

Isolated laryngotracheal separation following blunt trauma to the neck

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Abstract

Isolated laryngotracheal separation following blunt trauma to the neck is a very rare subset of laryngeal trauma and has not been previously well characterized. A 'clothes-line' type injury is one way in which such an injury may occur in which a cyclist rides into a rope or cable. A case of this kind is presented, followed by a discussion of the relevant clinical symptoms and signs as well as the difficulties in making a diagnosis. The critical role of fibre-optic subglottoscopy and tracheoscopy in reaching this diagnosis is also examined.

Key words: Larynx; Trachea; Wounds and injuries

Introduction

Laryngotracheal trauma is extremely rare and injury involving complete laryngotracheal separation rarer still. The structure of the larynx, its mobility and its protective housing (between mandible and sternum and flanked by sternomastoid) affords it a great deal of protection. The incidence of laryngeal trauma is estimated at 1 in 14 000 to 30 000 emergency department visits in the USA (Schaefer, 1991; Bent *et al.*, 1993) and is diagnosed in less than one per cent of all blunt trauma patients (Fuhrman *et al.*, 1990). Of all laryngotracheal trauma, roughly 60 per cent are blunt (Gussack *et al.*, 1986; Bent *et al.*, 1993) and only a very small proportion are 'clothes-line' type injuries (Fuhrman *et al.*, 1990). Despite several good reviews of laryngotracheal trauma, extraordinarily little literature is present regarding the specific injury of isolated laryngotracheal separation. Of 183 cases of laryngotracheal trauma described in several reviews, only four cases of complete laryngotracheal separation were cited, and there exists almost no specific characterization of this injury, even to the point of failing to distinguish between blunt and penetrating trauma (Olson and Miles, 1971; Gussack and Jurkovich, 1988; Bent *et al.*, 1993; Cherian *et al.*, 1993; Yen *et al.*, 1994).

The present case illustrates the salient clinical features of this unusual injury and demonstrates those features and procedures which will lead to the correct diagnosis. Additionally, this case demonstrates that the diagnosis may be initially elusive.

Case report

A 16-year-old boy struck his neck on a barrier rope while riding his motorcycle on a deserted airfield. His cervical spine was secured by paramedics at the scene using a hard collar and sandbags. On arrival at the accident and emergency department advanced trauma life support (ATLS) protocol was followed. It was noted that he was aphonic and had mild inspiratory stridor. He gestured



FIG. 1

'Clothes-line' anterior neck contusion was the only visible sign of laryngotracheal separation. (Photograph taken following initial presentation and management.)

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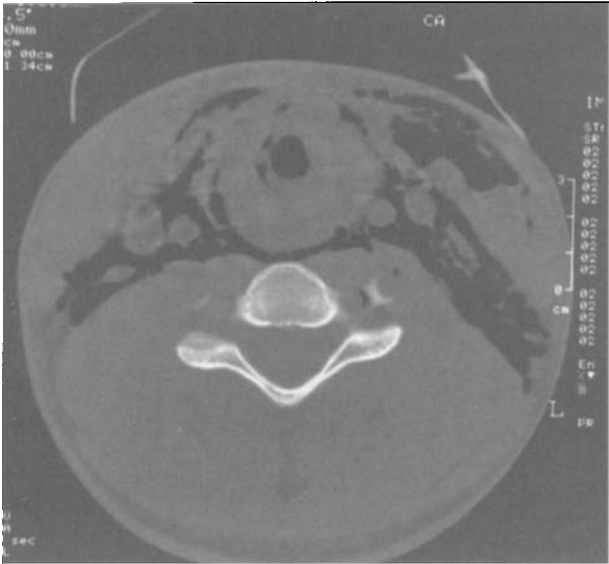


FIG. 2

CT scan of the neck demonstrating extensive subcutaneous emphysema.

repeatedly to his neck implying that it was painful. A vague transverse contusion was visible over the front of his neck (Figure 1). The hard collar was removed accordingly and his cervical spine immobilized manually. He also had subcutaneous emphysema extending over the neck and anterior chest wall.

His primary survey was cleared but lateral cervical spine X-ray showed loss of the tracheal air column and massive air extravasation into the subcutaneous tissues (also demonstrated on subsequent CT scan – Figure 2). Chest X-ray showed an extensive pneumomediastinum (Figure 3). Fibre-optic transnasal laryngoscopy demonstrated bilateral true vocal fold paralysis in the paramedian position, but no other glottic or supraglottic abnormality. Examination beyond the folds, however, demonstrated complete laryngotracheal separation with the subglottic air column surrounded only by the soft tissue of the neck. The patient underwent emergency tracheotomy under local anaesthesia. Laryngotracheal separation with a 4 cm gap

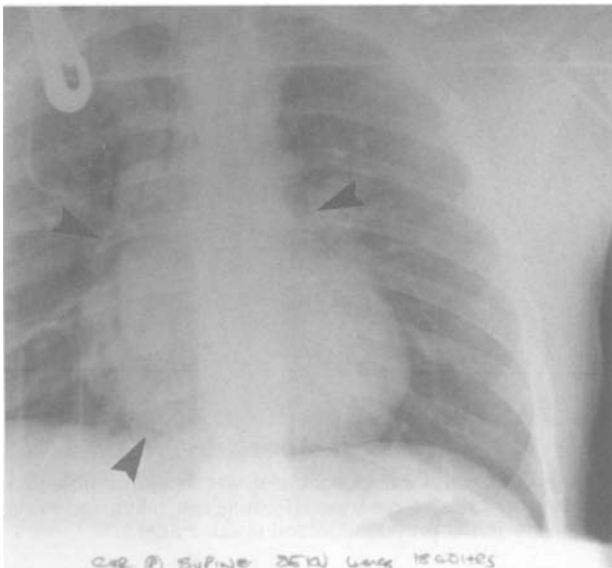


FIG. 3

AP chest radiograph showing extensive pneumomediastinum.



FIG. 4

Exposure, via an anterior approach, of the laryngotracheal complex demonstrating complete separation. (Photograph taken at definitive repair, the day following initial presentation and tracheotomy.)

between the cricoid cartilage and first tracheal ring was found (Figure 4) and the distal trachea cannulated with a cuffed endotracheal tube. The findings on oesophagoscopy were unremarkable. The patient underwent formal repair of the laryngotracheal complex two days later.

Discussion

Laryngotracheal disruption due to blunt trauma is a rare injury (Gussack *et al.*, 1986; Fuhrman *et al.*, 1990). Rarer still is when the blunt trauma giving rise to the injury is of the ‘clothes-line’ variety (Fuhrman *et al.*, 1990). In such a case, a cyclist without neck protection, travelling at speed, sustains a cable injury to the anterior portion of the neck. The usually protective mandible is raised, exposing the now vulnerable laryngotracheal complex to the impact. The upper airway is driven posteriorly, along with the cervical oesophagus against the vertebral column with potentially life-threatening results.

Visible external signs of the underlying airway injury may be sparse as in this case, particularly if the mechanism of injury is blunt trauma. In view of the possibility of missing such injuries therefore, Schaefer advises that any patient with anterior neck trauma presenting with hoarseness, subcutaneous emphysema, haemoptysis or neck tenderness must be considered to have sustained a laryngeal injury (Schaefer, 1991). Such protocol is also followed by Harris *et al.* (Harris and Ainsworth, 1965; Harris and Tobin, 1970). Signs and symptoms of isolated laryngotracheal separation include: bilateral true vocal fold

paralysis and its sequelae, including hoarseness and mild to moderate airway distress; external indications of trauma to the skin overlying the trachea; extravasation of air into the soft tissues of the neck resulting in subcutaneous emphysema and characteristic radiographic findings.

Another factor which may compound the difficulty in making this diagnosis is the age group in which these injuries tend to occur. The young fit patient has a tremendous capacity to compensate for respiratory compromise. Indeed, the patient in this case study was in respiratory compromise on arrival to the emergency department with an arterial pO₂ of 8.6 kPa on room air (normal is greater than 10.6 kPa) despite little outward display of respiratory distress.

Fibre-optic transnasal laryngoscopy is now the recommended mainstay of the initial evaluation in such injury (Fuhrman *et al.*, 1990; Schaefer, 1991). Direct assessment of vocal fold mobility, airway patency, and mucosal integrity is possible with this procedure (assessing for the presence of endolaryngeal haematomas and lacerations). An advantage of fibre-optic transnasal laryngoscopy is that it allows this examination to be performed without endangering the cervical spine. Although transnasal fibre-optic laryngoscopy is now recommended as the initial examination of choice for the glottis and supraglottis, there is no literature regarding its value in the subglottic and tracheal trauma diagnosis (Gussack *et al.*, 1986; Fuhrman *et al.*, 1990; Schaefer, 1991; Bent *et al.*, 1993). The only mention of it in the literature to date, is the oblique reference to its use as a means of obtaining an airway (via fibre-optic intubation) but with no mention of its diagnostic potential (Mathisen and Grillo, 1987). Fibre-optic transnasal laryngoscopy demonstrated vocal fold fixation in the paramedian position in this case and clinched the diagnosis of laryngotracheal separation. The endoscope was gently passed between the paralysed folds to examine the subglottic anatomy and it was here that the laryngotracheal disruption was discovered. This was in the face of mild airway symptoms (which might have been attributed to bilateral vocal fold paralysis alone) and minimal external signs of the injury. Also it allowed for critical decision-making, not only with regards to the urgent need for a tracheotomy, but with surgical planning as well (positioning the tracheotomy site very low in the neck) and provided the surgeon with an initial pre-operative understanding of the nature and degree of the internal injury.

Some authors, in the past, advocated the use of direct laryngoscopy primarily to evaluate the larynx (Olson and Miles, 1971; LeJeune, 1978). However, not only does direct laryngoscopy require a general anaesthetic, but it may also exacerbate mucosal tears, may miss a dislocated epiglottis because the instrument lifts the epiglottis forwards out of sight, and may place the cervical spine at risk (O'Keefe and Maw, 1992).

Computerized tomography is of value in assessing the laryngeal framework (Stanley, 1984) particularly in the equivocally injured larynx where the results of computed tomography (CT) scanning may influence the likely treatment plan of the patient (Schaefer, 1991; Cherian *et al.*, 1993; Yen *et al.*, 1994), and in cases of blunt trauma

(Gussack, 1986; Gussack and Jurkovich, 1988; Fuhrman *et al.*, 1990; Bent *et al.*, 1993). However, both CT scanning and direct laryngoscopy are far superseded by fibre-optic transnasal laryngoscopy in detailing subglottic injury.

In conclusion, several points bear emphasis. Isolated laryngotracheal separation following blunt trauma to the neck is an unusual condition, with a paucity of prior literature. A high index of suspicion must be maintained, given that extensive injury to the laryngotracheal complex may occur in the face of minimal outward signs. Clinical signs of particular value include bilateral vocal fold paralysis with an otherwise normal supraglottis, anterior neck contusion, and subcutaneous emphysema. Airway distress may be surprisingly minimal. Finally, fibre-optic transnasal subglottoscopy may be able to clinch the diagnosis of laryngotracheal separation.

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