CASE REPORT

Go-karting injury: a case of laryngeal trauma

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Accepted 19 May 2017

SUMMARY

We report a case of accidental strangulation and crush injury to the anterior neck resulting in laryngeal trauma. This extremely uncommon mechanism of injury provides a safety warning regarding precautions with neck wear, and the unusual resulting injury represents an opportunity to review best practice in management of laryngeal trauma.

BACKGROUND

We report a case of laryngeal trauma following an unusual mechanism of injury. Such trauma is rare. Junior Ears, Nose and Throat (ENT) and Emergency Department (ED) doctors are likely to be among the first doctors attending to a patient with laryngeal trauma presenting acutely. The potentially life-threatening nature of laryngeal trauma means that a working knowledge of the assessment and management of such injuries is crucial.

CASE PRESENTATION

A 41-year-old woman was brought by helicopter to a major trauma centre following neck trauma. While go-karting wearing a handbag and a scarf, with her bag slung over the right shoulder, her scarf and bag strap were caught in the left rear wheel of the kart. These became entangled, causing a sudden, forceful tightening of the strap and scarf around her neck resulting in a severe strangulation injury. As a result of the force of the injury, she was pulled from the vehicle in a posterior direction, with the kart coming to a stop. She remained conscious. Emergency services were called. On their arrival, a

deep laceration to the anterior neck to the right of the midline was covered with an occlusive dressing and the patient was transferred to the regional trauma centre by helicopter. During transport, she remained stable, with only a slight tachycardia. On arrival at the trauma centre, she was extremely distressed, but alert, breathing unaided and able to articulate in full sentences with high-pitched intermittent dysphonia but no hoarseness. Examination of the larynx was performed by flexible nasal endoscopy. It showed bleeding and marked supraglottic oedema. There was, however, no haematoma and the larynx appeared structurally intact. Vocal cords were oedematous but functioning normally on phonation. There was haemoptysis with frothy blood-stained sputum and marked surgical emphysema throughout the neck. Removal of the occlusive dressing revealed a zone II penetrating neck wound through platysma, through which there was bleeding with air bubbling but no obvious major active haemorrhage (figure 1). Medical history and medication history were unremarkable.

INVESTIGATIONS

As the patient was stable on arrival with bleeding easily controlled by direct pressure, an urgent CT angiogram of the neck, aortic arch and carotids was performed in the trauma scanner situated in the emergency department. The CT showed no vascular injury but extensive surgical emphysema to the anterior neck tracking into the mediastinum and into the larynx (figure 2). No fracture line was identified, but the radiologist report identified gas tracking from the right side of the neck into the larynx, suggesting an injury at this level.

TREATMENT

An emergency neck exploration was undertaken by the on-call consultant ENT surgeon and registrar with the on-call vascular surgeon in attendance. The airway was secured by awake fibre-optic endotracheal intubation. The existing neck wound was extended across the midline and the strap muscles divided to reveal the anterior larynx to be open with the endotracheal tube clearly visible. A free-floating triangular-shaped segment of left-sided thyroid cartilage (12 mm length, 8 mm base) avulsed from the anterior commissure 1 mm superior to the level of the glottis was found in the superior hypopharynx. The mucosal surface of the medial wall of the thyroid cartilage had been stripped away by the trauma. The vocal cords appeared uninjured. A primary repair of the injuries was undertaken: the mucosa was gently laid back and the friable cartilage segment was reduced and carefully sutured

Figure 1 Right neck wound.

CrossMark

To cite: Brimioulle M, King M, Bowles P, et al. *BMJ Case Rep* Published Online First: [please include Day Month Year]. doi:10.1136/bcr-2017-220070

Figure 2 Neck CT: axial and coronal views.

(Vicryl 5-0 suture). A tracheostomy was not performed at the time but the nasal endotracheal tube was left in place to act as a stent to protect the repair. The patient was transferred to the intensive treatment unit (ITU) intubated and ventilated with a 'second look' surgery planned on the next elective head and neck surgery list for definitive fixation of the fracture.

A second surgery was performed 2 days later for reassessment of the injuries by a specialist head and neck surgeon. The suture line of the mucosal tear was identified and was intact. Pharyngoscopy revealed mucosal abrasion of the posterior pharyngeal wall, and oesophagoscopy confirmed the oesophagus to be intact. There was a degree of laryngeal oedema. The initial primary repair of the cartilage was left unchanged. Because of poor healing properties of cartilage tissue, the fracture line was stabilised further by using a mini X plate, which reduces the risk of displacement after resorption of the Vicryl suture. In order to secure the airway, a surgical tracheostomy was performed at the third tracheal ring to minimise the risk of further damage to the larynx, and the patient returned to ITU. She was successfully weaned from ventilator support the following day.

The patient experienced post-traumatic anxiety and flashbacks, for which she received support from the inpatient psychiatric team.

A barium swallow was done 11 days after plating of the fracture in order to assess oesophageal integrity and swallowing pattern. The test showed an intact oesophagus and an incompetent swallow, thought to be partly due to the nasogastric (NG) tube. Five days later, she was decannulated in line with the local decannulation protocol. With speech and language therapy support, she was weaned from NG feeding and the NG tube was removed, resulting in marked improvements in her swallowing.

OUTCOME AND FOLLOW-UP

The patient was discharged 20 days after the initial injury. On follow-up, there was a persistent small skin wound over the tracheostomy site, but speech and swallowing were normal, and her psychological state had improved.

DISCUSSION

A literature search revealed several cases of trauma caused by scarf strangulation, though none which shared the mechanism of trauma and the extent of injuries. The most famous case is that of dancer Isadora Duncan, who died in 1927 of laryngeal fracture and carotid rupture when her silk scarf got caught in the wheel of her car.¹ More recently, a patient survived following carotid injury and laryngeal trauma.² Other cases of accidental strangulation by scarf resulting in different injuries, including scalp avulsion or cervical spine fracture, have been reported.^{3,4}

Table 1 Schaefer classification of laryngeal trauma			
Group	Description of injury	Evaluation	Management
I	Minor laryngeal haematomas or lacerations without detectable fractures	Flexible laryngoscopy	▲ Usually managed medically: steroids, antibiotics, antireflux medication, humidification, voice rest
II	More severe oedema, haematoma, minor mucosal disruption without exposed cartilage or non-displaced fractures	Direct laryngoscopy and oesophagoscopy	▲ Serial examination to detect worsening of injury ▲ Occasionally require tracheostomy ▲ Medical adjuncts may be helpful
III	Massive oedema, large mucosal lacerations, exposed cartilage, displaced fractures or vocal cord immobility	Direct laryngoscopy and oesophagoscopy	▲ Tracheostomy is often required ▲ Exploration and surgical repair are generally required
IV	Same as group III, but more severe, with disruption of anterior larynx, unstable fractures, two or more fracture lines, or severe mucosal injuries	Direct laryngoscopy and oesophagoscopy	▲ Tracheostomy is always required ▲ Surgical repair, requiring stent placement to maintain integrity of the larynx
V	Complete laryngotracheal separation	Urgent airway evaluation	▲ Tracheostomy required to secure airway ▲ Complex laryngotracheal repair through a low cervical incision after airway is secured

Adapted from Schaefer¹².

Laryngeal trauma is rare, accounting for less than 1% of all emergency department trauma.⁵ It can be classified by mode of injury into external and internal. External injury is further divided into penetrating and blunt injury.^{5–9} As well as cartilage injury and avulsion of tissue, blunt trauma causes haemorrhage into the mucosa and oedema; all of which can result in airway compromise.^{5 10}

Initial assessment and management of laryngeal trauma follow advanced trauma life support protocol with primary consideration given to assessing and establishing a secure airway.⁶

The most common symptoms of laryngeal injury include dysphonia, dyspnoea and stridor. Signs include surgical emphysema and crepitus, hoarseness and an altered laryngeal contour.⁶ Airway obstruction should be suspected with evidence of stridor, aphonia and dyspnoea with the use of accessory muscles.^{5 6 11} Internal laryngeal injury can cause coughing and haemoptysis.

The severity of laryngeal injuries can be categorised according to the Schaefer classification (table 1), which helps guide management.¹² This case represents a grade 3 injury, and was managed accordingly.

After initial assessment, management initially depends on airway status. Impending obstruction requires establishment of a safe airway.¹⁰ A surgical tracheostomy is often recommended, as insertion of an endotracheal tube can disrupt the larynx further.^{9 10 13} Flexible endoscopy can then be performed, allowing an internal laryngeal assessment. The imaging of choice for assessment of cartilaginous injury is a thin-cut CT of the neck.¹⁴ A CT angiogram may also be necessary to exclude occult vascular injury.^{5 6 13}

Specific management can then be considered. The aim is to restore normal breathing, swallowing and speech. Non-displaced thyroid cartilage fractures can be managed conservatively. Surgical management is necessary for displaced cartilage fractures

and associated soft tissue injuries must be addressed.^{10 15 16} Such injuries must be repaired ideally within 24 hours and no later than 48 hours after trauma, in order to avoid long-term sequelae.^{9 17}

In the case of our patient, the full extent of injury was not obvious on initial presentation or on examination. However, the CT scan, performed mainly to rule out significant vascular or bony injury, identified the likely laryngeal fracture and was instrumental in informing subsequent management. The neck exploration confirmed the laryngeal injury, which is thought to have been caused by the larynx being forcefully rotated to the right, exposing the left side to injury. Primary repair was performed by the on-call team with definitive surgical management completed in a second stage procedure by subspecialist head and neck surgeons within 48 hours of the initial injury.

Contributors MB: primary author of the manuscript. MK: literature review and review of the manuscript. PB: review of the manuscript. NS: review of the manuscript.

Competing interests None declared.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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REFERENCES

- Isadora Duncan's accident. *The Taunton daily Gazette*. Massachusetts, 1927.
- Gowens PA, Davenport RJ, Kerr J, et al. Survival from accidental strangulation from a scarf resulting in laryngeal rupture and carotid artery Stenosis: the "Isadora Duncan syndrome". A case report and review of literature. *Emerg Med J* 2003;20:391–3.
- Kaur M, Gupta B, Sinha C, et al. A report on a case of accidental neck strangulation and its anesthetic concerns. *Anesth Essays Res* 2010;4:120–2.
- Tumram NK, Ambade VN. Fractured cervical vertebra in accidental strangulation by chunni. *Egypt J Forensic Sci* 2013;3:96–8.
- Harris A, Sood S. trauma L-tracheal. In: Hussain SM, Logan and Turner' *Diseases of the nose, throat and ears; Head and Neck Surgery*. 11th edition. Boca Raton: CRC Press, 2016.
- Weissbrod PA, Schaefer SD. Management of acute external laryngeal trauma. In: Lalwani AK, Pfister MHP, *Recent advances in Otolaryngology; Head and Neck Surgery*. vol 5. New Delhi: Jaypee Brothers Medical Publisher, 2016.
- Gussack GS, Jurkovich GJ, Luteran A. Laryngotracheal trauma: a protocol approach to a rare injury. *Laryngoscope* 1986;96:660–5.
- Jewett BS, Shockley WW, Rutledge R. External laryngeal trauma analysis of 392 patients. *Arch Otolaryngol Head Neck Surg* 1999;125:877–80.
- Bell RB, Verschuereen DS, Dierks EJ. Management of laryngeal trauma. *Oral Maxillofac Surg Clin North Am* 2008;20:415–30.
- Hwang SY, Yeak SC. Management dilemmas in laryngeal trauma. *J Laryngol Otol* 2004;118:325–8.
- Fuhrman GM, Stieg FH, Buerk CA. Blunt laryngeal trauma: classification and management protocol. *J Trauma* 1990;30:87–92.
- Schaefer SD. The treatment of acute external laryngeal injuries. 'State of the art'. *Arch Otolaryngol Head Neck Surg* 1991;117:35–9.
- Granholm T, Farmer DL. The surgical airway. *Respir Care Clin N Am* 2001;7:13–23.
- Lupetin A, Hollander M, Rao V. CT evaluation of laryngotracheal trauma. *Seminars in musculoskeletal radiology*. : Thieme Medical Publishers, 1998:vol 2: 105–15.
- Woo P. Laryngeal framework reconstruction with mini-plates. *A Otorhinolaryngol* 1990;99:772–7.
- Pou AM, Shoemaker DL, Carrau RL, et al. Repair of laryngeal fractures using adaptation plates. *Head Neck* 1998;20:707–13.
- Bent JP, Silver JR, Porubsky ES. Acute laryngeal trauma: a review of 77 patients. *Otolaryngol Head Neck Surg* 1993;109:441–9.

Learning points

- ▶ Laryngeal trauma is rare; nonetheless, initial laryngeal trauma management should follow advanced trauma life support guidelines without missing potential trauma to other parts of the body.
- ▶ Airway stabilisation is the first and most important step in management, followed by exclusion or management of major vascular injury.
- ▶ In case of extensive injuries, early thin-cut CT scan of the neck is of paramount importance to disclose clinically occult cervical airway, vascular and/or spinal injury.
- ▶ Early involvement of a specialist head and neck surgeon is essential.
- ▶ Following the initial stages, multidisciplinary team management may be required, particularly the involvement of the speech and language therapy team and a trauma psychologist.

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