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CASE REPORT

Right-sided Bochdalek hernia obstructing in an adult: case report and review of the literature

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Abstract Bochdalek hernias on the right side of the diaphragm are very rarely diagnosed in adults. We review a case of a 35-year-old female who presented acutely with intestinal obstruction. Plain and cross-sectional imaging identified a large right-sided Bochdalek hernia, containing colon, causing a mechanical obstruction and, surprisingly, concurrent appendicitis. The patient underwent an emergency laparotomy. At surgery the colon was reduced and was viable. The diaphragmatic defect was repaired using non-absorbable sutures and an appendicectomy was then performed for purulent appendicitis. She made an uneventful recovery and remains well at 9-month follow-up. We discuss what we believe to be the first reported case of an obstructed right-sided Bochdalek's hernia associated with appendicitis in an adult and review the published literature on this rare condition.

Keywords Bochdalek hernia · Colonic obstruction · Diaphragmatic hernia · Appendicitis

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Introduction

A diaphragmatic hernia may be congenital or secondary to traumatic rupture of the diaphragm. The most common site of congenital herniation is through the foramen of Bochdalek (a persistence of the pleuroperitoneal cavity) in the posterolateral portion of the diaphragm. This phenomenon is well reported, with 80–90% occurring on the left side of the diaphragm and with patients usually presenting immediately after birth and requiring early surgical repair [1].

A Medline search showed only 14 previous published cases of right-sided congenital Bochdalek hernia presenting in adulthood. This case merits reporting, because the obstruction was associated with purulent appendicitis, perhaps secondary to a closed loop obstruction. In addition the hernia was right-sided in the presence of a normally developed liver.

Case report

A 35-year-old woman presented to the emergency department with a 12-h history suggestive of intestinal obstruction. She had been experiencing intermittent abdominal colic for several months. There was no significant past medical history or trauma. Clinical examination revealed she was dehydrated, febrile (temperature 37.6°C), tachycardic (130 beats per minute), and had mild abdominal distension and tenderness in the right lower quadrant.

Investigations revealed a raised white cell count of 12.25×10^9 g L^{-1} (reference range 4–11 $\times 10^9$ g L^{-1}). A chest radiograph revealed dilated large bowel loops above the right hemidiaphragm (Fig. 1). An urgent computerised tomography (CT) scan revealed a right-sided diaphragmatic

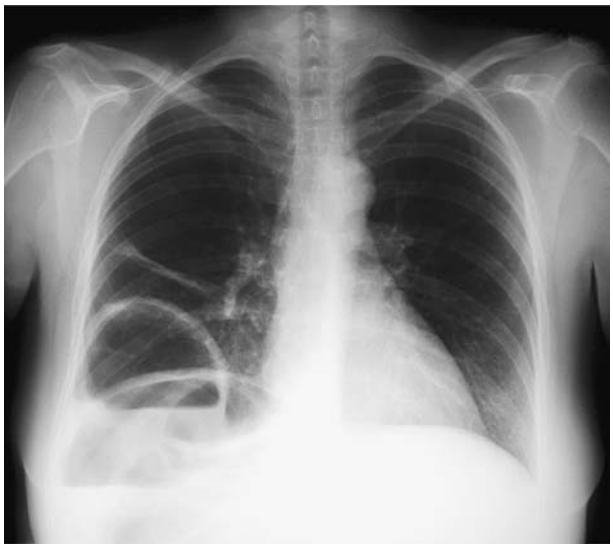

Fig. 1 Chest X-ray showing gas filled bowel loops above the right hemidiaphragm

hernia causing a mechanical large bowel obstruction of the proximal transverse colon (Fig. 2) and appendicitis (Fig. 3).

An emergency laparotomy was performed through an upper midline incision. The findings included a right Bochdalek's hernia containing transverse colon with closed loop obstruction. The diaphragm had to be divided to enable reduction of the bowel, which was found to be viable, back into the intra-abdominal cavity. The abdomen contained pus in all quadrants because of a perforated appendix. An appendicectomy was performed. In the presence of sepsis, the hernia was repaired with non-absorbable sutures (as opposed to mesh). Final closure of the diaphragm followed aspiration of the pleural cavity on full inspiration. The patient received a five-day course of post-operative antibiotics. She made an uneventful recovery and was discharged home. She remains well at nine-month follow-up.

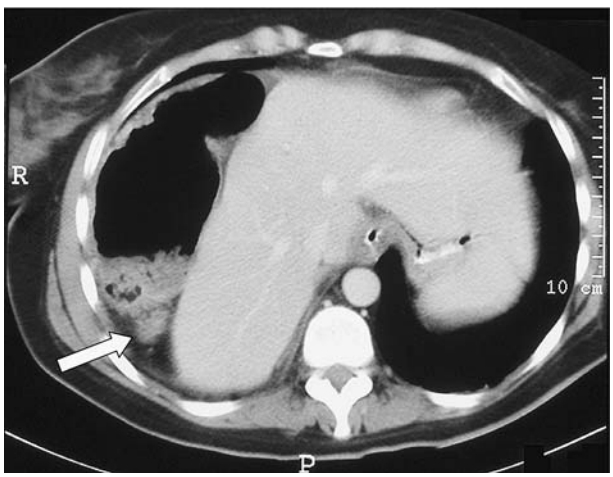

Fig. 2 CT scan of thorax showing right-sided diaphragmatic herniation with a proximal dilated bowel loop and a distal collapsed loop (*arrow*)

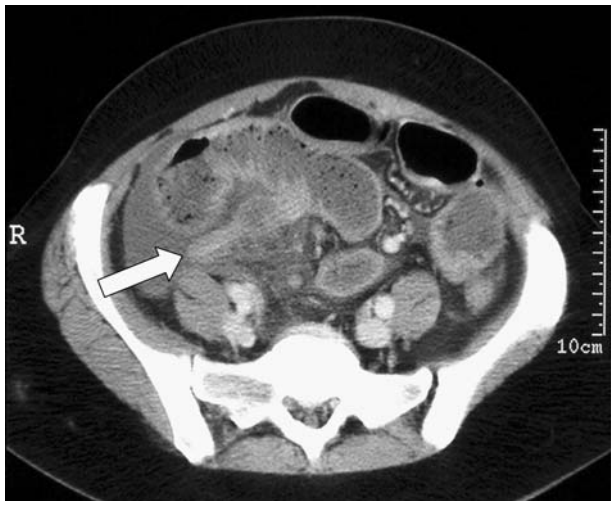

Fig. 3 CT scan of pelvis showing inflamed appendix (*arrow*) with pericaecal fluid

Discussion

Bochdalek first described a congenital hernia, resulting from the developmental failure of the posterolateral foramina to fuse properly, in 1848 [2]. Most such hernias are diagnosed in children where symptoms are associated with pulmonary insufficiency. A Bochdalek hernia in adulthood is unusual with fewer than 100 cases reported in literature [1]. Classically Bochdalek hernias usually arise on the left (70–90%). This may be because of the protective effect of the liver on the right and, in part, because of the different times at which the pleuroperitoneal folds fuse on each side. These hernias are rarely found on the right (often associated with a hypoplastic liver) or bilaterally [3]. A Medline search of the literature revealed only 14 cases of right-sided Bochdalek's hernia in adults (Table 1).

Clinical presentation of right-sided Bochdalek hernia in adults may vary from an incidental finding on radiological investigation to strangulation of contents with significant morbidity and mortality. Summarising the reported cases 43% presented acutely with abdominal pain, 36% with respiratory symptoms (two patients had both), and 27% with symptoms of obstruction (Table 1). In an acute presentation in half the cases the hernia sac contains colon, in 40% the sac may contain multiple other viscera (including small bowel, stomach, liver, right kidney, and/or gallbladder [4]).

Bochdalek hernias show up on chest X-rays as gas and fluid-filled viscera in the hemithorax, as in our case. Associated mechanical obstruction may be obvious on plain X-ray imaging. Contrast-enhanced computerised tomography

Table 1 Available literature of right-sided Bochdalek hernias in adults

First author Refs.	Patient age (years/sex)	Presenting symptom	Diagnostic imaging	Herniated organ	Operative approach
Ketonen [11]	NA	Gastrointestinal symptoms	Chest X-ray, barium meal	NA	Thoracoabdominal
de Oliveira [12]	NA	Intestinal obstruction	CT	NA	Thoracoabdominal
Sinha [13]	70/F	Right sided chest pain	CT	Colon	NA
Molina Trigueros [14]	85/F	Abdominal pain	NA	Colon	NA
Fabrin [15]	24/M	Dyspnoea and haemoptysis	NA	Stomach	NA
Mar Fan [8]	32/F	Abdominal (right hypochondrial) pain	CT	Small bowel	Diagnostic laparoscopy converted to laparotomy
Petrovskii [16]	24/M	Dyspnoea and haemoptysis	NA	Stomach	NA
Zenda [4]	69/M	Abdominal pain	CT (small left liver)	Ileum, Colon, Gallbladder	Abdominal
Sakorafas [17]	88/F	Intestinal obstruction	CT (incidental Bochdalek)	Liver, right kidney, colon	Laparotomy and adhesiolysis (from previous gynaecological surgery)[a]
Giuliani [18]	74/F	Intestinal obstruction	NA	Small bowel	Abdominal
Fisichella [19]	55/F	Intestinal obstruction	CT	Small bowel, Liver	Thoracoabdominal
Kanazawa [20]	63/F	Dyspnoea and abdominal pain	CT	Colon (strangulated), right kidney	Thoracoabdominal (atrophic right liver)
Court [21]	Unknown	Respiratory symptoms	NA	Colon (perforated), hypoplastic liver	Abdominal
van Deurzen [22]	67/M	Abdominal pain, respiratory symptoms	CT	Small bowel (strangulated)	Thoracotomy

NA, data not available; CT, computerised tomography

[a] Bochdalek hernia not repaired

(CT) is an increasingly important investigation in assessment of the acute presentation, however. Typical findings are fat or soft tissue contour on the upper surface of the diaphragm, characteristic posterolateral location on the hemidiaphragm, and diaphragmatic discontinuity adjacent to the mass [5]. The rare finding of dilated bowel above the hemidiaphragm makes the diagnosis obvious. Other investigations include upper gastrointestinal contrast series, which can exclude malrotation [5], but may miss complications such as appendicitis demonstrated here. A delayed or missed diagnosis of diaphragmatic hernia can occur, leading to significant morbidity and mortality [6].

Management of a Bochdalek's hernia includes reducing the abdominal contents and repairing the defect through a laparotomy or thoracotomy. The best approach for management of hernias occurring on the left side is controversial. Those who advocate a thoracotomy claim improved ability to separate adhesions between thoracic viscera and the hernia sac [6]. Those in favour of a laparotomy believe it superior in the recognition and management of malrotation and for dealing with visceral complications such as obstruction or strangulation [7]. Right-sided defects are traditionally dealt with by a thoracic or thoracoabdominal approach, because of the presence of the liver. Abdominal repair with mobilisation of the right lobe of the liver produces adequate views [8] and we believe will gain more popularity with the advent of more advanced laparoscopic techniques. Our patient had an emergency laparotomy, because of the presence of bowel obstruction and suspected appendicitis. More recently, successful laparoscopic [9] and thoracoscopic repair of left Bochdalek's hernia have both been described [10].

In summary, adult presentation of a Bochdalek hernia on the right is a rare clinical entity, the outcome depending on the type of presentation, early radiological confirmation of the diagnosis, and prompt intervention when peritonitis or perforation exists. This review summarises the available published literature on acute right-sided Bochdalek's hernia presenting in adults. This case emphasises the need for cross sectional imaging in planning surgery because it identified concurrent appendicitis.

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