Case Report

Videolaryngoscope-assisted flexible intubation tracheal tube exchange in a patient with a difficult airway

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Summary

An 88-year-old woman presented with acute airway obstruction caused by a large retrothyroid bleed following anterior neck trauma. Her airway was secured in the operating theatre with an awake nasal flexible optical bronchoscope tracheal intubation using an Intubating Laryngeal Mask Airway tracheal tube. Haemostasis was achieved following surgical ligation and the patient was transferred to the critical care unit. Postoperatively, a large leak around the tracheal tube was noted and a decision was made to change to an orotracheal tube with a subglottic drainage port. Our exchange technique required two experienced operators. The first operator used videolaryngoscopy with a hyperangulated blade to establish an optimal view of the larynx. The second operator placed an airway exchange catheter through the existing nasal tracheal tube to ensure airway control. The trachea was then intubated orally using a flexible optical bronchoscope observed under direct vision using the videolaryngoscope. The technique combined several simple and well-documented approaches, but importantly, the airway remained secure and visible throughout the procedure.

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Introduction

An Intubating Laryngeal Mask Airway tracheal tube (ILMA™ tracheal tube, Teleflex Medical Europe Ltd, Athlone, Ireland) is frequently selected when awake nasal flexible bronchoscope intubation is performed. Their soft bullet-shaped tip 'hugs' the bronchoscope and enables railroading without impingement, which reduces the risk of laryngeal trauma and increases the rate of success [1]. That said, their low-volume high-pressure cuffs may be a disadvantage in patients requiring prolonged mechanical ventilation [2]. Several other problems with the ILMA™ tracheal tube have been highlighted including kinking of the tube and inadequate tube length when used as a nasal tracheal tube.

It may be desirable to exchange a nasal ILMA™ tracheal tube for an orotracheal tube with a more appropriate cuff and a subglottic drainage port when prolonged postoperative mechanical ventilation in critical care is required. Tracheal tube exchange procedures can be high risk, especially in patients with a documented difficult airway. With most techniques, there is a short period where the airway is unsecured. We describe a novel technique that avoids the need for a transiently unsecured airway and we believe it is suitable for high-risk tracheal tube exchanges, both in the operating theatre and critical care environments.

Report

An 88-year-old, ASA 4 female patient was admitted following a fall and injury to the front of her neck. This resulted in a large retrothyroid bleed, massive haematoma formation and partial extra-thoracic airway obstruction. A decision was made to secure

her airway in the operating theatre before surgical exploration using an awake fiberoptic technique. A size 6.5 mm ILMA™ was placed nasally, with difficulty due to anatomical distortion, and the surgeon was able to identify and control the source of the bleeding. The patient was sedated and mechanically ventilated overnight in the critical care unit and she returned to the operating theatre the following morning for secondary clot evacuation. As it was envisaged that she would require a further period of mechanical ventilation and given there was a significant tracheal tube cuff leak, we decided to exchange the tube for an orotracheal tube with a more appropriate cuff and a subglottic drainage port.

Anaesthesia was provided with manual intravenous propofol and alfentanil infusions, which were titrated with the use of a BIS monitor (BIS, Covidien, Covidien (UK) Commercial Ltd, Gosport, UK) and aiming for a BIS value of below 60. Paralysis was achieved with rocuronium 0.6 mg.kg⁻¹. The concentration of oxygen was adjusted to maintain oxygen saturations above 94% but was increased to 100% prior to and during the tracheal tube exchange.

We used a technique for the exchange of the nasal ILMA™ tracheal tube to an oral tracheal tube that we have used several times previously and in similar circumstances. We believe this technique has not yet been described in the literature. It requires two experienced operators, the use of a Cook® airway exchange catheter (AEC) (Cook Medical, Bloomington, IA, USA), a videolaryngoscope with a hyperangulated blade (C-MAC® D-blade, Karl Storz UK, Slough, UK) and a flexible optical bronchoscope (Ambu® aScope™ Slim (Ambu, Copenhagen, Denmark)). The technique is as follows:

- 1 The Cook® AEC is placed in the nasal tracheal tube through a sealed catheter mount and advanced into position just above the carina. Lung ventilation continues via the nasal tracheal tube.
- 2 An optimal view of the glottis is established with the C-MAC D-blade by the first operator.
- 3 Oral videolaryngoscope-assisted flexible intubation (VAFI) is performed by the second operator who stands to the right of the first operator (Fig. 1a). When the bronchoscope tip is just below the cords, the cuff of the nasal tracheal tube is partially deflated, enabling the flexible bronchoscope to be advanced into the trachea to sit alongside the nasal tracheal tube within the trachea. The flexible bronchoscope image is used to confirm sight of tracheal rings and the carina, and confirm the position of the AEC above the carina.
- 4 The nasal tracheal tube is withdrawn over the AEC by the first operator to a few centimetres above the vocal cords, while leaving the AEC in place (Fig. 1b).
- 5 With the AEC in place, the new orotracheal tube is advanced over the flexible bronchoscope by the second operator into the trachea, and positioned optimally above the carina using the bronchoscope image.
- 6 The whole procedure of intubation and optimal positioning is observed and confirmed via the videolaryngoscope and the flexible bronchoscope screens. The orotracheal tube cuff is inflated and the flexible optical bronchoscope is then removed before attaching the ventilator circuit to the new tracheal tube and confirming successful ventilation with capnography. Steps 4–6 take approximately 5 s.
- 7 Only at this point should the AEC be removed.

Discussion

Tracheal tube exchange in a known difficult airway is potentially hazardous for a number of reasons. The most significant hazard is the failure to resecure the airway following removal of the old tracheal tube. As this case demonstrates, there are nevertheless circumstances where tracheal tube changes may be necessary and there is a need for a technique that reduces the chance of major airway complications. Various approaches have been described including the use of an AEC or similar device, direct laryngoscopy, videolaryngoscopy and passing a flexible optical bronchoscope pre-loaded with a tracheal tube into the trachea alongside the existing tube [3].

The sole use of an AEC is a relatively simple and well-documented manoeuvre which works on the principle that, if positioned through the existing tracheal tube before its withdrawal, it will sit within the trachea and provide a route for re-intubation if required. It also enables oxygen delivery, although the risk of complications from the use of a high-pressure gas source is relatively high [4, 5]. Blind placement of an AEC has resulted in various complications, including misplacement of the catheter within the oesophagus should the Murphy eye or tracheal tube tip be sitting outside of the vocal cords, damage to the tracheal mucosa including tracheal or bronchial perforation, and barotrauma [6]. Alternatives to the AEC include the gum-elastic bougie and the tracheal tube ventilation catheter (Cardiomed Supplies Inc., Lindsay, ON, Canada), but in modern practice the AEC is generally favoured.

In a difficult airway, achieving a good view of the glottis may be difficult with conventional laryngoscopy and the use of a videolaryngoscope to optimise the view during exchange is logical. It is well recognised that videolaryngoscopy improves the

Figure 1 Videolaryngoscope-assisted flexible intubation (VAFI) tracheal tube exchange. (a) Oral videolaryngoscope-assisted flexible intubation (VAFI) is performed by the second operator who stands to the right of the first operator. (b) The nasal tracheal tube is withdrawn over the airway exchange catheter (AEC) by the first operator to a few centimetres above the vocal cords, while leaving the AEC in place.

laryngeal view, particularly when direct laryngoscopy is difficult [7]. Mort and Braffet compared AEC-guided tracheal tube exchanges combined with direct or videolaryngoscopy in patients in whom direct laryngoscopy was difficult [8]. Videolaryngoscopy decreased the incidence of hypoxia, airway complications and the need for multiple attempts at tube exchange. Furthermore, first-pass success rates were greater in the videolaryngoscopy group (91.5% vs. 67.7%; $p = 0.0001$) and the proportion requiring three or more attempts at tube attempts was less (1.2% vs. 6.8%; $p = 0.0003$).

Hyperangulated videolaryngoscopy requires navigation of the tracheal tube 'around the corner' and this is best achieved using a preformed stylet. However, several case reports have described using a flexible bronchoscope with a hyperangulated videolaryngoscope as an alternative technique [9, 10]. The videolaryngoscope provides an optimal view of the larynx and the flexible bronchoscope acts as a manoeuvrable stylet, with the added benefit of viewing its transit. This technique has been termed 'videolaryngoscope-assisted fibreoptic intubation' (VAFI), although perhaps a better term is 'videolaryngoscope-assisted flexible intubation'.

In conclusion, the technique described combines the best elements of airway exchange with an AEC with the advantages of a hyperangulated videolaryngoscope and VAFI. Throughout this method, the airway remains under complete control and directly visualised both from the larynx and from within the trachea. This allows for extreme safety in managing a difficult airway where tracheal tube exchange otherwise carries exceptional risk. Following successful performance of this approach in several patients, we recommend that this technique may be of value to others both in the operating theatre and in critical care environments.

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