Emergent esophageal conditions. The radiologist's view.

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Learning objectives

To analyze the clinical and radiological features of esophageal emergencies, about a different cases seen in the emergency department of our hospital.
Background

Normal esophageal anatomy.

The esophagus spans approximately 25-30 cm from the lower border of the cricoid cartilage to the gastroesophageal junction. Usually, it descends along the left of midline in the neck then deviates to the right throughout most of its thoracic course. It returns to the left before entering the diaphragmatic hiatus at T10. Normal esophageal wall thickness is considered less than or equal to 5 mm on CT. The esophagus is surrounded by adventitia without a serosa. This lack of serosa permits esophageal pathology to spread more easily superiorly into the neck, laterally into the mediastinum or inferiorly into the upper abdomen.

Topographically, there are three distinct regions: cervical, thoracic, and abdominal.

1. The cervical segment, which extends from the cricopharyngeus muscle to the suprasternal notch, lies posterior to the trachea and anterior to the cervical vertebrae and is bordered laterally by the carotid sheaths and the thyroid gland.

2. The thoracic portion, extending from the suprasternal notch to the diaphragm, lies in posterior mediastinum anterior to the vertebral column, passing behind the aortic arch. It is in close relation with the trachea as well as the posterior surface of the left main bronchus, pericardium, and right pulmonary artery anteriorly; descending thoracic aorta, left subclavian artery, thoracic duct and pleura on the left; azygos vein and pleura on the right.

3. The abdominal portion extends from the diaphragm, after passing the esophageal hiatus, anterior to the aortic hiatus, continuing with the cardia of the stomach at the gastro-esophageal junction. In its abdominal course, it is covered with the peritoneum of the greater sac anteriorly and on its left side, and it is covered with the lesser sac peritoneum on the right side.

Esophageal processes such as esophagitis, foreign body impaction, traumatic esophageal injury, and complications of perforation often present emergently. The increasing use of crosssectional imaging in emergent care settings, the availability and ease of computed tomography (CT), and the often nonspecific manifestations of acute esophageal conditions all ensure a role for CT in the initial detection and diagnosis of these pathologic processes. In addition, CT is a useful adjunct to conventional esophagography and direct visualization, helping delineate the location and extent of disease, assess complications, and exclude alternative diagnoses. Delays in diagnosis account for most of the morbidity and mortality associated with esophageal
emergencies; accurate diagnosis and early initiation of an appropriate management strategy (conservative, endoscopic, or surgical) are integral to successful outcomes.

**Esophagitis.**

Gastroesophageal reflux disease is a common cause of noncardiac chest pain. Esophagitis related to the ingestion of caustic substances, irradiation, medication, or infection also may result in acute chest pain. In severe esophagitis, full-thickness esophageal necrosis may lead to perforation with associated complications.

**Foreign Body Impaction.**

Although foreign body ingestion is seen relatively often in the emergency department, most ingested objects pass spontaneously, without intervention. However, the thin esophageal wall, the lack of a supporting adventitia, and the relatively poor blood supply leave the esophagus vulnerable to perforation and pressure necrosis from foreign bodies that become lodged in it. Between 10% and 20% of ingested foreign bodies, including those retained within the esophagus, therefore require endoscopic removal, and surgery is needed in about 1% of cases. Sharp or pointed foreign bodies, button batteries, and objects that cause obstruction require emergent removal; less urgent intervention is indicated if a foreign body fails to spontaneously clear the esophagus in a timely manner.

Foreign body ingestion and impaction occur across all age groups, with a median age of about 40 years. The clinical manifestations of esophageal foreign body impaction are variable. Symptoms may include dysphagia, odynophagia, foreign body sensation, and food refusal. Regurgitation and an inability to swallow saliva are suggestive of esophageal obstruction.

**Trauma.**

Traumatic injury to the esophagus may result from both extraluminal and intraluminal processes. Injuries that are proved due to extraluminal blunt or penetrating trauma typically involve the cervical and upper thoracic parts of the esophagus but are rare overall, probably because of the small size of the esophagus, its relatively protected position, and the likelihood of serious concomitant vascular, tracheal, or spinal cord injury. Intraluminal processes such as instrumentation (Figs 13, 14), foreign body impaction, barotrauma, and erosive esophagitis, among others, give rise to a spectrum of injuries that may be characterized according to the degree of resultant esophageal perforation.
At one end of the spectrum are injuries such as mucosal lacerations, intramural dissection, and hematoma, which are relatively innocuous; and, at the other end, transmural perforation, which is potentially catastrophic. Mucosal lacerations, most intramural perforations, and some cervical and contained perforations of the esophagus may be managed conservatively; acute free (uncontained) transmural intrathoracic perforation is generally considered a surgical emergency.

The symptoms of esophageal injury are often nonspecific. Pain is the most common symptom, and it is often severe. Dysphagia or odynophagia also is strongly suggestive of an esophageal abnormality.

**Mallory-Weiss tear and other mucosal lacerations.**

A Mallory-Weiss tear is a longitudinal mucosal laceration observed in the distal esophagus or across the gastroesophageal junction. Its pathogenesis is similar to that of Boerhaave syndrome:

Both occur in the setting of retching or vomiting, frequently after excessive alcohol consumption; they also may occur as a complication of endoscopy. Some degree of hematemesis is invariably present and is an indication for upper endoscopy.

Similar linear mucosal lacerations occurring elsewhere in the esophagus as a result of forceful swallowing of an impacted foreign body or food bolus may pose a diagnostic dilemma.

**Intramural dissection and hematoma.**

Often referred to collectively as submucosal dissection or intramural rupture, intramural dissection and intramural hematoma of the esophagus are rare. By contrast to mucosal laceration and transmural perforation, they may be considered intermediate forms of esophageal injury. Symptoms include an abrupt onset of retrosternal chest pain, dysphagia or odynophagia, and hematemesis, with most patients experiencing at least two of the three, and with hematemesis generally occurring later in the clinical course. A history of recent instrumentation is probably the most important risk factor. Other contributing events are foreign body impaction and forceful vomiting. Spontaneous intramural hematoma of the esophagus also has been reported, most often in patients who are undergoing anticoagulant drug therapy or who have inherent coagulopathy.
With conservative management, intramural esophageal dissection and hematoma are expected to resolve within a few days or weeks.

**Transmural Perforation.**

Iatrogenic injury through esophageal instrumentation is the leading cause of esophageal perforation, accounting for 53%-70%, and it is mainly due to endoscopic procedures. The risk of perforation with diagnostic endoscopy is very low (3%), but the risk increases when therapeutic procedures are performed such as dilatation, stent placement, variceal sclerotherapy, laser therapy, and photodynamic therapy.

Amongst other causes of iatrogenic perforations are the following: nasogastric tube placement, endotracheal entubation, transesophageal echocardiography, gastric fundoplication, esophageal myotomy, and mediastinal or thyroid surgery.

The most frequent etiology of non-iatrogenic perforation is spontaneous rupture, known as Boerhaave’s syndrome, which is induced by straining and vomiting. Uncommon causes of spontaneous rupture include weight lifting, coughing and labor.

Foreign bodies are also a cause of perforation, either by direct puncture of the wall or by pressure necrosis that leads to rupture.

Traumatic injury is rare, mostly due to penetrating injuries such as stab wound or gun shot, but may occur with blunt trauma during motor vehicle accidents.

Other less common causes include caustic injury, severe reflux, infections and malignancy.

Signs and symptoms depend on the site of perforation, its etiology and time of presentation. Spontaneous rupture is associated with the clinical classic triad (Mackler triad) of vomiting, chest pain and subcutaneous emphysema, which is present in half the cases.

In the majority of the patients chest pain is present, typically of sudden onset.

Cervical esophagus perforation is typically associated with neck pain and/or odynophagia instead of chest pain.

Other symptoms are variable and less specific and include vomiting, hematemesis, dysphagia, dyspnea, and cough.

Patients may present with atypical symptoms such as shoulder pain, epigastric pain, hoarseness and dysphonia.
Physical signs, which may be present, are subcutaneous emphysema, cyanosis, fever, tachypnea, tachycardia, hypotension or shock.

**Treatment / Management**

There are multiple treatment options, and a multidisciplinary approach is advocated. In patients with contained rupture with minimal mediastinal complications, who are clinically stable, a conservative approach is advised, consisting of nil per mouth, intravenous (IV) antibiotics, analgesics, nasogastric decompression, and parenteric nutrition.

Surgical treatment is indicated in patients with free perforation, mediastinal contamination, or presenting with shock, and for those treated with non-surgical approach without improvement.

The surgical treatment includes primary repair with or without reinforcement, resection with immediate/delayed reconstruction and exclusion with diversion.
Findings and procedure details

The essential attribute in the diagnosis of esophageal emergencies are a high index of suspicion.

Contrast esophagogram was frequently used as initial imaging modality. However, this technique carries a 10% to 38% false negative rate, possibly secondary to inflammatory edema at the site of the injury, and does not allow evaluation of the extent of the injury and presence of possible complications, as well as possible alternative diagnosis. Also, it is difficult to perform in severely ill patients, and is associated with the potential risk of pulmonary oedema precipitated by aspiration of oral contrast. Imaging of the esophagus is challenging because the esophagus is a long tube, poorly distensible, and surrounded by many vital organs.

Multi-detector computed tomography (CT) offers new opportunities in the imaging of the gastrointestinal tract. Its ability to cover a large volume in a very short scan time, and in a single breath hold with thin collimation and isotropic voxels, allows the imaging of the entire esophagus with high-quality multiplanar reformation and 3D reconstruction.

The combination of contrast-enhanced CT with near-isotropic multidetector imaging and distention with water or before oral contrast ingestion, offers improved diagnosis for a large variety of esophageal diseases.

CT findings.

Esophagitis.

The inflamed esophageal mucosa shows uniform, circumferential wall thickening that usually involves a relatively long esophageal segment (Figs. 1, 2, 3, 4, 5). Inflammatory and neoplastic wall changes cannot be reliably distinguished based on CT morphology. Short segments of ulcerative wall thickening are more suggestive of a malignant lesion (Figs. 6, 7, 8), while longer segments are more consistent with an inflammatory process (Figs. 1, 2, 3). The most common CT findings are a thickened esophageal wall and a target sign. Although endoscopy is a more sensitive modality for detecting this condition, the CT finding of a relatively long segment of circumferential esophageal wall thickening, with or without a target sign, should suggest the diagnosis of esophagitis in the proper clinical setting. (Figs. 4, 5).

Foreign body impaction.
When a history of foreign body ingestion is elicited, a radiographic evaluation is performed, generally with conventional radiography of the neck, chest, and abdomen. Barium studies are discouraged because they may hinder subsequent attempts at endoscopic examination and retrieval.

The CT appearance of foreign body impaction is variable, depending on the item ingested, the site of impaction, and the presence of an underlying pathologic esophageal process or associated complication. Foreign body ingestion is most commonly seen in children, people with psychiatric disorders, and prisoners.

Food boluses (often meat) account for most cases of foreign body impaction seen in adults. (Figs. 9, 10).

Bones from fish and chicken constitute the second most common foreign body in both pediatric and adult populations and are more likely to become lodged in the hypopharynx or cervical esophagus, where they may be difficult to visualize endoscopically; CT may be especially useful in such cases (Figs.11, 12).

Trauma.

CT findings of esophageal injury include esophageal; wall thickening, periesophageal gas and fluid collections, contrast material extravasation, mediastinal fluid collection, mediastinal inflammation, focal esophageal wall defect, and pleural effusion. Inasmuch as some findings are nonspecific and may be subtle, the diagnosis of esophageal injury requires a high index of suspicion in appropriate clinical settings.

Mallory-Weiss tear and other mucosal lacerations.

A mucosal laceration without transmural perforation is likely to be radiographically occult. However, to the attentive observer, CT images of the esophagus in patients with chest pain occasionally show evidence of hemorrhage or foci of extraluminal gas at a site of mucosal injury. (Figs. 15, 16).

Intramural dissection and hematoma.

CT findings of dissection correlate with those seen at esophagography: a mucosal flap with submucosal distribution of gas or contrast material, giving the esophagus the classic double-barreled appearance.
An intramural hematoma of the esophagus may occur spontaneously or in association with traumatic esophageal dissection (Fig. 17). At CT, it appears as an eccentric hyperattenuating mass within the wall of the esophagus.

The clinical diagnosis of a spontaneous intramural hematoma may be challenging because its symptoms may mimic those of acute myocardial infarction or aortic dissection. CT is invaluable for its ability to help differentiate intramural hematoma of the esophagus from acute cardiovascular disease.

**Esophageal perforation.**

Radiographic detection of esophageal injuries relies on the presence of indirect radiological signs, including subcutaneous or muscular, thoracic or cervical emphysema, a widened mediastinum, pneumomediastinum pneumopericardium (Figs 18, 19), (left-sided) pneumothorax, pleural effusion, an abnormal course of a nasogastric tube when it is inserted, and a left lower lobe atelectasis. CT displays the same indirect signs as conventional radiology and more specific signs, such as a localized esophageal Wall thickening, mucosal hyperemia, mucosal dissection, and esophageal hematoma, as well as edema. Esophageal injuries are associated with periesophageal fluid, extraluminal air (pneumomediastinum, subcutaneous emphysema) pleural effusions and possible contrast extravasation. (Figs.20, 21, 22). CT also allows the visualization of very small collections of mediastinal air in cases with small tears.

**Complications.**

Historically, most of the mortality associated with esophageal emergencies has been attributed to delays in the diagnosis and treatment of esophageal perforation.

Esophageal perforation is association with a number of potentially life threatening complications given its close relation to other intrathoracic organs.

Acute mediastinitis is associated with a high mortality rate if recognized late in its course. CT findings include mediastinal collections, possibly associated with air-fluid level and mediastinal fat densification. Other ancillary findings include lymphadenomegaly, pleural and pericardial effusion, subcutaneous emphysema and pulmonary consolidation.

Pleural complications include empyema and esophagopleural fistulization. Empyema typically appears as a fluid density collection in the pleural space, sometimes with air, associated with pleural thickening and enhancement. It forms obtuse angles with the
adjacent lung, which tends to be displaced and compressed. Esophagopleural fistula following esophageal perforation is a rare complication, more common in patients with esophageal neoplasm or infectious esophagitis, and is suggested by the presence of hydropneumothorax. The site of communication might be seen at CT.

Pulmonary complications include lung abscess and pneumonia. Abscesses are generally rounded in shape, and may contain only fluid or have an air-fluid level, and are typically associated with surrounding consolidation. The wall of the abscess is typically thick and irregular.

Tracheobronchial fistulization, although rare, may occur, especially in oncologic patients and those with prior irradiation. CT may be helpful in the diagnosis of a fistulous tract and search for associated infection.
**Fig. 1:** Figs 1, 2, 3.- Axial contrast-enhanced CT image and sagittal and coronal reformatted image from contrastenhanced of the chest, obtained in a middle-aged man with a new onset of chest pain, shows hiatus hernia and mucosal enhancement, diffuse submucosal edema and circumferential esophageal wall thickening, findings suggestive of esophagitis.

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Fig. 2: Figs 1, 2, 3.- Axial contrast-enhanced CT image and sagittal and coronal reformatted image from contrastenhanced of the chest, obtained in a middle-aged man with a new onset of chest pain, shows hiatus hernia and mucosal enhancement, diffuse submucosal edema and circumferential esophageal wall thickening, findings suggestive of esophagitis.

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Fig. 4: Axial contrast-enhanced CT image obtained in a woman with a breast cancer in treatment with chemotherapy, shows circumferential esophageal wall thickening, suggestive of chemotherapy-related esophagitis.

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Fig. 5: Contrast-enhanced CT images of the chest show mucosal wall thickening and a subtle "target sign" (arrow). These findings are consistent with a radiation esophagitis in this patient being treated for lung cancer.

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Fig. 6: Figs 6, 7, 8. - Contrast-enhanced CT images of the chest in axial, coronal and sagital reformations shows a markedly diffuse esophageal wall thickening in the proximal third of the esophagus, with inhomogeneous enhancement and blurred outer borders in terms an oncological process.

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Fig. 7: Figs 6, 7, 8. - Contrast-enhanced CT images of the chest in axial, coronal and sagittal reformations shows a markedly diffuse esophageal wall thickening in the proximal third of the esophagus, with inhomogeneous enhancement and blurred outer borders in terms an oncological process.

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**Fig. 8:** Figs 6, 7, 8. - Contrast-enhanced CT images of the chest in axial, coronal and sagital reformations shows a markedly diffuse esophageal wall thickening in the proximal third of the esophagus, with inhomogeneous enhancement and blurred outer borders in terms an oncological process.

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Fig. 9: Figs 9, 10.- Foreign body impaction in the esophagus of an elderly man with dementia, and a recent onset of chest pain and sialorrhea. Axial contrast-enhanced CT image of the abdomen and sagittal reformatted image shows matter impacted in the distal esophagus.

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Fig. 10: Figs 9, 10.- Foreign body impaction in the esophagus of an elderly man with dementia, and a recent onset of chest pain and sialorrhea. Axial contrast-enhanced CT image of the abdomen and sagittal reformatted image shows matter impacted in the distal esophagus.

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Fig. 11: Figs 11, 12.- Contrast-enhanced CT images of the chest in axial and coronal MIP reconstruction shows a chicken bone in the lower third of the esophagus with air bubble in the mediastinum suggestive of esophageal perforation.

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**Fig. 12:** Figs 11, 12.- Contrast-enhanced CT images of the chest in axial and coronal MIP reconstruction shows a chicken bone in the lower third of the esophagus with air bubble in the mediastinum suggestive of esophageal perforation.

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Fig. 13: Figs 13, 14.- Contrast-enhanced CT images of the chest in axial and sagittal reformations shows transmural esophageal perforation by nasogastric tube.

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**Fig. 14:** Figs 13, 14.- Contrast-enhanced CT images of the chest in axial and sagittal reformations shows transmural esophageal perforation by nasogastrict tube.

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Fig. 15: Figs 15, 16.- Mucosal laceration in a middle-aged woman with chest pain. Axial contrast-enhanced chest CT image shows esophageal thickening, mucosal irregularity, and several tiny foci of blood inside of stomach.

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**Fig. 16**: Figs 15, 16.- Mucosal laceration in a middle-aged woman with chest pain. Axial contrast-enhanced chest CT image shows esophageal thickening, mucosal irregularity, and several tiny foci of blood inside of stomach.

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**Fig. 17:** Axial contrast-enhanced chest CT image shows intramural esophageal hematoma with pleural effusions.
Fig. 18: Figs 18, 19.- Contrast-enhanced CT images of the chest in axial and sagittal reformations shows wall thickening, mucosal dissection. Esophageal injuries are associated with periesophageal fluid, extraluminal air (pneumomediastinum, subcutaneous emphysema) pleural effusions.

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Fig. 19: Figs 18, 19.- Contrast-enhanced CT images of the chest in axial and sagital reformations shows wall thickening, mucosal dissection. Esophageal injuries are associated with periesophageal fluid, extraluminal air (pneumomediastinum, subcutaneous emphysema) pleural effusions.

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Fig. 20: Figs 20, 21, 22.- Axial contrast-enhanced CT image demonstrates leakage of oral contrast material adjacent to the medial and distal esophagus, with associated pneumomediastinum and left pleural effusion. Diffuse irregularity is visible in the mucosa lining the esophageal. Axial non enhanced CT image and sagittal and coronal reformatted shows oral contrast material, gas, and debris outside the esophagus, in terms a esophageal perforation.

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Fig. 21: Figs 20, 21, 22.- Axial contrast-enhanced CT image demonstrates leakage of oral contrast material adjacent to the medial and distal esophagus, with associated pneumomediastinum and left pleural effusion. Diffuse irregularity is visible in the mucosa lining the esophageal. Axial non enhanced CT image and sagittal and coronal reformatted shows oral contrast material, gas, and debris outside the esophagus, in terms a esophageal perforation.
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Conclusion

So it is important to make a good clinical and radiological characterization and correlation of this pathologies. An awareness of the CT findings associated with the spectrum of acute esophageal disease facilitates the accurate and prompt diagnosis of esophageal emergencies and thereby contributes to a more successful outcome and reducing delays in diagnosis that are likely to have a negative effect on patients.
References


