Diaphragmatic Hernia in a Patient with Chest Trauma

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Case Presentation
A 27-year-old man was brought to the emergency department following a major motor vehicle collision as an unrestrained driver. On physical examination, he was in severe respiratory distress and had reduced breath sounds, palpable left rib fractures, and crepitus over the left chest. An initial chest radiograph was performed (Figure 1) followed by CT (Figures 2, 3).

**FIGURE 1.** Frontal chest radiograph demonstrates multiple displaced posterior left-sided rib fractures (arrows) with nonspecific opacification of the left hemi-thorax that is more focal at the base, just superior to the left diaphragm.

**FIGURE 2.** Coronal contrast-enhanced CT image of the abdomen demonstrates the stomach (St), spleen (Sp) and portions of the tail of the pancreas (P) herniating into the left hemi-thorax with intact portions of the left diaphragm noted laterally and appearing slightly thickened (arrow). The herniated contents slightly narrow at the defect, resulting in a so-called “collar sign.”

**FIGURE 3.** Axial contrast-enhanced CT at the thoraco-abdominal junction demonstrates the stomach (St) and spleen (Sp) in the left hemi-thorax abutting the posterior ribs resulting in a so-called “dependent viscera sign.” Other pathology is also present but suboptimally viewed, including a left rib fracture, subcutaneous emphysema, pneumomediastinum, and a left pneumothorax.
Key Imaging Findings
A left diaphragmatic hernia in the setting of major blunt chest trauma

Differential Diagnosis
Traumatic diaphragmatic rupture
Bochdalek diaphragmatic hernia
Morgagni diaphragmatic hernia
Hiatal hernia

Discussion
Diaphragmatic hernias are common and encountered routinely in chest imaging. However, traumatic rupture is less common compared to the ubiquitous hiatal hernia. An initial chest radiograph demonstrated nonspecific opacities in the left base. These abnormalities were further characterized on subsequent CT that revealed the opacities on radiography to represent a combination of the herniated abdominal contents in the inferior left hemi-thorax as well as pleural fluid (blood) and airspace disease (contusion and atelectasis).

The differential for this case includes traumatic and nontraumatic causes of diaphragmatic hernias and includes the eponymous Bochdalek and Morgagni hernias, a hiatal hernia, and traumatic diaphragmatic rupture. In addition to the location and CT appearance of the hernia, the history and presence of other significant traumatic pathology are key considerations when evaluating the diagnostic possibilities.

Differential Diagnosis
Traumatic Diaphragmatic Rupture
Rupture of the diaphragm is not common, but is identified in a small percent of patients with blunt trauma, with motor vehicles accidents being the most common cause. Penetrating injuries are more common causes of diaphragmatic injury. Traumatic diaphragmatic rupture from blunt trauma occurs more frequently in the posterolateral aspect of the hemi-diaphragms at sites thought to be relatively weaker structurally. It is more commonly diagnosed on the left side with a variety of reasons hypothesized for the disparity in laterality including the liver providing a degree of protection to the right hemi-diaphragm.

Traumatic diaphragmatic rupture is rarely an isolated CT finding, with other traumatic findings in the thorax such as a rib fracture(s), effusions, and pneumothoraces also present in the vast majority of cases. Diaphragmatic rupture in the setting of blunt trauma often results in larger diaphragmatic defects (often > 10 cm) compared to penetrating trauma, leading to a larger defect for upward herniation of abdominal organs due to negative intrathoracic pressure.

Diaphragmatic rupture may occasionally be suggested on chest radiography. Radiographic findings include diaphragmatic elevation, intrathoracic stomach bubble or other intrathoracic bowel, and abnormal location of an oro- or nasogastric tube tip. CT is more likely to delineate a traumatic diaphragmatic rupture due to the greater anatomic detail compared to chest radiographs. With modern scanners, the diaphragm and the defect will likely be directly visualized with coronal and sagittal reconstructions aiding visualization. In addition to directly identifying the diaphragmatic defect, other CT signs of diaphragmatic rupture include thickening of the remaining diaphragm due to blood and/or muscle retraction, the “dependent viscera sign” (herniated organs layering against the posterior ribs), and the “collar sign” (narrowing of herniated organs and/or fat at the diaphragmatic defect).

Diaphragmatic rupture has the potential to be overlooked at initial evaluation due to small size and/or obscuration from adjacent pleural and parenchymal changes. Additionally, more immediately life-threatening traumatic injuries may capture the attention of the radiologist and the clinicians. Diaphragmatic defects typically require surgical intervention. The herniated viscera are potentially at risk for complications if left untreated including obstruction, strangulation, and ischemia.

Bochdalek Diaphragmatic Hernia
Bochdalek hernia is a congenital diaphragmatic defect located posteriorly between the diaphragmatic pars lumbaris and pars costalis. It is the most common congenital diaphragmatic hernia in adults and is usually discovered incidentally on cross-sectional imaging. Bochdalek hernias usually contain fat, but abdominal viscera such as the kidney may also herniate through the defect. Controversially, they are more common on the left. They may be suggested by radiography, but can be occult. A common CT appearance is discontinuity of the posterior diaphragm with intrathoracic peritoneal fat herniation.

Morgagni Diaphragmatic Hernia
Morgagni hernias are a rare congenital diaphragmatic defect located anteriorly in the cardiophrenic space between the diaphragmatic pars costalis and pars sternalis. They are much more common on the right. Morgagni hernias may contain peritoneal fat, as well as abdominal solid organs and bowel. On plain films or CT, a Morgagni hernia will appear as a discontinuity of the diaphragm at the right cardiophrenic angle with intrathoracic peritoneal fat or solid organ herniation.

Hiatal Hernia
Hiatal hernias result from chronic widening at the esophageal hiatus due to weakening of the phrenoesophageal membrane. Prevalence increases with age. Hiatal hernias are generally categorized as sliding and paraesophageal, although mixed-type hiatal hernias also exist. When the defect is severe, other abdominal viscera and/or fat can enter the thorax from a hiatal hernia. Hiatal hernias are typically evaluated on barium fluoroscopy examinations and can also be detected on radiographs. CT is not typically done for the detection of hiatal hernia, but they are often encountered incidentally on CT.
Diagnosis

Left traumatic diaphragmatic rupture with intrathoracic herniation of the stomach, spleen, and tail of the pancreas in the setting of major blunt chest trauma.

Summary

This case of a left-sided diaphragmatic hernia had an initial wide differential considered. The key to narrowing the differential to the correct diagnosis of a traumatic diaphragmatic rupture is the location of the hernia, the CT evidence and history of trauma.

A Morgagni hernia would be found anteriorly and is very rarely found on the left side. A Bochdalek hernia would be located more posteriorly and typically contains fat. Although abdominal organs can enter a Bochdalek hernia, it would be extremely unusual to encounter a Bochdalek hernia containing the stomach, pancreatic tail, and spleen. Although a very large hiatal hernia can contain other abdominal organs, the defect should be able to be localized to the esophageal hiatus. The defect on this case was posterolateral in the left hemi-thorax, separate from the esophageal hiatus. Furthermore, such a large hiatal hernia would be highly unusual in a 27-year-old.

After applying these observations to the diagnostic considerations, a traumatic diaphragmatic rupture is the most appropriate diagnosis. This is an excellent example of a less common cause of a diaphragmatic hernia. As the treatment is surgical, it is important for the radiologist to be aware of this entity and to be able to differentiate it from other congenital and acquired diaphragmatic hernias that are much more frequently encountered.

References