Case Report

Awake tracheal intubation for blunt airway trauma

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Summary

A 64-year-old man sustained blunt trauma to the anterior neck following a mechanical fall resulting in an isolated laryngeal fracture of the left cricoarytenoid complex. Although there was no acute airway compromise, he developed worsening airway oedema which necessitated tracheal intubation. He underwent oral awake tracheal intubation with a flexible bronchoscope to facilitate formation of a tracheostomy under general anaesthesia. The challenges encountered in the clinical management of this case relate to decision making for the patient with airway trauma in the absence of the need for emergency tracheal intubation. We describe the advantages and pitfalls of various airway management strategies in the context of blunt airway trauma.

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Introduction

Airway trauma is well-recognised as a life-threatening condition due to the potential for airway obstruction and death, as well as later sequelae such as airway stenosis and recurrent infection [1]. Blunt airway injury has an incidence of 0.4% in trauma patients, and laryngeal fracture accounts for 1 case in every 125,000 emergency department attendances in the USA [2, 3]. Laryngeal fracture usually results from high-energy mechanisms of injury and mortality can be as high as 3.8% [3, 4]. However, signs and symptoms are often non-specific, provide a poor indicator of the site of injury and, apart from impending complete airway obstruction, correlate poorly with injury severity [4, 5]. The presence of airway compromise in blunt airway trauma suggests involvement of the cricoid cartilage and cricothyroid membrane in 50% of cases, and mechanisms of direct trauma will tend to involve the cricoid and thyroid cartilage [1]. Nevertheless, the use of computed tomography (CT) imaging is appropriate, as it is highly sensitive for detecting the site of injury [4].

Due to the relative rarity and complexity of airway trauma, there is a lack of evidence regarding its acute management, which is reflected in the absence of published consensus or guidelines [6]. Description of rates of emergent tracheal intubation in these cases are highly variable, ranging from 2.6% to 80%, although variability in individual study populations and definitions are likely to play a role in this finding [4, 6]. The literature appears to advocate for a multidisciplinary approach with an emphasis on prompt diagnosis and management; however, the uncertainty with regard to the need for definitive surgical management perhaps underlies the lack of agreed, published guidance [2, 6].

Report

A 64-year-old man, with a background of macular degeneration, presented to the emergency department following a mechanical fall. He sustained blunt force trauma to the anterior aspect of the neck from a piece of street furniture. His presenting complaint was odynophagia to fluids. Auscultation of the chest revealed soft inspiratory and expiratory noises, but no marked

stridor or respiratory distress. There was moderate swelling over the left side of the neck at the level of the thyroid cartilage. Flexible nasal endoscopy (FNE) revealed oedematous swelling of the left portion of the epiglottis and the left arytenoid and the left vocal cord did not mobilise normally on phonation.

A CT scan of the neck demonstrated a left-sided displaced fracture of the cricoid cartilage and anterior subluxation of the left arytenoid cartilage. Appearances also suggested diffuse left-sided swelling or haemorrhage in the region of the left vocal cord, with infiltration of the left supraglottic space and obliteration of the left piriform sinus. Asymmetry of the thyroid cartilage also suggested a non-displaced fracture of this structure.

Following discussion with the ear, nose and throat (ENT) surgeons, the patient was to be closely monitored in critical care with regular intravenous dexamethasone and nebulised adrenaline to be administered. During the night he developed stridor together with tracheal and subcostal recession, but without reduced oxygen saturations. These signs resolved when he was woken from sleep, although he had also developed a hoarse, wet-sounding voice. A repeat FNE demonstrated a left supraglottic haematoma involving the left piriform fossa, false cord, lateral epiglottis and vocal cord. The left glottis was swollen to the midline and no movement of this side was seen on phonation or respiration. A number of clinicians including ENT surgeons, anaesthetists and intensivists discussed the case and decided the best course of management should be an urgent tracheostomy.

We performed oral awake tracheal intubation with a flexible bronchoscope in the emergency theatre. Before the procedure, he received nebulised adrenaline and lidocaine 4%, and then a target-controlled infusion of remifentanyl (effect-site concentration 3 ng.ml^{-1}). Intubation proceeded in a seated position with high-flow nasal oxygenation applied and a microlaryngeal tracheal tube railroaded over a single-use flexible bronchoscope. A single attempt was required to pass the tube, with correct positioning confirmed by waveform capnography before induction of anaesthesia with propofol. Review of the images obtained at intubation confirmed significant left vocal fold and supraglottic swelling, but no cricoid narrowing.

A tracheostomy was performed under general anaesthesia, with stoma formation at the level of the third tracheal ring. A TRACOE® twist plus (TRACOE® Medical GmbH, Germany) cuffed, non-fenestrated tracheostomy tube was inserted, with a full size below that expected for his habitus to allow for further swelling. The cricoid fracture was not unduly mobile.

Following the procedure, sedation was weaned in the critical care unit and supplemental oxygen was provided with a mask over the tracheostomy tube opening with the cuff deflated. Three days later, he was transferred to a tertiary centre. Microlaryngoscopic examination revealed a patent larynx. His injury was therefore managed conservatively (Fig 1).

Discussion

Epidemiological data relating to airway trauma, and specifically laryngeal fracture, is highly heterogenous [2, 4, 5]. However, existing data suggest that outside of specialist centres the acute management of blunt laryngeal trauma is unlikely to be a

Figure 1 (a) Axial CT image at the level of T1 demonstrates a displaced fracture of the junction of the lamina and left arch of the cricoid cartilage (arrow) with associated soft tissue swelling. The adjacent infraglottic cavity is significantly narrowed and deviated to the contralateral side. (b) Reformatted sagittal CT image shows diffuse supraglottic, glottic and subglottic soft tissue swelling with regions of low attenuation material superior to the fracture (arrowhead), consistent with oedema and haemorrhage. There is a reduction in calibre of the laryngopharynx, glottic and subglottic cavities.

frequent event, particularly in cases of an isolated injury that is not accompanied by overwhelming respiratory distress [4]. The fracture described in this report would meet the criteria for a 'group three' blunt airway injury by one proposed grading system, indicating a significant injury, but not requiring hyperacute airway management [4]. This appropriately illustrates why it is difficult to formulate an all-encompassing guideline for cases of blunt airway trauma [4].

A multidisciplinary decision was made in the first instance to monitor the patient and manage his airway conservatively. Furthermore, there was a desire to avoid a strategy which may further displace the damaged structures or cause further trauma to the airway. The decision to monitor these patients should be done so in the knowledge that oedema and haemorrhage can continue to develop over a matter of days, therefore, observation in critical care is an appropriate strategy [6]. The largest observational dataset on laryngeal fractures, taken from emergency department attendances in the USA, suggests the percentage of patients requiring urgent tracheal intubation or tracheostomy is lower than has previously been reported (2.6% and 0.1%, respectively), whereas unselected data on blunt airway trauma suggest many more require some form of airway management and 50% require a tracheostomy [2, 3]. The key clinical feature is the absence of acute respiratory compromise, which allows flexible laryngoscopy to be performed to assess airway patency, vocal cord mobility and compromise of laryngeal structures [5].

The patient remained under multidisciplinary review and, as the degree of swelling progressed, it became clear that a tracheostomy would be required. The discussed strategies for securing the airway included percutaneous tracheostomy or cricothyroidotomy, awake surgical tracheostomy under local anaesthesia or surgical tracheostomy under general anaesthesia. Percutaneous strategies were felt to be inappropriate, given the external swelling and distortion of landmarks and underlying anatomy [4]. The ENT surgeons felt attempting an awake tracheostomy with local anaesthetic would be inappropriate, due to the possibility of aberrant anatomy in an awake, potentially agitated and non-paralysed patient. This may also increase the likelihood of an iatrogenic nerve palsy and worsen the already partially immobile glottis. Lack of familiarity with this technique is also likely to be a factor for many surgeons [4]. Therefore, a decision was made to perform the tracheostomy under general anaesthesia, which would require further planning with regard to airway management before tracheostomy formation.

The use of a supraglottic airway device or facemask was deemed inappropriate on several grounds. These included the desire to avoid positive pressure ventilation above the level of the injury, and the supraglottic device not sitting properly above the injured tissues. There was also an agreement that, in the first instance, a definitive airway should be sought. Although direct laryngoscopy has a role to play in the acute management of laryngeal fractures, it was decided there would be sufficient time to attempt awake tracheal intubation with a flexible bronchoscope.

Awake videolaryngoscopy is an alternative strategy for tracheal intubation before induction of general anaesthesia and its increasing recognition in the literature mirrors the familiarity with these devices shown by both trainees and consultants [7]. Alongside increasing familiarity, other advantages when compared with the use of a flexible bronchoscope include reduced time to tracheal intubation, improved anatomical views and a degree of flexibility with regards to tracheal tube size and type [7–9]. Both modalities appear to have similar failure rates [8]. Although videolaryngoscopes may usefully allow for manipulation of the airway, for example, by upward traction during intubation, which may increase the space above the swollen, pathological larynx, this potential advantage was negated by the desire to avoid undue manipulation of the airway [7]. Use of a flexible bronchoscope has a documented low incidence of airway trauma (0.7%), although a systematic review found no compelling evidence that either method is associated with fewer complications [8, 9]. Thus, despite increasing familiarity with videolaryngoscopes in anaesthetised patients, a greater familiarity with flexible bronchoscopy in awake patients was pivotal in its selection in this case, and we suspect this is currently true for many anaesthetists. We believe this case highlights one area in which published guidance on awake tracheal intubation would be of use, and acknowledge that such a guidance may lead to increased familiarity with awake videolaryngoscopy, which has a potential role to play in the management of blunt airway trauma.

Management options for laryngeal fractures include conservative approaches, open reduction with various fixation devices and even laryngeal stenting. Surgical management is usually required when anatomical structures have been displaced, and restoration of the continuity of the cricoid is of high importance as the only complete cartilaginous ring in the airway. Such repairs should be performed early, and usually following the formation of a tracheostomy [10]. For our case, the fracture was managed conservatively due to operative findings of a stable injury with minimal disruption to the functional anatomy and with the security of the tracheostomy.

In conclusion, we describe the successful management of a laryngeal fracture of the left cricoarytenoid complex without acute respiratory distress. Due to progressively worsening airway oedema, we managed the patient with a surgical

tracheostomy under general anaesthesia following awake tracheal intubation. We believe this case will be of interest to anaesthetists and intensivists who may have limited experience managing these injuries, particularly outside of the hyperacute window of their initial presentation.

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