

Airway trauma

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Abstract

Airway trauma can be considered according to the mechanism of injury, which may guide further management. Trauma may be mechanical, either blunt or penetrating, be due to burns or be iatrogenic as a result of instrumentation of the airway. Immediate airway intervention will be required for obvious airway compromise. Such patients may be difficult to manage, and may be complicated by polytrauma. It is important to appreciate the potential for rapid deterioration in patients with an injury to the aerodigestive tract. Delayed diagnosis can result in poor outcomes from airway and neck trauma, and a structured approach to resuscitation, investigations and ongoing care should be adopted. Iatrogenic airway trauma is not confined to patients in whom intubation is difficult or prolonged, although these are risk factors. Pharyngeal and oesophageal perforation are associated with greater risk of mortality than other iatrogenic airway injuries. Cricoid joint dysfunction, vocal cord palsy, granuloma, haematoma and tracheal stenosis can all occur as a result of airway instrumentation, and may not be apparent until some time later. Specialist referral of these patients is appropriate, and prompt treatment may improve outcomes. Careful sizing of endotracheal tubes and close monitoring of cuff pressures are important in minimizing airway trauma through intubation.

Keywords Airway; cricoid joint; cricothyroidotomy; endotracheal tube; intubation; stenosis; tracheostomy; trauma

Airway trauma can be considered according to the mechanism of injury and the degree of respiratory compromise that ensues (Table 1).

The initial response of the anaesthetist to airway trauma will be influenced by the degree of respiratory compromise that is present. Patients with obvious respiratory distress will require immediate intervention to secure a patent airway and effective ventilation.

Patients may have further complications such as suspected cervical spine or vascular injury, or the presence of other life-threatening injuries. The trauma team should involve other specialities as necessary, particularly ENT, maxillofacial or burns specialists. Some patients may be at risk of rapid deterioration, and history and examination findings are particularly relevant in guiding timely, appropriate treatment.

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Learning objectives

After reading this article you should be able to:

- classify airway trauma according to the mechanism of injury
- recognize that airway trauma is an anaesthetic emergency, where immediate intervention may alter the outcome
- appreciate that iatrogenic trauma is not confined to the difficult airway and that endotracheal intubation is an invasive procedure

Immediate airway intervention

Immediate action for airway control may involve orotracheal intubation or intubation through a large open wound in the airway or emergency surgical airway, under local anaesthetic if necessary. These patients may be difficult to manage. Skilled assistance should be available, and senior help should be sought at an early stage.

Fibreoptic intubation is often difficult under these circumstances because of airway distortion, bleeding and the difficulties of passing a fibrescope past areas of airway damage, and is not recommended.

A selection of sizes of endotracheal tubes should be available, along with straight and curved laryngoscope blades and gum elastic bougies of different sizes. If elevation of the vallecula with a curved blade fails to pull a dislocated epiglottis forwards, a straight laryngoscope blade may be required to elevate the epiglottis directly.

If orotracheal intubation is required in blunt laryngeal trauma, this should be performed without the use of cricoid pressure as the latter may result in cricotracheal separation and loss of airway patency. Some authors suggest tracheostomy as the first approach to securing the airway in blunt laryngeal trauma as there is a risk of causing a false passage by oral intubation, but this view is controversial.^{1,2}

An emergency surgical airway may be required either as an emergency tracheostomy or via a cricothyroidotomy. In laryngeal trauma, cricothyroidotomy may cause further injury and an emergency surgical airway should be via tracheostomy if possible.²

Blunt airway trauma

The upper airway is relatively protected by the mandible and sternocleidomastoid muscles, the upper airway is also fairly mobile due to limited fixed attachments, therefore is able to absorb impact. Together this probably accounts for the rare incidence of airway injury from blunt trauma,² nevertheless when it does occur it is potentially life-threatening. Causes include assault, motor vehicle accidents (due to impact on a dashboard or airbag) and

Classification of airway trauma

- Mechanical: blunt or penetrating
- Burns
- Iatrogenic

Table 1

sporting misadventure. Injuries caused range from mucosal tears to laryngotracheal separation. A high index of suspicion should be maintained when assessing and observing patients with potential laryngeal injury, as late diagnosis and intervention can result in poor airway and voice outcomes.¹

Symptoms suggestive of laryngeal trauma can vary widely, but may include pain, dyspnoea, stridor, dysphonia, dysphagia and hoarseness.^{1–3} Careful, gentle assessment should be undertaken to avoid accidental dislodgement of unstable cartilage fragments, which may cause further airway compromise. Examination may reveal abrasions over the anterior neck, subcutaneous emphysema, stridor, haemoptysis, bruits, the loss of palpable landmarks in the thyroid or cricoid cartilage or signs of a pneumothorax.

Flexible fiberoptic laryngoscopy may reveal oedema, haematoma and an abnormal vocal cord position.³ Computed tomography (CT) scanning can be used to identify laryngeal cartilage damage and plan treatment, although some authors suggest that CT is irrelevant in cases where surgical intervention is clearly necessary.¹ Further assessment with bronchoscopy, laryngoscopy and oesophagoscopy may be required.^{1,4}

Blunt injury to the facial skeleton and tissue of the mouth and pharynx can produce airway compromise because of distortions of normal anatomy, bleeding and the presence of teeth or other fragments in the airway.

Penetrating injuries of the airway

Penetrating neck wounds can be described according to anatomical zones: zone I between the clavicles and the cricoid cartilage; zone II from the inferior margin of the cricoid cartilage to the angle of the mandible; and zone III from the angle of the mandible to the base of the skull.² Patients with neck trauma who are haemodynamically unstable or who have an obvious injury to the aerodigestive tract will require urgent surgery.⁵ However, in those who are stable on initial assessment, the zone of injury has traditionally influenced the diagnostic approach. More recently, CT has been advanced as the first-line investigation in stable patients with penetrating neck injuries, with subsequent investigations and endovascular or operative repair being guided by initial CT findings.⁵ It is important to note that, in injuries to zones I and II, oesophageal trauma may initially be asymptomatic but can proceed to cause infections within the neck and mediastinum, and a high index of suspicion should be maintained.^{2,6}

Burns and inhalation injury

Burns to the airway can present a major challenge to the anaesthetist, and careful attention should be paid to the history and examination. A history of a fire in an enclosed space should raise the suspicion of an airway burn or inhalation injury. The face, mouth, nose and pharynx should be inspected for burns. Other signs of airway burns include soot in the sputum, nose or mouth, dyspnoea, stridor and hoarseness. Furthermore the patient often has concomitant traumatic injuries including to the c-spine in their attempt to escape the fire. They may also have a low Glasgow coma score (GCS) due to the effects of smoke inhalation or due to the antecedent events that resulted in the fire such as the ingestion of alcohol and or drugs.

A key management issue is the potential for difficult intubation or loss of the airway caused by oedema. Such deterioration

should be anticipated, and the airway controlled early. Endotracheal tubes should not be cut, and careful attention should be paid to tube ties.

Burns patients will often come back to theatre many times and scarring and contractures on the neck can result in a previously routine intubation converting to a difficult intubation.

Iatrogenic trauma

Certain instances of airway trauma caused by instrumentation will be apparent to the anaesthetist at the time of their occurrence; for example, lacerations to the lip or tongue, damage to teeth or abrasions to the uvula and soft palate from throat packing.

Other instances of trauma may be less easy to detect. Pharyngeal or oesophageal perforation is a serious complication of aerodigestive tract instrumentation, and is associated with greater severity of injury and risk of mortality than other iatrogenic airway injuries.⁷ The principal early sign of perforation is surgical emphysema, but it is not present initially in all cases. If perforation is suspected, the patient must be observed carefully for symptoms (dysphagia, pain) and signs (surgical emphysema, swelling, fever).⁷

Cricoarytenoid joint dysfunction, vocal cord palsy, granuloma formation or haematoma can all occur^{7,8} and cause significant morbidity. These conditions can all cause symptoms of hoarseness and throat discomfort. If symptoms fail to resolve, patients should be seen by an ENT specialist for investigation and further management (Figure 1).

Subglottic stenosis is a serious consequence of mucosal damage, and may be multifactorial in its aetiology. It is of particular concern after prolonged intubation, when the stenosis is usually at the site of the cuff or tube tip. Care must be taken to monitor cuff pressures closely. Early intervention for post-intubation tracheal stenosis improves outcome,⁹ and patients should be referred to an ENT specialist with an interest in this condition.

Airway damage is not confined to instances of difficult intubation, nor is it only a consequence of prolonged intubation.⁸ An analysis of the American Society of Anesthesiology's closed claims project database showed that, of claims for airway injury, difficult intubation was not a factor in 61% of cases.⁷



Figure 1 Intubation granuloma secondary to traumatic intubation.

Small (internal diameter less than 7.0 mm) endotracheal tubes can reduce the risk of airway trauma and are easier to pass atraumatically.¹⁰ Larger proximal inflation pressures may be required for smaller tubes, although it does not follow that tracheal or cuff pressures will be increased.¹⁰ There are circumstances in which larger tubes are advantageous; for example, for the passage of bronchoscopes and larger suction catheters. The choice of tube size should be considered carefully according to the needs of the patient, and with an awareness of the potential hazards of intubation.

Also of note is recent analysis of NHS litigation claims.¹¹ Although the data set does not relate to clinical incidence, of the 67 claims relating to airway management 22 claims were for direct airway trauma, (excluding dental damage) 11 of the cases were from a tracheal tube, five from a tracheostomy insertion and in the remaining seven cases the airway device was not specified. It must be emphasized that these numbers relate to incidence of litigation only, but nevertheless no litigation for trauma was documented from sole use of a supraglottic device. ◆

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