Original article

Intubated, ventilating patients with complete tracheal transection: a diagnostic challenge

Douglas MG Bowley, Frank Plani, Dennis Murillo, Martin Smith, Elias Degiannis

*Milpark Hospital Trauma Unit and Chris Hani Baragwanath Hospital, and
Department of Surgery, University of the Witwatersrand Medical School, Johannesburg, Republic of South Africa*

Tracheal transection is a rare injury after blunt trauma. The presence of complete tracheal transection in the intubated, ventilating patient is even more rare and constitutes a major diagnostic challenge. The liberal use of computed tomography (CT) scans as an adjunct to endoscopy is paramount.

Key words: Tracheal transection – Blunt trauma – Intubation – Diagnosis

The presence of complete tracheal transection in the intubated, ventilating patient is very rare and constitutes a major diagnostic challenge. Two case reports are discussed.

Case 1

A 14-year old boy was ejected during a motor vehicle accident. The Glasgow Coma Score was assessed as 5/15 and he was transported to the nearest hospital where he was intubated and ventilated by a consultant anaesthetist. It was noted that ventilation was difficult with high airway pressures and low oxygen saturations despite administration of 100% oxygen; he was air-lifted to Milpark Hospital 2 days later.

On arrival, examination revealed surgical emphysema from head to groin; X-ray showed a right-sided pneumothorax, mediastinal emphysema and severe bilateral pulmonary contusions. Bilateral intercostal drains were placed, with minimal air leak. Fibre-optic bronchoscopy and oesophagoscopy were immediately undertaken but no major airway or oesophageal lesions were seen. The endotracheal tube was changed and its position checked by chest X-ray and bronchoscopy. The subcutaneous

emphysema dramatically reduced over the next few days, by which time a percutaneous tracheostomy was fashioned.

By day 35 post-injury, the patient was breathing spontaneously but weaning from the tracheostomy proved impossible, as occlusion of the tracheostomy caused severe respiratory embarrassment. Panendoscopy revealed complete occlusion of the trachea above the tracheostomy. Tracheal resection and anastomosis was undertaken and histology showed occlusion of the tracheal lumen by fibrous tissue at the site of complete transection of the trachea. The patient had a satisfactory airway and voice postoperatively.

Case 2

A 34-year-old man was ejected during a motor vehicle accident. A paramedic intubated him 'uneventfully' and the patient was air-lifted to the Chris Hani Baragwanath Hospital. There was significant subcutaneous emphysema over the neck but less over the chest. X-ray revealed pneumomediastinum, bilateral pneumothoraces and severe pulmonary contusions. Bilateral intercostal drains were inserted, which had ceased bubbling by the end of

Correspondence to: Prof. E Degiannis, Department of Surgery, Medical School, 7 York Road, Parktown 2193, Johannesburg, Republic of South Africa. Tel: +27 11 7172580; Fax: +27 11 4782814; E-mail: degiannis@yebo.co.za

Figure 1 Axial CT scan of the neck just below the cricoid ring. Note the endotracheal tube lying in an amorphous cavity without a cartilaginous boundary. This appearance is diagnostic of complete tracheal transection.

the resuscitation; mechanical ventilation was required. On day 7, the subcutaneous emphysema had resolved, but the neck remained swollen and indurated. Chest X-ray confirmed resolution of the subcutaneous emphysema and a correctly positioned endotracheal tube; however, extraluminal air was noted at the level of C5/6. Oesophagoscopy and duplex Doppler were normal. CT scan of the larynx and trachea, demonstrated complete tracheal transection (Fig. 1), a burst fracture of the cricoid cartilage and fracture and splaying of the thyroid cartilage. The endotracheal tube was seen correctly positioned in the distal trachea along with a significant amount of endotracheal blood (Fig. 2). The patient underwent a difficult exploration of the neck, a distal terminal tracheostomy was fashioned and a laryngeal stent inserted. Eight weeks later, the laryngeal stent was removed and complete paralysis of the vocal cords was noted. The patient remains with a distal terminal tracheostomy, under the care of the otolaryngological surgeons, and options to improve vocal function are being considered.

Discussion

Complete disruption of the cervical trachea is rare, with a reported incidence of 1 in 4491 trauma admissions.¹ Blind oral or nasal intubation in patients with tracheal injury can lead to false extratracheal intubation,^{2,3} with irretrievable loss of the airway.⁴ In one large series of patients with blunt injuries to

Figure 2 Axial CT scan at the level of the manubrium. The endotracheal tube is positioned in the distal trachea; the gap between the ends of the trachea was nearly 5 cm.

the cervical trachea, blind intubation failed to achieve an adequate airway in 76%.⁴ Intubation over a fibre-optic bronchoscope has been advocated as an aid to diagnosis of upper airway injury and to act as a stent to guide the endotracheal tube into the distal trachea.² However, false extratracheal placement has been reported despite use of a fibre-optic bronchoscope,³ and delay in the availability of equipment or expertise may delay life-saving care.²

Particular diagnostic difficulties arise in the poly-trauma patient without on-going post-intubation ventilatory problems. In both our patients, the diagnosis of complete tracheal transection was missed initially. In the first patient, the regression of the massive surgical emphysema after re-intubation supports the conjecture that intubation of the distal trachea was not achieved initially. After complete transection of the trachea, an intact sheath of peri-tracheal fascia may allow a conscious patient to breath or may facilitate distal tracheal intubation; also, continuity of the fascial sheath may enable ventilation even if an endotracheal tube has not reached the distal trachea.^{1,5-7} Fortuitous intubation of the distal trachea in the presence of complete transection is unlikely but cannot be discounted; however, it is also possible that, in our patients, the continuity of the injured trachea was maintained by a small bridge of intact tissue that was damaged during intubation, converting partial to complete transection. Apparently, correct position of the endotracheal tube was noted in both patients on chest X-

ray and 'confirmed' in the first patient by bronchoscopy. This demonstrates that adequate ventilation and even apparently correct position of the endotracheal tube are no guarantee of the integrity of the upper airway.

In the first case, endoscopy was not helpful, as the gap had been bridged by the endotracheal tube. If a CT scan had been ordered, as with our second patient, the diagnosis would have been made. We strongly advise CT scan as a reliable diagnostic modality in severe blunt laryngotracheal injury, particularly in the intubated patient. Fortunately, the percutaneous tracheostomy in the first patient was without adverse consequences; however, we believe all patients with suspected significant tracheal injury should undergo a standard tracheostomy in a controlled theatre environment to reduce the risk of potentially catastrophic loss of the airway. We also feel that the presence of massive subcutaneous emphysema in the absence of significant pneumothoraces and minimal air leak from the intercostal drains should have alerted us to the possibility of a tracheal injury.

Recurrent laryngeal nerve injury can be expected in approximately 60% of patients with complete transection of the cervical trachea.⁸ Some recovery of vocal cord function may occur spontaneously,⁶ but if the vocal cord paralysis is permanent then several options to regain some vocal function are available.⁹ The first patient underwent a tracheal resection and primary anastomosis, with satisfactory postoperative airway reconstruction and vocal function. Unfortunately, the short-term results in the second patient, who had co-existent severe laryngeal trauma, have been unsatisfactory and the prognosis is dismal irrespective of future operative management.

Conclusions

Tracheal transection is a rare injury that presents diagnostic and management challenges. Even more difficult diagnostic problems are posed by the subgroup of patients with complete tracheal disruption that have been successfully intubated and are ventilating adequately. A low threshold of suspicion is required, particularly in those patients with incongruous clinical findings that respond poorly to therapeutic measures.

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