



A case report of complete cricotracheal separation: an experience from the east coast of Malaysia

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Complete cricotracheal separation, which is the most severe type of laryngeal trauma, is an uncommonly seen injury that clinicians have limited experience in managing. However, it is potentially fatal. Due to limited exposure to this condition, mismanagement can occur, which may further aggravate the patient's condition. The most crucial part of managing this injury is to establish a secure airway. Tracheostomy under local anesthesia is the preferred method of airway stabilization, in order to avoid further injuries to the airway caused by endotracheal intubation. Here, we discuss the management of complete cricotracheal separation based on a case experienced in the east coast region of Malaysia, where this type of injury is rarely encountered.

Keywords: Cricotracheal separation; Laryngeal trauma; Airway injury; Laryngeal repair; Case reports

INTRODUCTION

According to the Schaefer-Fuhrman classification of laryngeal trauma, cricotracheal separation is classified as a grade 5 injury, which is the most severe type [1]. It is not frequently encountered; therefore, clinicians have limited experience in its management. In Malaysia, only four cases of complete cricotracheal separation have been reported, all of which were managed in the capital city of the country [2-4]. No cases have been reported from the east coast region.

CASE REPORT

A 28-year-old male patient was brought into the casualty department after he was found in a car that had hit a divider. The patient was fully conscious but was unable to recall the details of the accident. He had difficulty breathing and dysphonia but no stridor or hemoptysis. There was subcutaneous emphysema that extended from the neck down to the chest and bilateral upper limbs. There was no bruising or laceration of the neck. The laryngeal framework was not palpable due to the neck swelling. His oxygen saturation ranged between 88% and 92%

on a high-flow mask, and he was tachycardic with stable blood pressure.

In view of airway compromise, the patient was intubated. During the first intubation, the vocal cords and epiglottis were noted to be edematous. Intubation was done using a 7.5-mm endotracheal tube (ETT). Postintubation, the oxygen saturation was only around 82% to 86% on manual bagging. The position of ETT was checked and reintubation was performed two more times with a 7.0-mm ETT before he was finally able to achieve 100% saturation. A chest X-ray showed a right third rib fracture with bilateral pneumothorax.

Computed tomography of the neck showed massive subcutaneous emphysema, with the possibility of loss of the first to third tracheal rings and fracture of the lateral lamella of cricoid plate (Fig. 1). The patient was then referred to the otorhinolaryngology department for laryngeal trauma. He was started on intravenous dexamethasone (8 mg, three times daily) and was admitted



Fig. 1. Sagittal view of the neck computed tomography showing loss of the first to third tracheal rings with an endotracheal tube *in situ* (arrow). [1] indicates the length of the tracheal defect (3.80 cm) caused by separation.

to the intensive care unit. On day 2 posttrauma, he underwent neck exploration, tracheostomy, direct laryngoscopy, and tracheobronchoscopy.

Intraoperatively, upon separating the strap muscles, the pretracheal fascia was bulging, suggesting an air-filled cavity. Incision of the fascia immediately exposed an ETT that clearly was not within the tracheal lumen. The trachea had been completely avulsed from the cricoid cartilage and retracted inferiorly by the trauma (Fig. 2). There was a displaced fracture of the left cricoid arch (Fig. 3). The thyroid gland was severed in half, where the left lobe was pulled down together with the retracted trachea, exposing the esophagus, which was intact. Neither recurrent laryngeal nerve was identified. The fractured cricoid fragment was repositioned and sutured with Dafilon 2/0 (B. Braun, Petaling Jaya, Selangor, Malaysia). Anastomosis of the cricoid and trachea was done primarily using interrupted sutures with Dafilon 2/0, leaving a window that just sufficed for placement of a tracheostomy tube. Bilateral tracheal stay sutures were placed (Fig. 4). Finally, the chin was sutured to the upper chest to keep the neck flexed.

Postoperatively, the patient was kept on a nil-by-mouth regimen. Feeding was done via a nasogastric tube and a proton pump inhibitor was started. He was slowly weaned from sedation



Fig. 2. Immediate exposure of the endotracheal tube (arrow) after incising the pretracheal fascia. The tracheal rings are not in view as they had avulsed inferiorly.

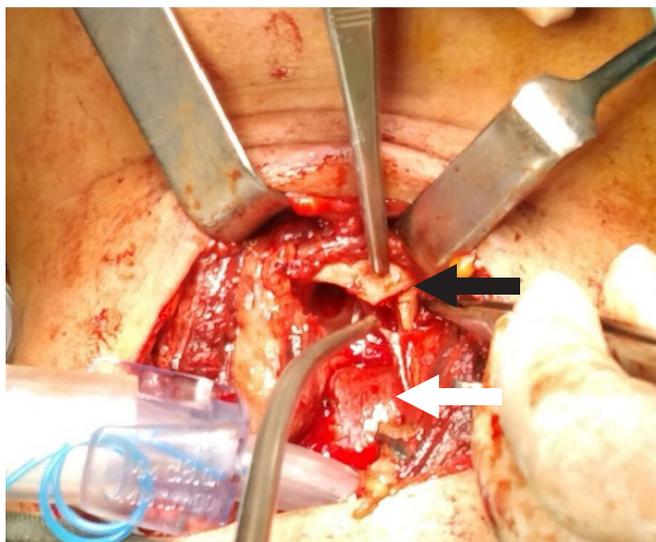


Fig. 3. Fracture of the left cricoid arch (black arrow). The endotracheal tube had been partially withdrawn until the level of the vocal cords, exposing an intact esophagus (white arrow). A tracheostomy tube had been placed just above the avulsed trachea.

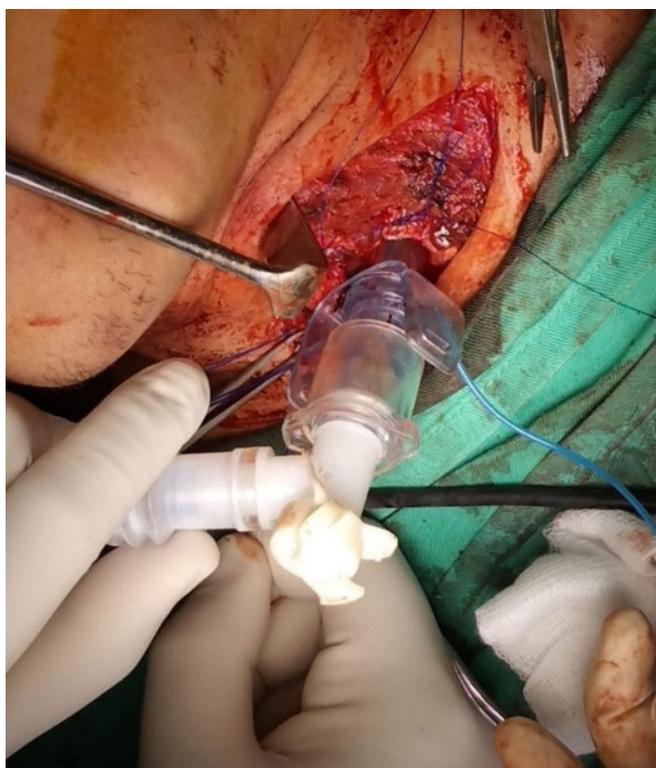


Fig. 4. Successful primary anastomosis of the cricotracheal airway with stay sutures *in situ*. Note the high tracheotomy done using the preexisting defect.

within 2 weeks to avoid vigorous movements of the neck. On day 14 postoperatively, a second-look procedure was done. Direct la-

ryngotracheoscopy showed an intact and patent cricotracheal airway with sutures *in situ*. No granulation tissue was noted. Flickering of the bilateral vocal cords was seen.

The patient recovered well after the second surgery and was able to wean off his nasogastric tube. He had no aspiration symptoms after consuming substances orally. He was able to phonate when the tracheostomy tube was occluded and had a good cough reflex. He was discharged home on tracheostomy. At the time of writing, he is awaiting his first outpatient follow-up visit. We are expecting excellent recovery and good vocal cord movement, as he did not show signs of vocal cord immobility prior to discharge. However, the risk of subglottic stenosis should still be anticipated.

The patient provided written informed consent for publication of the research details and clinical images.

DISCUSSION

Laryngeal injuries are uncommon and account for only 1% of all trauma cases [2]. An even more uncommon subset of laryngeal injuries is cricotracheal separation. In Malaysia, only four cases of complete cricotracheal separation have been published, and none from the east coast region. Although rare, they can be fatal. Laryngeal injuries caused by external factors can be due to penetrating, blunt, and blast injuries [5]. In cases of mild injuries with airway compromise, it is found that intubation potentially worsens the severity, with possible separation of weak airways by the ETT [5].

Patients with laryngeal injuries commonly have dysphonia, subcutaneous emphysema, stridor, and respiratory distress. Cricotracheal separation typically occurs due to “clothesline” injuries where the patients normally display external signs, such as ecchymoses or marks around the neck [6]. Interestingly, in our patient, there were no external signs suggesting a laryngeal injury. Due to the absence of these signs, the diagnosis of laryngeal injury might have been missed during the initial evaluation. The subcutaneous emphysema might have been thought to be secondary to pneumothorax; hence, intubation was performed without ruling out airway injury. It is important to note, however, that subcutaneous emphysema confined to the neck is a distinct feature of airway discontinuity.

In patients with airway compromise, tracheostomy under local anesthesia is advocated [2]. This is to prevent any further damage to the laryngotracheal framework caused by intubation injuries, which include avulsion of the endolaryngeal mucosa and disruption of a fragile airway by the ETT [7–9]. There is a possibility

that our patient had only sustained a minor laryngeal injury initially, but the injury was aggravated by intubation. Although his airway was successfully secured, this caused worsening of emphysema and possibly, the complete cricotracheal separation. However, these are only postulations since no endoscopic examination or imaging was done prior to intubation.

In stable patients, a flexible laryngoscopy can be performed to assess the patency of the airway, vocal fold mobility, and integrity of the larynx. However, these findings correlate poorly with the severity of the injury [9]. Similar to flexible laryngoscopy, imaging of the neck should only be performed following airway stabilization. CT imaging is valuable in conditions where oedema or hematoma makes it difficult to observe the continuity of the endolarynx and trachea [5]. These procedures give additional information to assist in management decisions.

According to Holinger and Johnston [10] and Curtin et al. [11], fractures of the larynx should be treated just as fractures anywhere else in the body; that is, the parts should be restored to as nearly normal positions as possible and splinted in their functional position. The aim of surgical management is airway preservation, prevention of secondary sequelae of healing, and restoration of laryngeal functions [12]. In cricotracheal separation, the standard of care is emergency tracheostomy, neck exploration, and immediate reconstruction [13]. The general agreement is that surgical exploration should be done within 24 hours after injury [5], although Maran et al. [13] defined “early” as within 1 week after injury. However, both airway and voice outcomes decline with further delay of surgical intervention. Chronic sequelae of laryngeal trauma include poor voice quality, recurrent granulation tissue formation, airway stenosis, and chronic aspiration [14].

In conclusion, laryngeal injuries should be managed with extreme caution as they are potentially fatal. A high index of suspicion should be given to any patients presenting with subcutaneous emphysema of the neck. The primary aim is to establish a secure airway. The decision of whether or not to perform endotracheal intubation should be made promptly but only after thorough deliberation. In a partially transected airway, blind endotracheal intubation must always be avoided as it can lead to complete cricotracheal separation. Early repair of laryngeal injuries is advocated as it leads to better voice and airway outcomes.

NOTES

Ethical statements

Written informed consent for publication of the research details <https://doi.org/10.20408/jti.2021.0071>

and clinical images was obtained from the patient.

Conflicts of interest

The authors have no conflicts of interest to declare.

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Author contributions

Conceptualization: AM, KAMR, MZA, SBY, WEWM, BDS, NMSNAG, ZABA; Supervision: AM, KAMR, MZA, SBY, WEWM, BDS, NMSNAG, ZABA; Writing—original draft: AR; Writing—review & editing: AM, KAMR, MZA, SBY, WEWM, BDS, NMNAG, ZABA.

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