Oesophageal rupture

Introduction

Oesophageal perforation is a rare but catastrophic event which can occur through a variety of insults. The risks of external trauma are low because of the mediastinal position of the oesophagus but the escalating availability of upper gastrointestinal endoscopy and associated instrumentation has resulted in an increase in iatrogenic damage which now accounts for the majority of injuries. Oesophageal perforation carries a high morbidity and mortality because of the difficulty of access to the oesophagus, the unusual blood supply, the lack of a strong serosal layer and the proximity of vital structures. Added to this, clinicians gain limited exposure to these cases because of their rarity.

Aetiology

Iatrogenic perforation of the oesophagus

The oesophagus can be damaged from within, such as during endoscopic instrumentation, or from without such as by paraoesophageal surgery, with the former being far the more common. The number of diagnostic videoendoscopic examinations performed entails that many iatrogenic injuries are seen despite the inherent safety of the procedure (overall perforation risk 0.03%).

By far the majority (75–90%) of iatrogenic perforations occur in the distal oesophagus, often in the presence of an underlying abnormality. Proximal trauma is more likely with hyper-extension of the neck, arthritis of the cervical spine or in the presence of an oesophageal diverticulum.

Therapeutic endoscopy carries a 200-fold higher perforation risk than diagnostic endoscopy, both for procedures for benign conditions, such as balloon dilatation for achalasia and with cancer-related procedures, such as palliative stenting, all of which are associated with a 5% perforation risk. Non-endoscopic instrumentation can result in either direct trauma, for example, from nasogastric tube, transoesophageal echocardiography probe insertion or from oesophageal intubation by an endotracheal tube or indirectly by pressure necrosis from the inflated cuff of tracheal tubes or close lying intercostal chest drains. Paraoesophageal surgery, such as anti-reflux surgery, can also inadvertently lead to direct trauma but the risk is low (0–1.2%).

Spontaneous perforation of the oesophagus

The rare, eponymous Boerhaave's syndrome is defined as complete disruption of the oesophageal wall occurring in the absence of pre-existing pathology and is characterized by barogenic oesophageal injury leading to immediate and gross gastric content contamination of the pleural cavity, with rapid and catastrophic onset of chemical and bacterial mediastinitis.

Penetrating injuries of the oesophagus

Sharp, penetrating injuries of the oesophagus are most common, accounting for approximately 19% of all oesophageal injuries, because the oesophagus passes superficially through the neck. These injuries often occur in conjunction with other serious injuries to surrounding viscera so are easily missed and consequent delay greatly increases morbidity and mortality.

Blunt oesophageal trauma

In contrast, although rare, gunshot injuries and blunt trauma occur more commonly to the thoracic oesophagus with blunt cervical oesophageal trauma only occurring in high velocity accidents. Thoracic oesophageal trauma can result from vascular thrombosis caused by contusion of the oesophagus, from traction laceration in rapid deceleration events or from barogenic damage.

Mr Jon Shenfine *is Specialist Registrar in Upper Gastrointestinal Surgery and* **Professor S Michael Griffin** *is Professor of Gastrointestinal Surgery in the Northern Oesophago-Gastric Cancer Unit, Royal Victoria Infirmary, Newcastle upon Tyne NE1 4LP*

Correspondence to: Professor S Michael Griffin

Clinical presentation

Clinical features of oesophageal perforation depend on the cause, site and delay from injury.

Full-thickness, intrathoracic, iatrogenic perforation is usually recognized immediately and is associated with chest pain, dysphagia and odynophagia, often allied to a systemic inflammatory response. Systemic symptoms are less common with cervical perforations which present with neck pain, dysphonia, cervical dysphagia, hoarseness and subcutaneous emphysema.

Spontaneous oesophageal perforation classically presents with sudden, distressing, retrosternal or epigastric pain following an episode of raised intra-abdominal pressure, usually vomiting, with subsequent subcutaneous emphysema (Mackler's triad). Misdiagnosis and treatment delay is common as a result of the similarity of presentation to cardiorespiratory disorders. Within 24–48 hours a systemic inflammatory response gives way to cardiopulmonary collapse and multiorgan failure as a consequence of overwhelming bacterial mediastinitis.

Penetrating oesophageal trauma manifests in a similar fashion to iatrogenic trauma but a high index of suspicion based on the tract of the injury is essential for diagnosis and damage should be suspected in any transcervical or transmediastinal wound, especially when gunshot derived.

Blunt oesophageal trauma is rare and usually only occurs in high impact events so is frequently associated with more immediately life-threatening airway or cardiopulmonary damage. Again a high index of suspicion is necessary and damage and oesophageal perforation should be actively excluded.

Investigations

Plain radiography

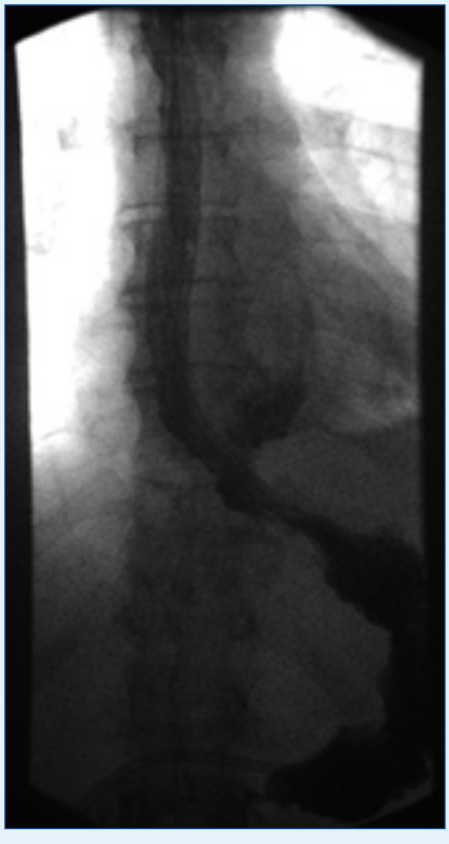
The typical findings of oesophageal perforation on a plain chest radiograph are pleural effusion, pneumomediastinum (*Figure 1*), subcutaneous emphysema, hydropneumothorax, pneumothorax and collapse or consolidation but these findings may be subtle and are dependent on the site, the extent of trauma and the time interval following the insult so are only helpful if perforation is suspected. In spontaneous perforation a plain abdominal radiograph may help to exclude a perforated peptic ulcer.

Figure 1. Chest radiograph following oesophageal dilatation of a benign stricture demonstrating pneumomediastinum.

Contrast radiography

Oral water-soluble contrast radiography is the investigation of choice to confirm perforation and ascertains the site (*Figure 2*), degree of containment and degree of drainage, however, false negative results are possible. If negative, films can be repeated in lateral or oblique positions or using barium.

Figure 2. Contrast swallow demonstrating oesophageal leak. Naso-jejunal feeding tube has been sited and is visible.



Upper gastrointestinal endoscopy

Flexible videoendoscopy is an expert procedure as it carries significant risk in inexperienced hands. Nevertheless, with fluoroscopic guidance it allows crucial assessment of the site, the extent of the mucosal injury, reveals any underlying pathology and facilitates placement of a nasogastric or nasojejunal tube for drainage or feeding (*Figure 3*). This is especially useful in an 'on table' situation where trauma is suspected but where other injuries preclude radiological examination.

Computed tomography

Computed tomography (CT) is not a first-line investigation but may be useful in critically ill patients with an atypical presentation (*Figure 4*). In combination with interventional radiological techniques, CT has revolutionized the management of intra-thoracic collections.

Figure 3. Endoscopic view of spontaneous oesophageal perforation.

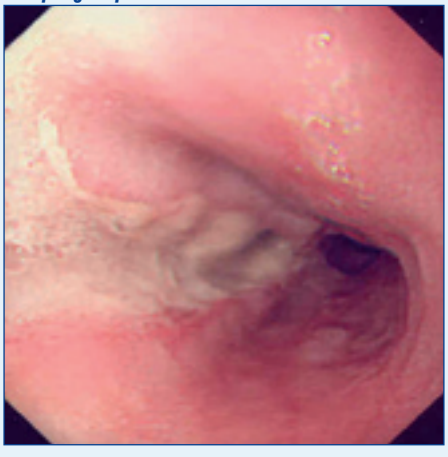
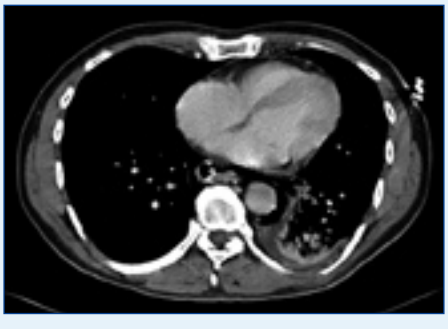


Figure 4. Computed tomography scan of the chest demonstrating pneumomediastinum and contamination of left pleural cavity.



Other
Drainage of gastric contents on thoracocentesis is diagnostic. Administration of oral dyes, such as methylene blue, in the presence of a communicating drain may also be useful.

Management
All patients with oesophageal perforation are critically ill. They require respiratory and cardiovascular assessment and support and opiate-based analgesia whether or not shock, respiratory distress or organ dysfunction is present. The initial resuscitation is documented in *Table 1* and regular re-assessment is obligatory. Survival is dependent on avoiding or controlling mediastinal and pleural contamination with surgery being mandatory when gross contamination is present.

Non-operative management
With advances in radiological interventional techniques, antibiotics and enteral nutrition, success with non-operative management is possible in carefully selected patients. Two patient groups in particular are suitable for consideration: those diagnosed rapidly with minimal contamination or those with a delayed diagnosis who have demonstrated tolerance to the perforation. Some guidance for patient selection is possible using the criteria detailed in *Table 2*.

Distal perforation
Patients require intensive observation and should be kept strictly nil orally. A nasogastric tube should be placed under endoscopic and/or radiological assistance past the perforation to decompress the stomach. Chest drains are placed where pleural perforation has occurred and contrast radiology, endoscopy and CT performed to monitor the status of the oesophageal leak and collections. All patients should be given broad-spectrum, intravenous antibiotics, antifungal and antisecretory agents with a low threshold for drainage of collections and surgical intervention. Enteral feeding may be established using a feeding jejunostomy. Non-operative treatment is not 'conservative' and intervention when required should be rapid and aggressive.

Removable self-expanding metal stents may help to seal iatrogenic perforations of malignant tumours if deemed unfit for resection but stent insertion cannot be recommended for perforations within a normal oesophagus, as expansion of the stent will expand the defect as well.

Table 2. Criteria for non-operative management of oesophageal perforation

Contained perforation	
Free flow of contrast back into oesophagus on contrast swallow	
No symptoms or signs of mediastinitis	
No evidence of solid food contamination of pleural or mediastinal cavities	
Other factors to consider	Perforation is 'controlled'
	No underlying oesophageal disease
	No sepsis
	Availability for intensive observation and access to multidisciplinary care
	Low threshold for intervention
	Enteral feeding established

Cervical perforation
Perforations of the cervical oesophagus are often managed non-operatively with percutaneous drainage of collections but when uncontained, primary closure with prevertebral lavage and drainage using a left lateral incision anterior to the sternocleidomastoid is recommended and is well tolerated by even critically ill patients.

Operative management
Surgery is appropriate if the patient has overt signs of sepsis, shock, gross contamination, an underlying obstructive pathology or retained foreign body or if they have failed non-operative management. Virtually all gunshot wounds require surgery. The prime objectives are to clear the contamination then to restore oesophageal integrity while preventing further soiling. A feeding jejunostomy should be fashioned for enteral feeding.

Depending on the perforation site a right-sided (for upper or mid oesophagus) or left-sided (distal oesophagus) posterolateral thoracotomy is used at an appropriate level. The pleural cavity is cleaned and lavaged, the mediastinal pleura incised to expose the injury and necrotic, devitalized tissue debrided. In a spontaneous perforation, an extending myotomy should be made as the mucosal injury is always longer than the muscular one. Iatrogenic perforations often occur in association with a pathology such as carcinoma, peptic stricture or achalasia, as a result, surgery may carry a higher mortality despite reduced levels of contamination.

Table 1. Initial resuscitation

Control of airway
Administration of oxygen
Early anaesthetic assessment
Large bore intravenous access
Intravenous fluid resuscitation
Consider central venous access and arterial line monitoring ± inotropic support
Urethral catheterization
Fluid balance monitoring
Intravenous broad spectrum antibiotic and antifungal agents
Intravenous antisecretory agents (proton pump inhibitors)
Strict nil by mouth
Large bore intercostal chest drainage – possibly bilaterally
Nasogastric tube (only to be placed under endoscopic vision or radiological guidance)

Primary repair

A primary suture repair is the most common surgical technique and may be buttressed with nearby tissues to reinforce the suture line. This repair is associated with a high leak rate so should be reserved for those with demonstrably healthy tissue and limited soiling.

T-tube repair

Repair over a T-tube is a viable alternative in view of the high leak rate for primary repair. This diverts swallowed secretions via a controlled oesophago-cutaneous fistula allowing healing to occur without ongoing contamination. A large lumen (6–10 mm diameter) T-tube is placed through the tear with the limbs directed proximally and distally beyond the boundaries of the perforation and the oesophageal wall is closed loosely around. The tube is brought out through the chest wall and secured with a further drain placed down to the repair and apical and basal intercostal chest drains. The T-tube is left until a defined tract is established with the majority removed between 3 and 6 weeks.

Resection

Oesophageal resection is a major undertaking but in the presence of a diseased oesophagus may be the only solution. Immediate reconstruction can be used where there is minimal contamination or a delayed approach may be taken.

Exclusion and diversion

Exclusion of the contaminated mediastinum and diversion of secretions maximizes healing while minimizing risk. However, techniques to achieve this are complex and are no better than other simpler treatments.

Perforation and cancer

Perforation of an inoperable malignancy should be managed non-operatively, in this situation a sealing self-expanding metal stent may be the most appropriate treatment. In patients with less clearly defined operability most authors recommend resection. However, this carries considerable mortality (between 22 and 75%) and long-term survival is compromised such that this treatment should be considered palliative. As such, every effort should be made to prevent iatrogenic injury during staging procedures.

Conclusions

The fragility of the oesophageal wall, the lack of serosa, the proximity of vital organs, the inaccessibility and the lack of symptoms and signs can mean that even small perforations of the oesophagus can be ultimately fatal. The majority of surgeons only deal with a handful of difficult cases in their career and these cases are best managed by specialist units with ancillary staff trained, equipped and experienced to prevent the disastrous consequences of misdiagnosis and inappropriate management. Overall mortality for oesophageal perforation is high and prevention of injuries is the real solution with appropriate endoscopic training most likely to improve outcomes. BJHM

Conflict of interest: none.

Further reading

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KEY POINTS

- Oesophageal perforation is a rare but hazardous event.
- Iatrogenic damage during upper gastrointestinal endoscopy accounts for the majority of injuries.
- Therapeutic endoscopy carries a 200-fold higher perforation risk than diagnostic endoscopy.
- Clinical features depend on the cause, site and time delay from injury.
- Severe and sudden chest pain following vomiting associated with subcutaneous emphysema is pathognomic of spontaneous perforation of the oesophagus.
- Oral water-soluble contrast radiography is the investigation of choice but endoscopic assessment in expert hands is invaluable and computed tomography is also useful in patients with an atypical presentation.
- Survival is dependent on controlling mediastinal and pleural contamination.
- Surgery is mandatory when gross contamination is present.
- Thorough wound debridement, lavage of pleural and mediastinal cavities and drainage are probably more important than the specific repair technique used.