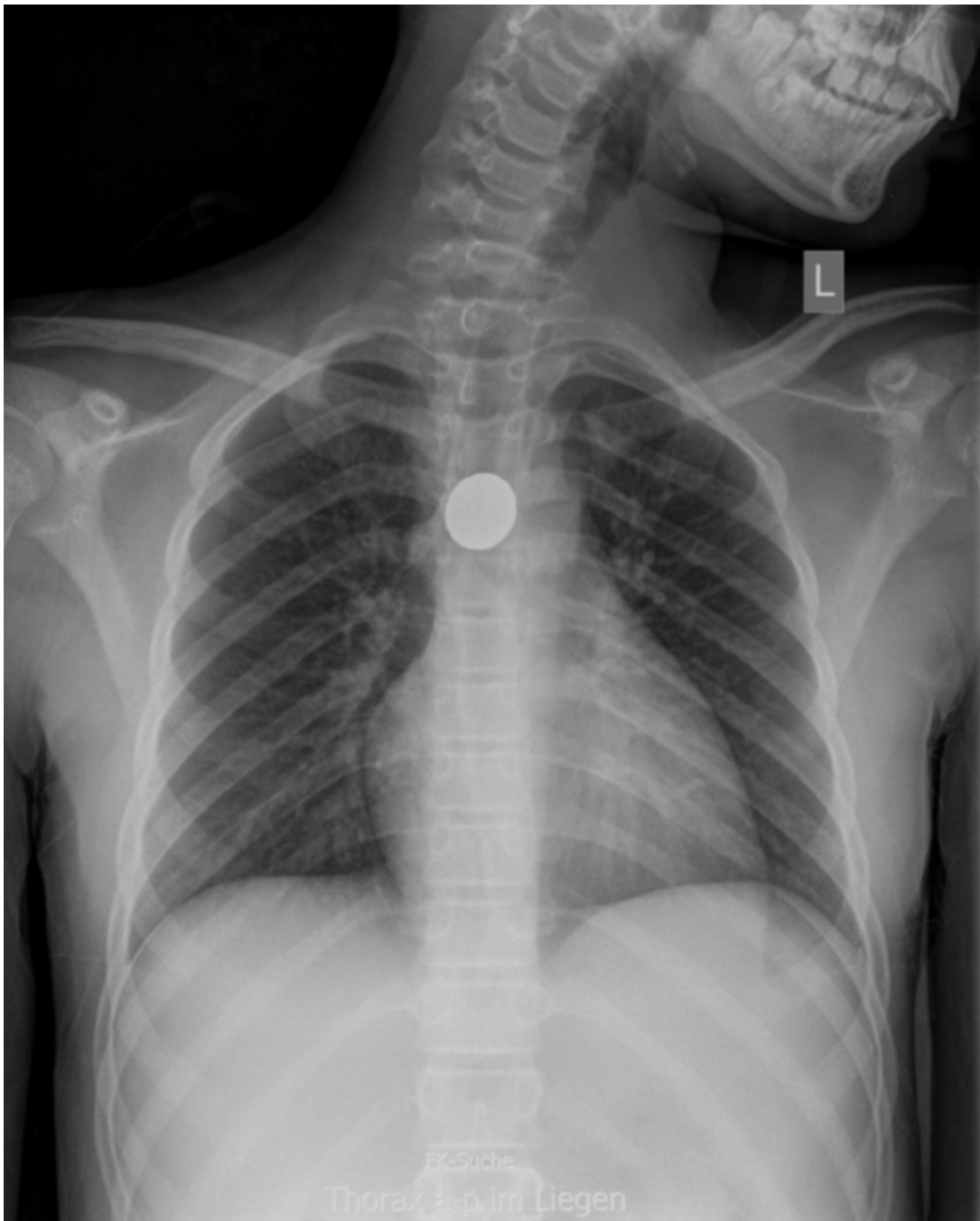


## Thoracic Trauma: Esophageal Injury

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**The esophagus can be injured by blunt or penetrating traumatic injuries. These type of injuries are rare, but they still life-threatening conditions. Most causes of esophageal injuries are considered iatrogenic, but may be spontaneous or traumatic. Rapid diagnosis and management provides the best chance for the patient to live without disabilities. However, delayed diagnosis is common, leading to increasing morbidity and mortality. In this article, we will discuss the pathophysiology, etiology, investigations, and management for this potentially fatal gastrointestinal condition.**



## Pathophysiology of Esophageal Injury

The esophagus is more important than the rest of the GI tract for the risk of trauma because it is devoid of a **serosal layer** (contains elastic and collagen fibers) that provides the required stability against trauma.

Most of the esophageal injuries involve the thoracic esophagus, followed by the cervical and the intra-abdominal esophagus. The most common site of the perforation by penetrating and iatrogenic traumas is the **cervical esophagus**, while the most spontaneous trauma occurs in the **intra-abdominal esophagus**.

**Iatrogenic causes** represent most of the injuries, followed by **external trauma** (penetrating and blunt), **barogenic rupture** and **ingested foreign bodies**.

## Several mechanisms involved in esophageal trauma

**Instrumental injuries of the** esophagus (iatrogenic injury) are considered the most common causes of perforation by the shearing forces. Also, it can be caused by different GIT integrated procedures, such as upper GIT endoscopy and strictures dilatation.

**Direct piercing** or **shearing forces** along the longitudinal axis of the esophagus, especially if associated with atrophy of the esophageal wall from necrosis may be the cause.

**Boerhaave syndrome**, which is defined as the spontaneous rupture of the esophagus, may occur as a result to a sudden rise in the intraluminal pressures, usually because of vigorous vomiting or retching, and that often occurs after heavy meals and alcohol consumption.

## Causes of Esophageal Injuries and Perforations

### Latrogenic causes

Represents the main cause of esophageal perforation. It accounts for about 75% of cases.

Occur during diagnostic and therapeutic procedures like endoscopy, stricture dilatation, esophageal varices ligation and endotracheal intubation.

Intraoperative esophageal perforation occurs during gastrointestinal and cardiothoracic operations. It accounts for about 2% of esophageal perforation.

### Boerhaave syndrome

It accounts for around 13% of esophageal perforation.

It occurs due to an increase in intraluminal pressure against the closed lower esophageal sphincter. This is mainly caused by violent vomiting and retching. It often follows ingestion of heavy meals and alcohol intake.

### Foreign body ingestion

Ingestion of caustic chemicals (corrosives) may cause direct inflammation of the wall and persistent damage, e.g. hydrochloric acid, sulfuric acid, hydroxide, potassium hydroxide (caustic potash) and sodium hydroxide (caustic soda).

Swallowing of foreign bodies, like pills and coins, can cause esophageal perforation directly by piercing, or indirectly by increasing intraluminal pressure.

### Trauma

Penetrating trauma is more common than blunt trauma. Penetrating trauma is usually associated with damage to surrounding cervical structures. It often occurs due to gunshots and stab injuries.

Blunt trauma can affect any part of the esophagus. Sometimes, the diagnosis is delayed secondary to other traumatic injuries.

# Clinical Presentation of Esophageal Injury

Esophageal perforation is a **serious life-threatening disease** which must be diagnosed very rapidly to avoid fatal complications following it. This depends on accurate history taking, observation and clinical examination of the patient.

## Symptoms

**Chest pain:** Severe pain at the site of perforation. It is considered a cardinal symptom for esophageal perforation. **It usually has acute and sudden onset and radiated to the back or the left shoulder.**

Classic presentation of Boerhaave syndrome is **severe and vigorous vomiting or retching followed by severe chest pain or epigastric pain.** It may be presented with chest or abdominal pain that occurs after straining, child birth, seizures, hiccup, severe cough or even blunt trauma.

As regards, iatrogenic causes, foreign body ingestion, and caustic material ingestion, the presence of fever and pain in the abdomen, neck, upper back and chest; dysphagia; dyspnea; odynophagia or dysphonia following esophageal instrumentation should increase the suspicion for esophageal injury.

If the patient has a history of pre-existing upper gastrointestinal pathology (GERD, Barrett esophagus, hiatal hernia, achalasia, esophageal carcinoma, strictures, radiation therapy, varices, infection), this raises the risk of traumatic perforation of the patient.

Old age (> 65 years) is a significant risk factor for perforation during esophageal instrumentation.

**Hematemesis** may be present, but it is normally not an obvious symptom.

## Signs

**Physical examination is usually non-specific, but certain clinical findings would be very helpful, including fever, tachycardia, tachypnea and hypotension.**

Mediastinal emphysema appears as crepitus at the base of the neck, later on subcutaneous emphysema appears over the neck and the chest wall

**The Mackler triad**, consisting of chest pain, vomiting and subcutaneous emphysema, is classically and usually associated with spontaneous esophageal rupture and it is present only in about 50% of cases.

Auscultation of the chest can be very important. It may show the **Hamman sign**, which is a crunching sound that can be heard over precordium with each heartbeat, and caused by mediastinal emphysema. It often occurs with thoracic or abdominal perforations.

If the perforation reaches the pleural cavity, it may lead to pneumothorax and pleural effusion and that may cause **respiratory distress.**

## Complications and Prognosis of Esophageal Injury

- Permanent damage to the esophageal wall causing narrowing or stricture
- Formation of abscess in and around the esophagus
- Pneumonitis and lung abscess formation

- An inflammatory response usually occurs rapidly after perforation and the condition can progress to shock – even death – if untreated
- Overwhelming bacterial mediastinitis that may cause multiple organ failure with a high mortality rate in a very short time
- Pneumothorax and pleural effusion that may cause respiratory distress

Outlook is good if the problem is found within 24 hours of its occurrence. Most people survive if surgery is performed within 24 hours. Survival rate goes down when treatment is delayed.

## Differential Diagnosis

The differential diagnosis involves a wide variety of causes of **chest pain**; each has a characteristic presentation and should be differentiated from esophageal injuries.

- Acute coronary syndrome
- Acute aortic dissection
- Aspiration pneumonitis and pneumonia
- Bacterial Pneumonia
- Acute pericarditis
- Empyema and Abscess Pneumonia
- Myocardial Infarction
- Pulmonary embolism
- Mallory Weiss syndrome
- Peptic ulcer disease

## Investigations and Diagnostic Tools for Esophageal Injury

### Radiography

Esophageal trauma diagnosis depends mainly on radiographic evidence that appear plain X-ray of the chest and Esophagogram. Specifically, posteroanterior and lateral plain chest X-rays can show signs indicative of esophageal injury.

### Chest X-ray

It may show subcutaneous and mediastinal emphysema. Pleural effusion, pneumothorax and hydropneumothorax may occur after traumatic injury of the esophagus, and are highly suggestive of traumatic esophageal perforation. Also, mediastinal air fluid level, free air under the diaphragm may be present.

The **V sign** can be seen in esophageal perforation, and it might indicate pneumomediastinum. There might be an air the outlines the left lower mediastinal border and medial left hemidiaphragm, taking the shape of the “V” letter.

### Esophagography (Gastrografin Sallow)

It is the best investigation for diagnosis that can reveal the site and extent of perforation. Gastrografin is used in this study, and not Barium, because it is very serious and can cause severe inflammation of the tissue and mediastinitis.

The patient lies on the right lateral decubitus position. A Barium study can be done immediately if Gastrografin study comes negative. That is because the sensitivity of Barium is higher than gastrografin.

## Computer tomography (CT scanning)

CT with the contrast of the chest and upper abdomen might reveal a presence of a leak, suggestive of esophageal perforation. A CT scan can confirm the above findings that may be present in a chest X-ray and esophagogram; also, it is better in the diagnosis site of traumatic perforation than the plain X-ray.

## Esophagoscopy

Upper endoscopy can be used in the early diagnosis of patients with suspected traumatic esophageal injury. It can be used when there is a high suspicion of perforation without radiographic findings. Flexible endoscopy allows the visualization of the esophagus and stomach in order to detect whether there is esophageal injury or not, especially if there is no previous history of esophageal instrumentation.

## Lab studies

Laboratory studies has little value in confirming the diagnosis of esophageal trauma, but the routine lab must be done like CBC, ABG, electrolytes, coagulation profile, liver function tests and kidney function tests.

## Management of Esophageal Injury

### Emergency treatment

Suspicion of esophageal perforation as a diagnosis is considered the first most important step in its treatment. Once esophageal perforation is suspected, confirm it and assess the **severity of the condition** and **hemodynamic stability** of the patient then start emergency treatment.

- **2 large IV lines**, nothing per mouth, **oxygen supply** and **cardiopulmonary monitoring**.
- Administration of **IV broad spectrum antibiotic**, **analgesics** and **total parenteral nutrition**.
- **Gastric tube** and **endotracheal tube** may be used according to the patient status.

**Tube thoracostomy** may be urgently used to decompress the chest. Fluid removed is often gastric contents, sometimes pus, which is often formed after a significant delay in diagnosis and treatment.

### Conservative treatment

Conservative management can be considered in patients with a contained perforation and limited leakage. It is also suitable for many patients with iatrogenic perforation and patients with inoperable malignant perforation.

Conservative treatment includes **continuous nasogastric suction** and the administration of an **intravenous analgesic**, **broad-spectrum antibiotics**,

**antiemetic, PPI, and parenteral nutrition.**

Drainage of the pleural and mediastinal contamination, effusion and abscess using **percutaneous drainage tube.**

Esophageal defects are closed with **endoclips, metal stents** or **fibrin glue.**

The outcome of patients depends mainly on proper treatment and appropriate drainage of any contamination in the pleural space or the mediastinum.

## Surgical treatment

Surgery should be performed in patients with a free perforation, in the absence of comorbidities that would prevent surgery and in patients free of underlying esophageal pathology (e.g., esophageal cancer). **Surgery should generally be performed within 24 hours if possible** to avoid any complications that may happen due to delayed intervention.

The used surgical approach depends on the state of the esophagus (healthy or diseased by malignancy or stricture) and the site and degree of perforation.

### **The most successful surgical approach**

Primary repair, with or without debridement of the mediastinal, and pleural drainage of the ruptured esophagus, mediastinal debridement, and pleural drainage. This is done by transabdominal or transthoracic approach depending on the site of perforation.

### **In iatrogenic cases, especially if there is a stricture distal to the site of perforation**

Myotomy is needed and the defect is closed by fundoplication.

If the esophagus is apparently damaged or diseased, primary repair could not be done but resection of the diseased part and fundoplication is done.

### **Repair over a T-tube**

It is an alternative approach that may allow for a controlled esophagi-cutaneous fistula to be done, which allows the healing to occur without contamination. The T-tube is usually removed after 4-6 weeks in most patients, and then the fistula eventually closes.

Diversion and exclusion of the esophageal secretions must be done to allow healing and prevent further contamination and infection.

## Minimal invasive techniques

Minimal invasive techniques have been described to treat this condition, but they are used only if there are no significant signs of contamination and sepsis, no major risk factors that could prevent the procedures and no contraindication for laparoscopy and thoracoscopy.

**Endoscopic stent placement** is done only in highly specialized centers with specialized expertise. It is used for patients with underlying diseases that preclude surgical intervention, but there must be no any underlying esophageal pathology.

**Self-expandable metal stents (SEMS) and self-expandable plastic stents (SEPS)** have been used to treat esophageal perforations.

# References

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