Airway management for tracheal stent insertion in a patient with difficult airway

INTRODUCTION

Airway management in a patient with a tracheal stenosis undergoing stent insertion poses a significant challenge to the anesthesiologist who has to ensure adequate ventilation in the presence of a stenotic segment and maintain adequate depth of anaesthesia to suppress the stress response. The airway management and ventilation technique for tracheal stent insertion in a patient with difficult airway is described in this case report.
CASE REPORT

A 56 year old, 45 kg male patient developed progressively worsening dyspnea after having undergone chemotherapy for non-small cell carcinoma of trachea. On examination, the patient was in respiratory distress with inspiratory stridor and marked bilateral wheezing. Upper airway was assessed to be normal with a Mallampati Class II. Bronchoscopic examination revealed a tight stricture getting intermittently blocked by inflammation and secretions. Patient was scheduled for interventional bronchoscopy with insertion of Dumon Y – stent across the stenotic trachea. The limbs of the Y would be inserted into left and right main bronchus while the long stem would remain in the trachea across the stricture.

After premedication with glycopyrrollate 0.2 mg IM, anaesthesia was induced with fentanyl 2 µg/kg and sevoflurane 5-8% in oxygen (O₂). However, direct laryngoscopy revealed a difficult airway (Cormack Lehane Grade III) and it was not possible to introduce the rigid bronchoscope. As visualization of glottic opening was not possible by direct laryngoscopy the fiberoptic bronchoscope (FOB) (nasal route) was used to guide the ventilating bronchoscope tip into laryngeal inlet [Figure 1]. After passage of the rigid bronchoscope anaesthesia was maintained with sevoflurane in O₂ with spontaneous respiration by attaching a Mapleson D Circuit to the side arm of the ventilating bronchoscope [Figure 2].

The FOB was then inserted via the rigid bronchoscope to examine the trachea-bronchial tree and adjust the tip of the rigid bronchoscope above the stricture. However, ventilation became inadequate and ETCO₂ increased from 35 mmHg to 50 mmHg and injection suxamethonium 75 mg intravenous (IV) was administered and high-frequency jet ventilation (HFJV) commenced by placing the O₂ driven jet through open end of the rigid bronchoscope. Propofol and fentanyl infusions at 50 µg/kg/min IV and 1 µg/kg/h respectively were administered to deepen the anaesthetic depth and diminish the pressure response. FOB examination revealed a crescent shaped tracheal stenosis 5.5 cm away from the vocal cords, causing 75% luminal obstruction. The FOB was then removed and under fluoroscopy guidance, a Y silicon Dumon stent was deployed across the tracheal stricture using the special introducer. After removal of the introducer, the FOB was reintroduced and with the bronchoscopic forceps the stent was adjusted to fit in proper place. During this procedure anaesthesia was maintained with jet ventilation via the ventilating port as there was insufficient space at inlet of rigid bronchoscope for placing the jet needle [Figure 2]. Jet ventilation remained suspended for about 3 min during the stent insertion maneuver. After stent insertion anaesthesia was discontinued. The O₂ saturation was maintained above 95% before, during and after the stent insertion. Following resumption of adequate spontaneous breathing, the rigid bronchoscope was removed.

DISCUSSION

Stents can be a definitive treatment for patients with tracheal stenosis who are not candidates for surgery or used as a palliative measure in advanced malignancy to provide symptomatic relief, as was the case in our patient. Airway management in patients with tracheal
stenosis undergoing stent insertion is challenging for the anaesthesiologist who has to ensure adequate ventilation in the presence of a stenotic segment, anaesthetic depth, suppress the stress response to insertion of the bronchoscope and has to provide a relatively still and dry field during stent insertion.

Stent placement may be performed with flexible FOB under topical anaesthesia in an awake patient[2,3] or with rigid bronchoscope under general anaesthesia with or without muscle paralysis. Rigid bronchoscopy has the advantage of providing a much wider spectrum of interventions, quickly achieving a patent distal airway and adequately ventilating the patient and preserving oxygenation in critical situations.

It is critical to maintain airway and ventilation in a patient with a stenotic segment. Our patient had a history of previous tumor and presented with inspiratory stridor. Although upper airway examination revealed a normal airway, on direct laryngoscopy glottis was not visible (Cormack and Lehane III) and the rigid bronchoscope could not be negotiated into the glottis. We used a flexible FOB passed nasally to negotiate the tip of the rigid bronchoscope into the glottis.

HFJV was resorted to in our patient when the ventilation became inadequate. Intermittent oxygen jets have been utilized previously for ventilation of patients with tracheal stenosis undergoing tracheal reconstruction, as well as in patients having tracheal or bronchial tumors.[4] We used the venturi injector as an interface between the bronchoscope on one side and the anaesthesia circuit on the other side and hence inhalation anaesthetic-oxygen mixture could be entrained by the intermittent oxygen jets. To achieve good ventilation it is ideal to place the jet nozzle at the open end of the rigid bronchoscope. However, during manipulation with the FOB and manipulating forceps it is difficult to use the jet at the open end. Alternatively, the side arm (jet port) of the bronchoscope was used at this junction and ventilation became effective due to the added coanda effect. Also, it is postulated that intermittent oxygen jets delivered proximal to the stenotic segment itself may create a Venturi effect which augments rather than hinders ventilation.

The use of intermittent oxygen jet ventilation can be complicated by the occurrence of barotrauma secondary to high pressure.[5,6] Also, the presence of tracheal stenosis can decrease significantly the cross-sectional area that impairs passive exhalation, leading to air trapping with consequent barotrauma. Dworkin et al. have reported that a unique critical effective tracheal diameter of 4.0-4.5 cm can cause a very large increase in expiratory time and thus air trapping. In our patient, the tracheal diameter was 4.0 cm and the HFJV helped to prevent air trapping.

**CONCLUSION**

Stent placement is a non-surgical treatment modality for tracheal stenosis. Tracheal stent insertion is best managed using rigid bronchoscope. In case it is not possible to visualize the glottic opening to negotiate the rigid bronchoscope, we suggest that FOB be used to negotiate the rigid bronchoscope and subsequently place the stent.

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