia 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 and later a smaller tracheal tube is placed in the main bronchus by the surgeon and single lung ventilation applied to maintain oxygenation during surgery.[6] One of the methods of emergency management of obstructed airway in patients with diagnosed subglottic stenosis is dilation of the stenotic area under direct vision using rigid bronchoscope and oesophageal bougies.[9] In emergency situation, awake fibreoptic intubation provides a safe approach of securing the airway. It can also help in assessing and maintaining integrity of the stent inserted and confirmation of correct positioning of ETT. Gentle introduction of a gum elastic bougie followed by railroading of ETT over the bougie may minimize the risk of ETT malposition and tracheal damage. Fibreoptic confirmation is, however, still mandatory.[10] In extreme cases, cardiopulmonary bypass under local anaesthesia through femoral route has been used in non cardiac operations. 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.[6] Although bypass may be the only safe and practical method of induction and maintenance of anaesthesia for operation on the trachea if the lumen diameter is severely compromised, systemic anticoagulation increases the risk of bleeding postoperatively, especially for those patients who need extensive dissection and a prolonged time of extracorporeal circulation.[8]

Conclusion

The key to successful management of the patients with critical tracheal stenosis is to establish safe and efficient gas exchange as rapidly as possible. In the presence of acute respiratory distress, definitive management should always take place in the OR under inhalation anaesthesia, while maintaining spontaneous breathing without muscle relaxant and a skilled surgeon ready to perform emergency tracheostomy.

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