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Portal Vein Gas Due to Gangrenous Cholecystitis Treated by a Laparoscopic Procedure: Report of a Case

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Abstract
Portal pneumatosis is a rare diagnostic factor, which is often associated with ischemic intestinal accidents. It has been associated with a negative prognosis for a very long time, and the presence of portal pneumatosis is usually an indication for the need to perform a laparotomy. A 68-year-old male patient with diabetes, obstructive lung disease, and a previous cerebral stroke associated with left hemiplegia presented with abdominal pain, fever and neutrophil leukocytosis. Computed tomography (CT) scan showed the presence of portal pneumatosis with signs of acute cholecystitis and remarkable gastrectasia. In consideration of the serious clinical picture, the patient first underwent esophagogastroduodenal endoscopy (EGDS), which showed ulcerative hemorrhagic gastritis. He then underwent a laparoscopic cholecystectomy. The histology results confirmed the intraoperative diagnosis of gangrenous cholecystitis. The patient was discharged on the 7th postoperative day. With the use of new diagnostic techniques, especially CT, the incidence of portal pneumatosis has increased and consequently the clinical approach of surgeons to this pathology is also changing. Indeed, when portal pneumatosis is not associated with intestinal ischemia, the therapeutic approach must be guided by the clinical condition of the patient and by the investigation of the causes of this pathology. The laparoscopic approach can be extremely useful either in the diagnosis (if this has not been achieved by noninvasive means) or in treatment, if possible, of the causes implicated by the portal pneumatosis.

Key words Portal vein gas · Portal pneumatosis · Laparoscopic cholecystectomy

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Introduction

Portal pneumatosis, the presence of air in the portal vein, was first described by Wolfe and Evans in 1955 in children with necrotizing entercolitis.[1] The incidence of such a diagnostic finding is very low but has been increasing. The rise in the incidence can be explained by the increasing availability of computed tomography (CT) imaging. There are many causes of portal pneumatosis. In the literature, however, cholecystitis has been indicated sporadically as the cause of portal pneumatosis.[2–4] In addition, acute cholecystitis can cause other rare clinical manifestations such as hemobilia due to a cystic artery pseudoaneurysm.[5] This report presents a clinical case of acute gangrenous cholecystitis associated with portal pneumatosis, which was treated successfully by a laparoscopic procedure. This approach has never been used before in the treatment of portal pneumatosis.

Case Report

A 68-year-old male patient with insulin-dependent diabetes, a previous stroke associated with left hemiplegia, chronic obstructive lung disease, and hypercholesterolemia was admitted for symptoms related to abdominal pain of increasing intensity in the left hypochondrium and associated with vomiting and fever (38°C). These symptoms had started 24 h prior to admission to the hospital. The patient was treated with antibiotics, proton pump inhibitors, and intravenous fluid. The laboratory examinations revealed elevated neutrophil leukocytosis (white blood cells 26.88; neutrophils 86.3%; hemoglobin 11.7). The pancreas and liver function tests were in the normal range. Over the next 24 h after admission, the patient underwent abdominal ultrasound (US) and abdominal CT scanning with medium contrast. This investigation revealed the presence of distension of the

gallbladder with increased thickness of its wall and perihepatic effusion, which suggested the presence of an inflammatory reaction (Fig. 1).

The portal pneumatosis was detected in the left branch of the portal vein and in the vessels for the V, VIII, and IV segments of the liver (Fig. 2a,b). The biliary tree was not dilated. No signs of intestinal distension or intestinal ischemia were observed. Gastric distension with increased fluid levels, gas shadows, and initial thickening of the gastric wall were also noted.

The patient underwent esophagogastroduodenal endoscopy (EGDS), which showed the presence of ulcerative hemorrhagic gastritis. A laparoscopic cholecystectomy was performed. During the operation the presence of perihepatic serobiliary effusion and gangrenous cholecystitis were confirmed. There were no other pathological findings. The operation lasted for 90 min and at the end a drainage tube was positioned in the subhepatic space, and was removed after 48 h.

The endoabdominal pressure was constantly maintained below 10 mmHg. The patient had no morbidity during the postoperative period except the onset of atrial fibrillation, which was treated successfully with pharmacological therapy.

The histological findings confirmed gangrenous cholecystitis and the culture of the bile, collected during the procedure, demonstrated the presence of *Escherichia coli* bacteria. The patient was discharged on the 7th postoperative day.

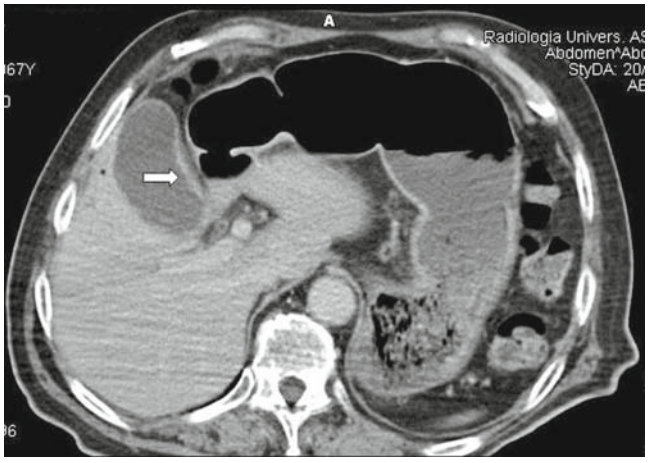
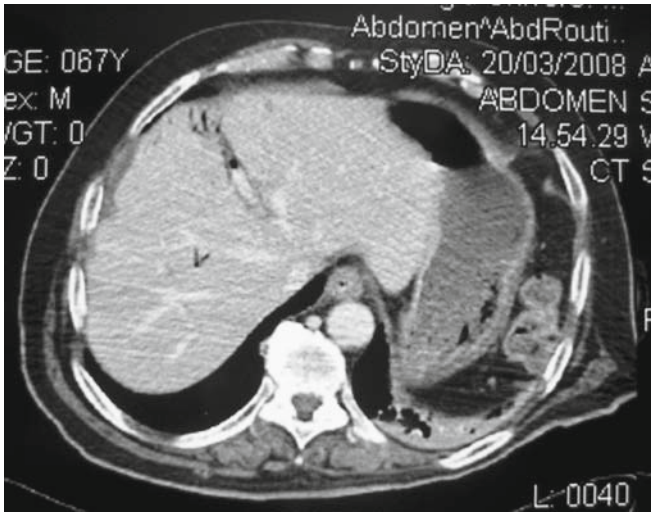


Fig. 1. A computed tomography scan shows the distended gallbladder and perihepatic effusion. The *arrow* indicates the increased thickness of the wall of the gallbladder

Discussion

Portal pneumatosis is a rare diagnostic finding. Only 182 cases were reported before 2001.[6] The etiology of this condition has not been established. The major predisposing factors are as follows. (1) Damage of the intestinal mucosa, which facilitates the passage of intraluminal gas into the portomesenteric system, such as bowel ischemia or necrosis (ischemic causes) secondary to superior mesenteric artery or vein pathology. Other causes of mucosal damage (nonischemic) are a gastric ulcer, Crohn's disease, and ulcerative bowel disease. (2) Bowel distension that causes minimal mucosal injury secondary to increased intraluminal pressure, such as an intestinal obstruction, blunt trauma, and iatrogenic causes (colonoscopy, barium enema, endoscopic retrograde cholangiopancreatography, etc). (3) Sepsis with a gas-producing organism that causes direct invasion of the portomesenteric circulation through seeding or embolization as in appendicitis, diverticulitis, pancreatitis, cholecystitis, ascending cholangitis, and intra- or retroperitoneal abscess.[3,4]



a

b

Fig. 2a,b. Presence of gas in the left branch of the portal vein and into the vessels for segments V, VIII, and IV of the liver

The most common gas-producing bacteria are *Clostridium perfringens, Escherichia coli, Klebsiella, Bacteroides fragilis*, among others. The most frequent causes of portal pneumatosis are intestinal ischemia, intestinal obstruction, diverticulitis, peritonitis, intra-abdominal abscess, pancreatitis, gastric ulcer, traumas, endoscopies, and sepsis. In 15% of the cases the cause cannot be identified.[3,4,7] The presence of portal pneumatosis in a gangrenous cholecystitis without any signs of emphysema in the cholecystic wall is unusual. In the current case the presence of portal pneumatosis may have been due to a microembolization in the veins of the cholecystic wall by the gas produced by the bacteria found in cholecystic bile. This microembolization could not be visualized in the wall but it became evident by the accumulation in the portal system. In this patient neither CT nor surgery showed any sign of portal phlebitis, indicating that the portal pneumatosis was not produced in the portal vein. Furthermore, CT and surgical observation excluded other causes of portal pneumatosis.

The clinical significance of the presence of air in the portal system remains an open question. Many[8] have viewed portal pneumatosis as an ominous prognostic index with an associated mortality ranging from 75% to 90%.[4,9] These findings may have been influenced by the fact that portal pneumatosis is usually associated with a mesenteric infarction. Moreover, the first cases described in the literature were diagnosed using a conventional abdominal X-ray, which is less sensitive to such clinical signs, and were usually found in association with intestinal ischemia. However even in recent studies[6] the mortality in portal pneumatosis related to mesenteric ischemia is reported to be 75%. Furthermore, the prognosis associated with these findings declines if they are associated with intestinal pneumatosis, which is more specific for intestinal ischemia.[10,11]

However, cases of portal pneumatosis not associated with ischemic accidents have shown a different prognosis with a mortality rate of 30%–40%.[9,12] In addition, there are many cases of portal pneumatosis in which conservative therapy resulted in the survival of the patients.[9] Such findings suggest that portal pneumatosis can be considered a consequence of different clinical manifestations, with variable clinical gravity, rather than a negative factor in the prognosis of the basic pathology. In the current clinical case, CT scan showed the presence of portal pneumatosis, but did not identify the cause. Esophagogastroduodenal endoscopy showed the presence of ulcerative hemorrhagic gastritis that did not explain the serious clinical condition of the patient, but that it could have had a role in causing the portal pneumatosis. The seriousness of the patient's condition required a cholecystectomy. During the laparoscopic operation, the abdominal cavity was properly explored and did not show the presence of other pathologies, other than serious gangrenous cholecystitis with a small quantity of pericholecystic and perihepatic serobiliary liquid. Therefore, the patient underwent a cholecystectomy and subsequently attained a complete resolution of the clinical condition. The bacterial culture of the bile collected during the intervention showed the presence of *E. coli* bacteria. This bacterium produces gas and might explain the presence of gas in the portal vein, especially because it was associated with significant mucosal damage caused by the gangrenous cholecystitis observed in this patient.

During the operation the endoabdominal pressure was maintained below 10 mmHg to avoid further reduction in the flow of blood into the portal system (in this particular case containing gas). In fact, some studies[13–15] have revealed that a reduction in the portal flux is proportional to the endoabdominal pressure.

Even today some[3,16] consider the use of laparotomy a necessity in cases of portal pneumatosis. However, others[8–10,17] believe that surgical indications must be based on the clinical condition of the patient and the information obtained from the CT scan.

The present case is interesting because of the association of portal pneumatosis with gangrenous cholecystitis, a situation rarely reported,[2–4] and for the subsequent laparoscopic approach, which provided a successful treatment of the patient. In fact, neither the portal pneumatosis nor the gangrenous cholecystitis should be a contraindication to a "cautious" laparoscopic approach.

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