

ESOPHAGOGRAPHY AND CT IN THE ASSESSMENT OF ESOPHAGEAL PERFORATION: CASE PRESENTATION AND REVIEW OF THE LITERATURE

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Purpose: Esophageal perforation is a life-threatening condition that can lead to severe complications like fulminant mediastinitis. Prompt diagnosis and early surgical intervention are required because of its high mortality rates. We present the imaging findings of esophageal perforation and define the diagnostic value of CT.

Materials and Methods: CT findings of three cases of esophageal perforation with different etiologies were defined. The causes of the perforations were idiopathic in one patient due to severe vomiting, iatrogenic in one patient secondary to endoscopic retrograde cholangiopancreatography, and traumatic in the other from chicken bone ingestion.

Results: CT abnormalities included esophageal thickening, periesophageal fluid, mediastinitis, pneumomediastinum, pleural effusion, pneumothorax and a foreign body.

Conclusion: Recognition of the CT findings of esophageal perforation is important in the early diagnosis of a condition that can be fatal if left untreated. In patients with acute chest pain, CT reveals the decisive diagnostic criteria for esophageal perforation, with its mediastinal and pulmonary complications.

Key Words: Esophageal perforation, CT, Esophagography

ÖZOFAGEAL PERFORASYONUN DEĞERLENDİRİLMESİNDE ÖZEFAGOGRAFİ VE BİLGİSAYARLI TOMOGRAFİNİN YERİ

Amaç: Özofageal perforasyon, fulminant mediastinit gibi ciddi komplikasyonlara neden olabilen hayatı tehdit eden bir durumdur. Yüksek mortalite oranları nedeniyle, uygun tanı ve erken cerrahi girişim gerekmektedir. Bu yazıda perforasyonun görüntüleme bulguları sunulmuş ve BT'nin tanınma değeri belirtilmiştir.

Gereç ve Yöntem: Farklı etiyolojilere bağlı özofageal perforasyonu olan üç olgunun BT bulguları tanımlandı. Perforasyon nedenleri bir hastada idiopatik, bir hastada endoskopik retrograde kolanjiopankreatografiye sekonder iatrogenik, ve diğerinde tavuk kemiği injeksiyonuna sekonder travmatik idi.

Bulgular: BT anormallikleri arasında, özofageal kalınlaşma, periözofageal sıvı, mediastinit, pnömomediastinum, plevral efüzyon, pnömotoraks ve yabancı cisim bulunmakta idi.

Sonuç: Özofagus perforasyonun BT bulgularının bilinmesi, tedavi edilmediğinde fatal bir durum olan bu antitenin erken tanısında önemlidir. Akut göğüs ağrısı olan hastalarda BT, eşlik eden mediastinal ve pulmoner komplikasyonlar ile birlikte, özofageal perforasyonun kesin tanınma kriterlerini ortaya koyar.

Anahtar Kelimeler: Özofageal perforasyon - BT - Özefagografi

INTRODUCTION

Esophageal rupture is a rare clinical phenomenon that can have tragic outcomes if not treated early and promptly. We report three cases of esophageal injury; each is secondary to three different etiologies. The aim of this article is to discuss the usage of different imaging modalities, outlining the key radiological manifestations, and to analyze the important role of radiologists in the early diagnosis.

CASE REPORTS

Case 1: A previously healthy 67-year-old man was admitted to the emergency department with intense abdominal pain. The patient noted the pain two hours earlier after accidentally swallowing a chicken bone. The onset of the pain was acute just after he swallowed the bone and the intensity of pain was steadily increasing. The chest X-ray examination in the emergency department showed widespread pneumomediastinum without evidence of pneumothorax or pleural effusion. The subsequent computed tomography (CT) examination of the thorax revealed widespread pneumomediastinum and the swallowed chicken bone in the middle third of the esophagus (Figure 1 a, b, c). The patient underwent an urgent thoracotomy with a presumed diagnosis of esophageal rupture due to a foreign body. Surgery revealed a 3-cm long vertically oriented tear in the esophagus and the chicken bone impacted at the tear site. The foreign body was removed and the tear was primarily repaired. The food particles in the mediastinum and the right pleural cavity were cleaned out. After the operation the patient developed intractable sepsis resistant to therapy with an unremitting, downhill course and expired two days after the operation.

Case 2: A 47-year-old man was admitted to the emergency department with intense chest pain. Two hours before he had experienced forceful retching without vomiting, followed by sudden and excruciating chest pain. The chest X-ray at the emergency department was unremarkable except for questionable mediastinal widening. The patient was referred to our department for a CT scan of the chest with a presumptive diagnosis of spontaneous esophageal rupture, namely, Boerhaave's syndrome. In the CT scan, after oral water soluble contrast agent, tiny amounts of free air were noted at all levels of the mediastinum, especially at the para-aortic and peri-esophageal planes. Additionally, left pleural effusion and right pneumothorax were observed. The contrast agent was also noted in the left pleural effusion (Fig. 2a, b, c). Following the CT examination, a fluoroscopic examination with water soluble contrast revealed an active extravasation at the distal end of the esophagus just above the cardia (Fig. 2d). During the operation, a vertical tear measuring 2 cm was found in the distal esophagus and primarily repaired. Gastric content was found in the medias-

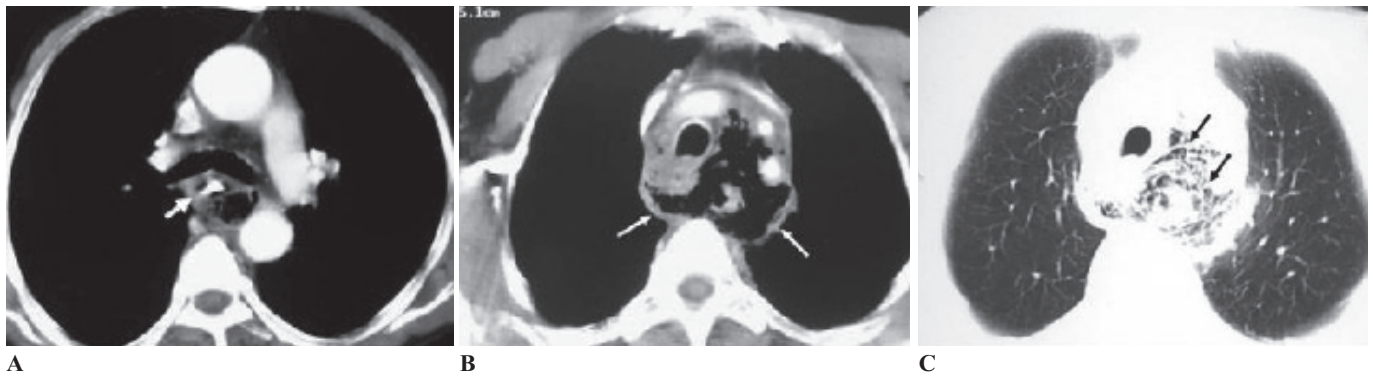


Figure 1 (a-b-c). A 67-year-old man with esophageal rupture due to chicken bone ingestion. CT scan at the level of the carina reveals a chicken bone (white arrow) located in the mid-esophagus (a). CT scan at the level of the trachea demonstrates mediastinal widening, extensive pneumomediastinum (white arrows) and increased density of mediastinal fat planes (b). The image with parenchymal window settings of the same CT section as in Fig. 1b also demonstrates extensive mediastinal free air densities (black arrows) (c).

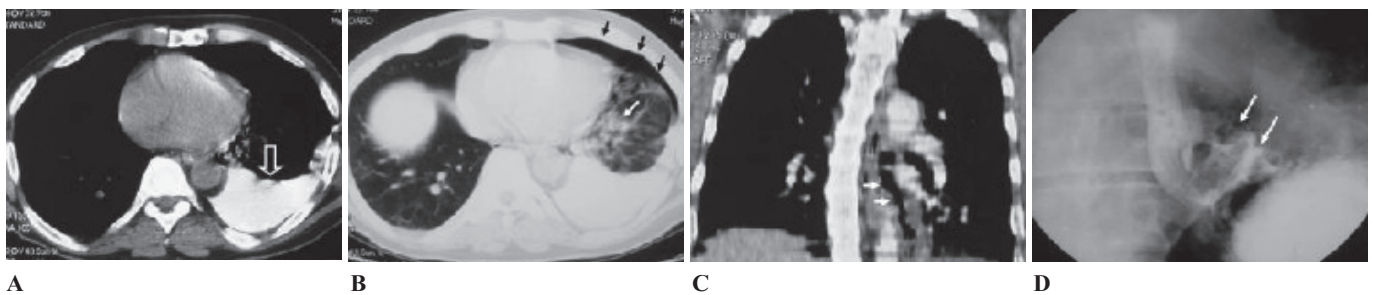


Figure 2 (a-d). A 47-year-old man with Boerhaave's syndrome. Accumulation of extravasated contrast agent in the left pleural space (open white arrow) after oral administration is observed (a). Parenchymal window settings clearly demonstrate left pneumothorax (black arrows), and parenchymal infiltrates (white arrows)(b). Pneumomediastinum (white arrows) is observed in coronal reformat image (c). Esophagography indicates contrast medium extravasation at the supradiaphragmatic level (white arrows)(d).



Figure 3 (a-c). A 55-year-old woman with esophageal perforation secondary to ERCP. Periesophageal free air densities in the posterior mediastinum and minimal right pleural effusion are observed in the CT section at the supradiaphragmatic level (a). Pneumomediastinum and anterior replacement of the inferior vena cava are observed in the CT section with parenchymal window settings at the level of the liver dome (b). Air tracking through mediastinal structures is clearly demonstrated in the coronal reformat image (c).

tinum and the right pleural cavity. The patient's postoperative recovery was uneventful and he was discharged six days after the operation.

Case 3: A 55-year-old woman was referred to our department with mild but gradually increasing chest pain that began two hours after endoscopic retrograde cholangiopancreatography (ERCP). The patient's clinical history was unremarkable except for obstructive-type jaundice that became apparent clinically two weeks previously. The CT scan examination of the abdomen was unremarkable except for dilated intra- and

extrahepatic bile ducts with a questionable stone at the distal end of the common bile duct. The ERCP showed a stone at the distal end of the common bile duct, which was successfully removed. The chest X-ray examination was unremarkable and the patient was referred to our department with a presumed diagnosis of instrumentational esophageal rupture. The CT examination showed a tiny amount of air in the mediastinal planes with no evidence of pneumothorax (Fig. 3a, b, c). The subsequent fluoroscopic examination failed to show any active extravasation and the repeated CT examination was also

negative for the presence orally ingested contrast material in the thoracic cavity. With the patient's clinical and radiological findings a more conservative treatment was preferred to a surgical intervention. The control CT scan four days after the first event showed the complete clearance of air, and the patient was discharged on the eight day with complete disappearance of clinical symptoms.

DISCUSSION

Esophageal injuries are uncommon but can have dramatic outcomes without immediate and prompt treatment. The primary method of treatment is surgery and timing is of the utmost importance for the success of the surgery. Mortality is unacceptably high in patients diagnosed late. The outcome dramatically improves when the condition is diagnosed early and surgery follows within 12 hours (1). Despite all efforts the overall mortality from esophageal perforation is 22% (2).

Esophageal rupture is an uncommon and difficult clinical entity. Its low incidence means that clinicians are unfamiliar with this potentially devastating problem. High clinical suspicion with special emphasis on personal history is mandatory for an early diagnosis and successful treatment. Esophageal perforations are most commonly due to penetrating or blunt trauma, endoscopic procedures, barogenic injury, malignancies, surgical injury, foreign body and caustic injuries. Barogenic esophageal perforations are usually spontaneous postemetic ruptures in previously healthy patients without a history of esophageal disease. Overall endoscopic and traumatic injuries are the most common causes, while spontaneous barogenic ruptures comprise 16% of the cases (3). Barogenic esophageal rupture is also called Boerhaave's syndrome after the original description by a Dutch physician named Hermann Boerhaave in Lord High Admiral Wessenaer after a heavy meal followed by ipecac-induced vomiting. The most common cause of Boerhaave's syndrome is forceful vomiting against a closed epiglottis, leading to a sudden increase in esophageal pressure. Weight lifting, defecation, childbirth, and seizures are among the several other mechanisms reported (4). The most common location of tears is the distal left lateral esophagus 3 to 5 cm above the gastroesophageal junction. The location of instrumentational rupture may be at all levels but the usual location is the level of the cricopharyngeal muscle. Ingestion of foreign bodies is another cause of esophageal perforation, responsible for 7% of cases. Cervical perforations have lower mortality rates when compared to thoracic perforations (5). The mid-esophagus lies adjacent to the right pleura and the distal esophagus neighbors the left pleura; perforations at these locations lead to leakages and sometimes to collections in the respective pleural cavities. Once the mediastinal pleura is breached, the negative pressure caused by respiration and positive gastric pressure prompts further drainage to the mediastinum and pleura, leading to hydrothorax and pneumothorax. The lack of a serosal layer in the esophagus makes it more vulnerable to rupture and perforation and allows direct soilage of the mediastinum with gastric contents and digestive sec-

retions. These secretions leaking into mediastinal planes and the pleural cavity lead to intractable mediastinitis, sepsis and eventually death.

Radiological studies are the mainstay of early diagnosis. The chest X-ray is generally the first imaging study. It may show pneumomediastinum, pneumothorax, pleural effusion and sometimes the subcutaneous emphysema. The leakage of fluid and air may lead to mediastinal inflammation and mediastinal widening. Air visible in a posteroanterior view is seen at presentation in only 20% of patients (6). Contrast esophagography is an invaluable diagnostic tool for diagnosing esophageal perforation and can be performed with water soluble contrast agent. Active contrast extravasation readily detects the rupture. Nevertheless, false negative rates have been detected in up to 10% of patients (7). The abnormalities seen on a CT scan are generally the first imaging finding to suggest the correct diagnosis. Extraluminal air is the first imaging finding and occurs in 92% of patients. Esophageal thickening is another useful clue for the diagnosis (8). Pleural effusion may be bilateral but left-sided predominancy is generally seen in Boerhaave's syndrome, like in case 2 herein. Pneumothorax may also be associated with other findings. Although surgery is the definitive treatment for the majority of patients, conservative treatment is another option for selected patients (9). The role of conservative treatment is still being debated by several authors. Non-operative therapy is best applied in the following clinical scenarios: instrumental perforation as in our third case, small perforations after dilatational therapy for any stenotic esophageal disorder, and late diagnosis with minimal clinical symptoms (5). Patients without the classical clinical symptoms of perforation and without clinically apparent sepsis are good candidates for non-operative treatment. Endoscopic perforation has been shown to be associated with improved survival and mild clinical symptoms and these patients can be successfully managed non-operatively, as in our third case. We think that CT must be the first imaging modality to be selected, due to its widespread availability, relatively short scanning time (especially after great advances in CT technology), and its superior ability to detect early findings of esophageal perforation. CT is also superior to an esophagogram, with its unique ability to demonstrate other complications of perforation like pneumothorax, pleural effusion or pulmonary infiltrates that cannot be demonstrated with an esophagogram, and it can delineate alternate diagnoses that can mimic the clinical symptoms of esophageal perforation. It may also be useful for the selection of patients who are candidates for non-operative management by clearly showing any accompanying complications of perforation and can guide the percutaneous drainage if needed during the same session. Sometimes sufficient patient cooperation cannot be achieved for an esophagogram, especially when he or she is in poor clinical condition. At these times, CT is again more successful than an esophagogram. In our experience, water soluble oral contrast must be used in patients with high clinical suspicion. The presence of contrast material in any part of the thoracic cavity definitely verifies the clinical diagnosis. However, clinical history may suggest that one of the main disadvantages of CT is its incapability

to show the exact location of the perforation. If the patient's clinical condition permits, esophagography must follow the CT examination.

Recognition of the CT findings of esophageal perforation is important in the early diagnosis of this condition, which is fatal if left untreated. As the initial diagnostic modality, CT reveals the decisive diagnostic criteria for esophageal perforation, with its mediastinal and pulmonary complications. An urgent esophagogram must follow positive CT imaging to definitely locate the rupture.

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