



CT Diagnosis of Air Embolism of Splenic-Mesenteric-Portal System in Two Cases of Bowel Infarction. Basic Elements of Differential Diagnosis with Pneumobilia

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Abstract

The presence of Portal Venous Gas (HPVG) represents a serious and rare occurrence associated with an unfavorable prognostic evolution in patient with acute abdomen. A prompt and correct diagnosis is mandatory for therapeutic planning in these patients [1].

Plain film of the abdomen is the first examination in patients with acute abdomen and displayed portal venous gas as a branched radiolucency extending up to 2 cm below the hepatic capsule. This finding is very difficult to detect and differentiate from pneumobilia based only on gas distribution [1].

Second-line examinations such as ultrasonography and CT have shown greater reliability in both detection and differential diagnosis with pneumobilia.

Currently, the increased use of CT and ultrasound allows early and highly sensitive detection of the underlying pathology [2].

We report below two cases of portal gas with involvement of the spleno-porto-mesenteric venous system.

Keywords: HPVG; Branched radiolucency; Gas embolism; Intramural gas; Splenic-mesenteric venous axis

Case Series

Case 1

80-year-old male patient, was referred to our emergency department for severe abdominal pain, peritonitis symptoms associated with rectorrhagia, with low blood pressure values (80 max/40 min).

Hematochemical examinations revealed leukocytosis.

Plain film of abdomen, performed preliminarily, evidences multiple air fluid levels. The presence of gas in the hepatic area is not evidenced. It was decided to perform multidetector CT study before and after administration of mdc for ev, which documents gas embolism of the portal splenic axis (Figure 1A) and in the peripheral intrahepatic portal branches (Figure 1B). Air in the context of the superior mesenteric vein (Figure 1C) and splenic vein was also appreciable. CT scan of the abdomen also confirms distention of the stomach, esophagus, and dijejuno-ileal loops, with mesenteric edematous suffusion (Figure 1D) and the presence of multiple air-fluid levels (Figure 1E). It also shows widespread presence of gas in the context of the walls of esophagus, stomach, digiuno-ileal loops and ileal loops. The diagnosis of evolving acute intestinal ischemia is made, and the patient underwent immediate surgical treatment. The patient died after six days of hospitalization in the intensive care unit, due to cardio-respiratory complications.

Case 2

A 78-year-old male patient was referred to emergency department with a clinical symptom of acute abdomen (violent abdominal pain, vomiting and fever, stool- and gas-closed alvo). Arterial

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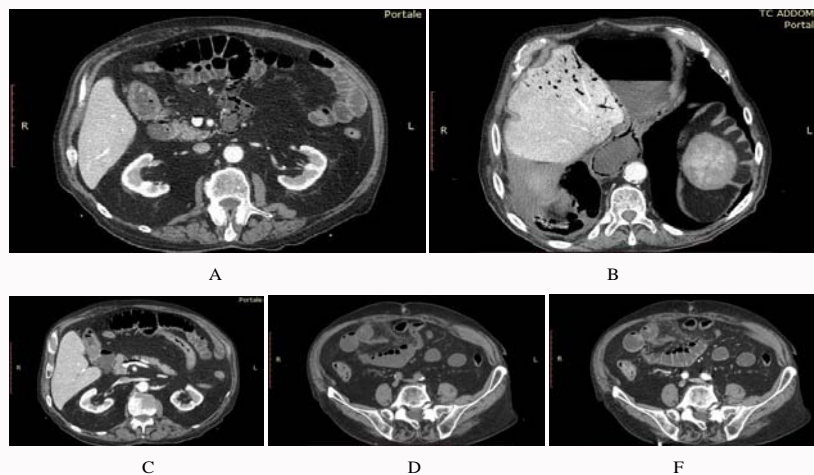


Figure 1: Gas embolism of the portal splenic axis (1A); peripheral intrahepatic portal branches (1B); mesenteric edematous suffusion (1C). Basal abdominal TC scan (1D); multiple IA levels (1E).



Figure 2: Distention of the ileal loops and colic loops, with intramural gas (2A-B); the ascending colon shows parietal thickening extending to the proximal transverse colon. Intramural gas persists at the intestinal loops (2C).

hypotension and tachycardia are associated. Physical examination shows a heart rate of 110 beats/min and a blood pressure of 90/60 mmHg.

The patient has a clinical history of arteropathy obliterans and myocardial ischemia, so he is sent directly for CT examination with intra venous mdc.

CT scan without mdc documents significant distention of the ileal and colic loops, with intramural gas (Figure 2A and 2B). The ascending colon shows parietal thickening extending to the proximal transverse colon (Figure 2C).

Gas is also seen in the branches of the superior mesenteric vein and in the peripheral, subcapsular, portal branches. A small amount of free peritoneal fluid is present.

The diagnosis of intestinal infarction was made and by surgery performed a few minutes after the CT scan confirmed the diagnosis.

Discussion

The presence of gas in the splenic-mesenteric- portal system, as reported in the literature, can be associated in most cases with ischemia and infarction with intestinal necrosis, marked distention of intestinal loops, intestinal abscess, ulcerative colitis, and less frequently with acute pancreatitis, cholangitis, cholecystitis, and diverticulitis with perforation. In infants, it is appreciable in cases of necrotizing enterocolitis [2]. A radiological finding of portal gas, however, does not necessarily indicate serious underlying pathology [3].

It can be seen in relatively benign situations such as after endoscopic procedures and gastric dilatation or COPD, requiring only conservative therapy.

Portal gas is sustained by mucosal injury that allows the passage of gas contained in the intestinal loops and gas-producing bacteria into the venous system, marked distention of the loops with increased endoluminal pressure, and sepsis with or without mucosal injury. Mechanical disruption of the mucosa can determine the presence of gas into the portal venous system [4].

Prognosis is related to the disease itself and is not affected by the presence of HPVG.

Patients who survive often undergo resection of most of the small intestine, which leads to enormous morbidity (e.g., short bowel syndrome, requiring total parenteral nutrition, etc.) [4].

Preliminary radiological examination, is often a first-line examination, and demonstrates an intestinal occlusive picture with the presence of air-fluid levels and gaseous distention of the loops. It may also demonstrate the presence of free air at the subdiaphragmatic space by means of a right intrahepatic linear hypertension, which is not easy to detect [5]. The presence of intramural gas and at the splenic-mesenteric venous axis is difficult to diagnose, just as it is difficult to make a differential diagnosis between portal gas and pneumobilia.

Second-level examinations such as ultrasonography and CT scan can diagnose, with high specificity, this morbidity. Indeed, ultrasonography can detect the presence of gas in the portal vein

and intrahepatic branches. Typical ultrasound features of portal gas are highly echogenic spots, flowing within the portal vein, or poorly defined, highly echogenic patches within the liver parenchyma [6]. Color Doppler flow imaging shows hyperechogenic foci moving within the portal vein lumen, producing sharp bidirectional spikes superimposed on the normal monophasic portal vein wave pattern. The limitations of ultrasonography are the difficult evaluation of the hepatic hilum and gas overdistention of the intestinal loops, as well as the painfulness of the abdomen [6].

CT scan without MDC, due to its spatial and contrast resolution, as well as the possibility of studying the intestinal wall, clearly demonstrates the presence of gas in the intestinal wall and in the splenic-mesenteric and intrahepatic portal branches, the distribution of which shows the characteristic monopodic "comb tooth" sign that allows its distinction with intrahepatic aerobilia. In addition, portal gas is peripheral and mainly affects the left sections of the liver due to the gravity.

CT scan after contrast-venous administration of contrast media shows the endovascular filling defect of the tract affected by the thrombo-ischemic phenomenon and allows a differential diagnosis with pneumobilia. Indeed, in the latter case, the gas will be visualized in the context of the biliary branch that runs parallel to the well-opaque portal branch. Moreover, whereas in pneumobilia the gas is located in the central portions of the liver, portal venous gas affects are distributed mainly in the subglissonian location. This can be attributed to the centrifugal flow of portal venous blood, which peripherally carries portal venous gas, unlike biliary gas, which tends to collect centrally as a result of the centripetal movement of the bile [6].

Gas embolization of the splenic vein (as reported in the first case) due to hepatohepatic flow is rarely encountered. It is indeed difficult to explain the diffusion of air to the splenic vein in the case where, like this one, the splenic-mesenteric-portal axis has regular diameter and course, the spleen has normal size and density, and there is no communication between the splenic and renal veins or hilar varicosities [7]. A possible explanation could be sustained by the hypovolemic shock that allows the gas to overcome resistance and diffusing in the spleen.

In conclusion, in both cases one CT demonstrated high sensitivity and specificity in diagnosing the presence of gas in the intestinal walls, in the mesenteric vascular branches and in the portal branches. Also, it represents the gold-standard in detecting the presence of gas in the splenic vein, it can accurately enable the diagnosis of the underlying disease and permit to plan the most favorable treatment to improve the patient's prognosis [7].

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