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CASE REPORT

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Asymptomatic liver segment herniation through a postoperative defect in the right hemidiaphragm following aortic bypass graft surgery

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Abstract We present a 16-year-old girl with asymptomatic liver segment herniation following aortic graft surgery for atypical coarctation of the aorta. The defect in the right hemidiaphragm was caused by the implantation of an ascending thoracic aorta to upper abdominal aortic bypass graft. The differential diagnosis of diaphragmatic defects as well as the role of various imaging modalities in establishing the diagnosis are discussed.

Keywords Diaphragm · Hernia · Liver · Aorta · Graft · Complication · Child

Introduction

Diaphragmatic hernias in children are either congenital or acquired. Whilst acquired defects are most commonly traumatic in origin, they can be caused by iatrogenic postoperative lesions or can occur spontaneously.

We present a girl with asymptomatic liver herniation through a postoperative right hemidiaphragm defect related to the implantation of an ascending aorta to upper abdominal aortic bypass graft. The diagnosis was suspected on the basis of a chest radiograph and was later confirmed both intraoperatively and by preoperative cross-sectional imaging at the time of reoperation.

Case report

This 16-year-old girl's past medical history was remarkable for atypical coarctation of the aorta, which was corrected using a modified subclavian flap at the age of 10 days. Two months after the operation she developed recurrent stenosis with a pressure gradient of up to 140 mmHg between the arms and legs. She then underwent implantation of an extra-anatomical 8-mm Dacron graft between the ascending and the supracoeliac portion of the abdominal aorta. The graft was passed through the right hemidiaphragm which was reconstructed. The chest radiograph at the time of discharge did not disclose any abnormality.

A follow-up chest radiograph 2 months later demonstrated a soft-tissue mass in the right cardiophrenic angle projecting over the anterior and middle portions of the right hemidiaphragm (Fig. 1).

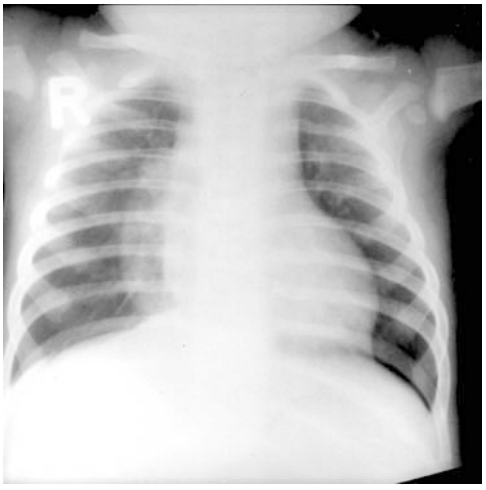

Fig. 1 Supine frontal chest radiograph 2 months after surgery. There is a soft-tissue mass in the right cardiophrenic angle projecting over the anterior and middle portions of the right hemidiaphragm

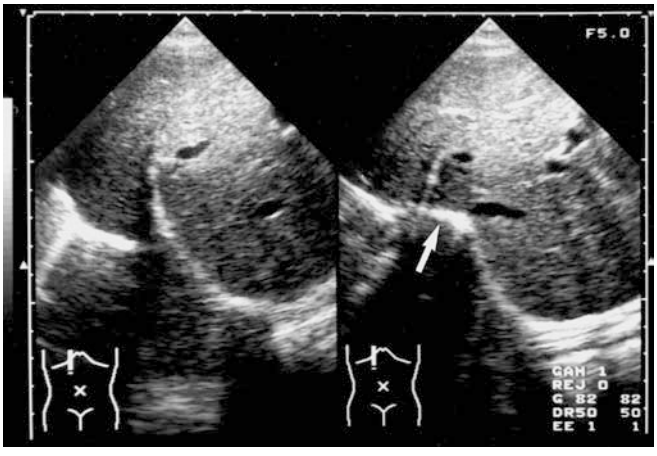

Fig. 2 US of the abdomen demonstrating herniated liver tissue in the right hemithorax, interpreted as resulting from partial relaxation of the right hemidiaphragm (*arrow*) or true herniation

An upper gastrointestinal series disclosed slight obstruction and displacement of the stomach and proximal small bowel caudally. A US examination of the abdomen showed herniated liver tissue in the right hemithorax, which was interpreted as resulting from either partial relaxation of the right hemidiaphragm (proven synchronous respiratory motion at fluoroscopy) or from true herniation (Fig. 2). As the patient was asymptomatic, surgical correction was not undertaken.

At the age of 11 years, graft stenosis was suspected on clinical grounds. MRI, however, did not confirm a stenosis, but showed the liver herniation adjacent to the graft (Fig. 3). The initial graft was replaced since it was outgrown. Via a median sternotomy and upper median laparotomy, graft replacement was performed using the preformed transdiaphragmatic route. The graft was totally removed and replaced with a 19-mm ascending aorta to upper abdominal aortic graft. Intraoperatively, a diaphragmatic defect with liver segment herniation into the right hemithorax was confirmed. There were dense adhesions in the right hemithorax

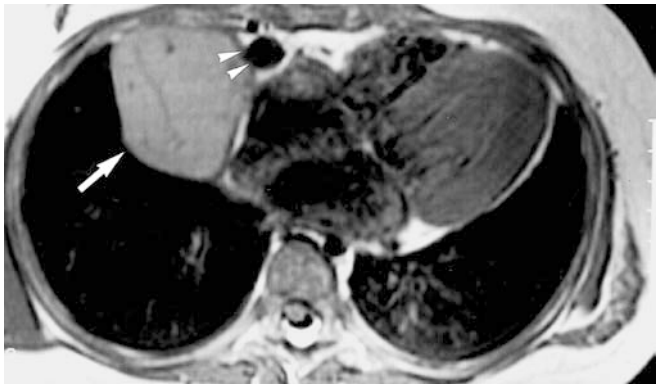

Fig. 3 Axial T1-weighted MRI at the age of 11 years showing the unchanged liver herniation (*arrow*) through the right hemidiaphragm adjacent to the graft (*arrowheads*)

covering the herniated liver. Five years later, the girl remains asymptomatic and thus far no complications have resulted from the herniated liver, which is still visible as a right cardiophrenic angle mass on chest radiographs.

Discussion

Diaphragmatic hernias in children are either congenital or acquired. Acquired defects are most commonly traumatic in origin, followed by iatrogenic lesions and spontaneous defects [1]. Traumatic diaphragmatic lesions are found in 3–8% of patients sustaining major blunt upper abdominal trauma; these are usually on the left side, attributed to the cushioning effect of the liver protecting the right hemidiaphragm [2]. Right-sided traumatic diaphragmatic hernias are more often related to penetrating injuries, but may also occur as a complication of surgery. The importance of early diagnosis is reflected by the high mortality rates ranging from 30% to 50%. In more than 50% of diaphragmatic ruptures, the diagnosis is missed initially, and strangulation of herniated bowel may occur [1]. Small diaphragmatic defects are at particular risk of causing bowel obstruction and strangulation. However, the adhesions found in our patient at the time of re-operation may have been protective against further liver or bowel herniation.

The radiological diagnosis is often complex and includes several imaging modalities [2]. Chest radiography, which is usually the first technique to identify an abnormality, may demonstrate intrathoracic herniation of a hollow viscus with or without waist-like constriction of the viscus at the site of the tear, a finding termed ‘the collar sign’ [1]. Usually, however, additional examinations such as US, CT, MRI or, rarely, contrast studies of the gastrointestinal tract are required to establish the correct diagnosis and precisely locate the defect [3, 4, 5].

In our patient, the normal chest radiograph following the first surgical intervention and the fact that the lesion was right sided exclude well-known congenital diaphragmatic hernias such as oesophageal hiatal hernia, congenital defects and aplasia of the diaphragm, as well as hernias through the foramina of the sympathetic nerve chain and the inferior vena cava. The differential diagnosis includes Morgagni hernia and so-called spontaneous rupture of the diaphragm following heavy physical exertion with high intra-abdominal pressures, a condition usually affecting the left hemidiaphragm.

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