Laryngotracheal separation after attempted hanging

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Summary
The successful management of a 29-yr-old patient with tracheal separation between rings one and two after attempted hanging is described. Increasing difficulty with ventilation via a tracheal tube and surgical emphysema indicated the need for a tracheostomy. The diagnosis was made during the tracheostomy procedure when it was observed that the tracheal tube was protruding through the incomplete transection of the trachea such that Murphy's eye was aligned with the lower tracheal stump. The patient underwent primary anastomosis of the trachea with placement of a Lorenz tracheal stent. On subsequent follow-up he had evidence of damage to both recurrent laryngeal nerves. The signs and symptoms of laryngotracheal separation after blunt trauma are described. A review of the airway management has been made as it requires combined anaesthetic and surgical expertise. Injuries to the trachea may have severe, life-threatening consequences and early diagnosis and management reduce morbidity and mortality. (Br. J. Anaesth. 1998; 81: 612–614).

Case report
A 29-yr-old male patient was transferred to our university hospital from a peripheral hospital for evaluation of laryngeal fracture. The patient had attempted to hang himself and was rescued by a witness within 2 min. On examination, he was conscious, had a hoarse voice, was coughing up blood and had stridor. Attempts, possibly to facilitate transfer, had been made to secure the airway by the paramedics at the site of the accident but were unsuccessful. Tracheal intubation was performed at the peripheral hospital under general anaesthetic using a 7.0-mm oral tracheal tube under fiberoptic vision. On examination of the larynx, the glottis appeared slit-like, there was significant oedema but no evidence of tears, disruption or bleeding. There was suspicion of a cervical spine injury and therefore he was placed in a cervical collar. CT scan performed at this hospital showed evidence of surgical emphysema with a displaced tracheal ring. Sedation, neuromuscular block and positive pressure ventilation were maintained during transfer to the university hospital.

On arrival at the university hospital, sedation and neuromuscular block were discontinued and the patient became agitated, was thrashing about, moving all four limbs and it was evident that there was increasing surgical emphysema extending down the neck to the lower limbs. On examination, there was no evidence of other injuries. Heart rate was 150 beat min⁻¹, arterial pressure 180/90 mm Hg and heart sounds were normal. Breath sounds were quiet and there was marked surgical emphysema of the neck extending down to the ankles. The results of arterial blood-gas analysis showed pH 7.15, \(P_{\text{aCO}_2}\) 10.1 kPa, \(P_{\text{aO}_2}\) 46.5 kPa, bicarbonate 26 mmol litre⁻¹ and base deficit −3.9 mmol litre⁻¹, with \(P_{\text{aCO}_2}\) 0.5. Abdominal and central nervous system examination revealed no significant findings.

We re-established sedation and neuromuscular block with a combination of morphine, midazolam and vecuronium. There were several episodes where it became difficult to ventilate the lungs manually, but arterial oxygen saturation remained stable. Bronchoscopy was attempted via the tracheal tube but the tracheal lumen could not be identified. A provisional diagnosis of airway discontinuity was made. Chest x-ray at this time showed surgical emphysema and no pneumothorax, while lateral neck x-ray showed evidence of airway discontinuity and no evidence of a cervical spine fracture.

We decided that the patient was too unstable for transport to the operating theatre, because of difficulty in ventilation and increasing subcutaneous air. Ventilation was managed by gentle manual bagging. The patient underwent emergency tracheostomy in the surgical intensive care unit using a size 8 Shiley tracheostomy tube and was taken immediately to the operating room for neck exploration, revision of tracheostomy and tracheal reconstruction. In the operating room, the Shiley tracheostomy tube was replaced with a size 7 armoured tube. The oral tracheal tube inserted at the peripheral hospital was left in place.

Effective gas exchange was maintained using air and oxygen mixtures, and the patient was anaesthetized using a combination of desflurane and morphine, with vecuronium given when necessary to maintain neuromuscular block. The landmarks in the front of the neck were difficult to identify. The patient had complete transection of the trachea between rings one and two. The tracheal tube (fig. 1) was observed to protrude between the first and second tracheal rings. The sternocleidomastoid muscles were transected by the injuries bilaterally. The

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internal jugular vein, carotid artery, thyroid cartilage and cricoid cartilages were intact. The trachea was anastomosed and a size 16 Cotton–Lorenz stent was inserted. After closure of the wound, a size 8 Shiley tracheostomy tube was inserted and secured. The immediate postoperative course in the intensive care unit was uneventful and the patient was discharged home after 12 days.

On follow-up, he was managing his tracheostomy well and could talk after plugging the tube. On flexible fibreoptic nasendoscopy, his true vocal cords were in adduction with a small posterior gap of approximately 2 mm.

Discussion
Laryngotracheal trauma is a rare injury, accounting for less than 1% of trauma cases seen in most major centres. This rarity is a result of many factors, including rapid death at the scene from asphyxiation, anatomical protection provided by the mandible and sternum, and lack of recognition of minor airway injuries in victims of major trauma by hospital staff.

The extent and location of blunt laryngotracheal trauma is determined by several factors. In one review, 88% of injuries occurred above the fourth tracheal ring. In contrast, penetrating knife and bullet wounds can occur in any part of the cervical trachea. In our case, severe flexion/extansion injury resulted in transection between the first and second tracheal rings. Cricoid fracture may result in recurrent laryngeal nerve injury which further compromises the airway lumen. In our case, the injury to the recurrent laryngeal nerves was apparent from residual deficit in vocal cord excursion.

The diagnostic signs of laryngotracheal injury include hoarseness, subcutaneous crepitus, dyspnoea, dysphagia, haemoptysis and skin abrasions over the anterior neck, but their presence is variable; surgical emphysema may not develop until hours after the event. Increased dyspnoea on extension of the neck is indicative of disruption of the upper airway and was described by Cherry and Hammond. Respiratory distress is often present but even in complete transection, the gap between the ends of the trachea may be sufficiently small to allow ventilation of the lungs to continue.

Definitive investigation and management of a patient with a suspected laryngotracheal injury have been reviewed by Cicala and colleagues, but are dependent on the airway status on arrival at hospital and the presence of associated injuries. Airway control with cervical spine protection is always the priority. Chest and neck x-rays may demonstrate air in subcutaneous tissues or distortion of the laryngotracheal air column. A CT scan has proved beneficial in distinguishing between patients with blunt laryngotracheal trauma who require conservative management and those who require surgical exploration, although it is not indicated in patients who obviously require intervention.

Fibreoptic endoscopic examination of the upper airway may help to establish the site and extent of injury: it also enables tracheal intubation while minimizing the risk to the potentially damaged cervical spine. In our patient, a 7.0-mm tracheal tube was passed over a fibreoptic scope. However, this technique can result in airway obstruction and may be technically difficult because of anatomical disruption, bleeding and debris. In our case, the tip of the tube was found to be protruding through the trachea, leading to progression of surgical emphysema with positive pressure ventilation. The Murphy’s eye of the tracheal tube, designed to overcome obstruction caused by tracheal wall occlusion, had allowed ventilation of the lungs to occur.

Fitzhugh and Powell recommended tracheostomy as the method of choice to establish an airway in the acutely injured patient with neck trauma, as attempts at tracheal intubation may result in the creation of a false passage, compromising the airway. Rapid deterioration of the patient, as in our case, may also necessitate tracheostomy, which may be performed under local anaesthesia. Alternatively, femoral–femoral cardiopulmonary bypass may be used in an emergency.

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References