Patients with cirrhosis and portal hypertension often have abnormal extracellular fluid volume regulation, resulting in the accumulation of fluid as ascites, edema or pleural effusion [1]. Due to the presence of ascites, an increase in the intra-abdominal pressure might lead to a small pleuroperitoneal bleb of the peritoneum from congenital defects in the hemithorax [2]. This lesion may appear as an intrathoracic mass as seen on a simple chest radiograph. A CT image may be helpful to differentiate an ascitic pleuroperitoneal bleb from an intrathoracic mass. We present three cases of a pleuroperitoneal bleb in patients with liver cirrhosis and ascites.

**Index words:** Pleuroperitoneal bleb
- Liver cirrhosis
- Ascites
- Pleural effusion
- Tomography, X-ray computed

In a cirrhotic patient, an increase in intra-abdominal pressure due to the presence of ascites might lead to a small pleuroperitoneal bleb of the peritoneum from congenital defects in the hemithorax. This lesion may appear as an intrathoracic mass as seen on a simple chest radiograph. A CT image may be helpful to differentiate an ascitic pleuroperitoneal bleb from an intrathoracic mass. We present three cases of a pleuroperitoneal bleb in patients with liver cirrhosis and ascites.

**Case Reports**

**Case 1**

A 56-year-old man was found to have hepatitis B viral cirrhosis. During follow-up, the patient developed ascites and abdominal distension and was admitted to the hospital for evaluation. Laboratory tests showed the presence of pancytopenia, hypoalbuminemia and hyperammonemia. A chest radiograph demonstrated elevation of the diaphragm and a small mass-like lesion on the right hemidiaphragm (Fig. 1A). The surface of the mass was smooth and round. This lesion was thought to be an intrathoracic mass. A CT image demonstrated the presence of a bleb of the posterior portion of the right hemidiaphragm that contained ascitic fluid (Fig. 1B). After five months, a follow-up CT examination demonstrated that the amount of ascites had decreased and the pleuroperitoneal bleb in the posterior portion of the right hemidiaphragm was reduced in size (Fig. 1C).
**Case 2**

A 50-year-old man presented to the hospital with abdominal distension and pain. The patient had no appetite and was known to have alcoholic cirrhosis. Laboratory tests showed the presence of anemia, thrombocytopenia and hypoalbuminemia. A chest radiograph demonstrated a small soft-tissue mass in the right hemithorax (Fig. 2A). A CT image revealed the presence of cirrhosis with ascites and demonstrated the presence of a round ascitic herniation in the right hemithorax (Fig. 2B), consistent with a pleuroperitoneal bleb. A re-formatted coronal CT image showed more distinctive features (Fig. 2C). After the patient was placed on a sodium-restricted diet and loop diuretics, the amount of ascites decreased. A follow-up CT image after one month showed that the pleuroperitoneal bleb had become smaller (Fig. 2D).

**Case 3**

A 45-year-old man was found to have hepatitis B viral cirrhosis. The patient presented with complaints of abdominal pain and distension. A routine blood test showed the presence of anemia, thrombocytopenia and hypoalbuminemia. A chest radiograph showed a small mass-like lesion on the left hemidiaphragm (Fig. 3A). A CT image demonstrated the presence of a round shaped bleb of the posterior portion of the left hemidiaphragm that contained ascitic fluid behind the spleen (Fig. 3B). A coronal MR image demonstrated a round shaped pleuroperitoneal bleb due to tense ascites (Fig. 3C). The patient was placed on a sodium-restricted diet and loop diuretics. After one month, the intrathoracic mass disappeared as seen on a chest radiograph (Fig. 3D).

**Discussion**

Liver cirrhosis with portal hypertension often results...
in ascites and pleural effusion, a situation that is denoted as hepatic hydrothorax [1]. Ascites formation involves portal hypertension with splanchnic vasodilatation [6, 7]. Increased ascites induces increased intra-abdominal pressure, which might result in small eventrations of the peritoneum [8]. As seen on a chest radiograph, this lesion appears as a soft tissue mass in the hemithorax. A bleb might be misinterpreted as a lung or pleural mass. However, in our cases, CT and MR images provided information for the correct diagnosis. CT scans were useful to confirm the presence of an eventration of the diaphragm that contained ascitic fluid. In addition, follow-up CT images after treatment revealed that the pleuropertitoneal bleb became smaller with a decrease in the amount of ascites. However, not all patients with liver cirrhosis and ascites develop this bleb. Recent studies have demonstrated the existence of diaphragmatic defects in a large number of patients with hepatic hydrothorax [9]. Diaphragmatic defects or fenestrations have been seen in patients with the use of thoracoscopy.
thoracotomy and ultrasonography (10). These lesions represent stretched pleura and a herniated peritoneum at the site of diaphragmatic defects (8). Tense ascites causes the diaphragm to stretch and bulge cephalad, resulting in an enlargement of preexisting diaphragmatic defects (8). These lesions, termed pleuroperitoneal blebs, become much larger (2). Bleb formation may precede a perforation in the diaphragm (1). These defects, which are congenital in origin, demonstrate discontinuities in the collagen bundles that make up the tendinous portion of the diaphragm (9). Increased intra-abdominal pressure separates fibers in the central tendon, weakening this particular non-muscular portion of the diaphragm (3).

In two of the presented cases, a pleuroperitoneal bleb with ascitic herniation occurred on the right side. In a study by Iwamoto et al., a pleuroperitoneal bleb also developed on the right side (3). In the case of hepatic hydrothorax, it has been reported that 85% of hepatic hydrothorax develop on the right side, 13% of cases occur...
on the left side and 2% of cases are bilateral (1). Autopsy studies suggest that pleuroperitoneal blebs occur less frequently in the left hemidiaphragm, as the left hemidiaphragm seems to be thicker and more muscular (2). We assume that a pleuroperitoneal bleb might tend to develop on the right side due to the same mechanism. In one case, the pleuroperitoneal bleb occurred on the left side. We suggest a left-sided pleuroperitoneal bleb develops as the patient might have a congenital diaphragmatic defect of the left hemidiaphragm. To the best of our knowledge, a left sided pleuroperitoneal bleb in a cirrhotic patient with ascites has not been previously reported in the radiological literature.

In conclusion, we have presented three cases of a pleuroperitoneal bleb that mimicked an intrathoracic mass. These cases resulted from increased intra-abdominal pressure due to tense ascites. A small pleuroperitoneal bleb may be difficult to differentiate from an intrathoracic mass or diaphragmatic lesion as seen on a simple chest radiograph. Radiologists should be cautious when interpreting chest radiographs of patients with liver cirrhosis and ascites.

References