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Case Report

Portal Venous Gas

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Abstract: Portal venous gas (PVG) has been reported in many conditions. They can be broadly divided into ischemic bowel and non- ischemic conditions. Presented here is a case demonstrating hepatic and extra-hepatic portal venous gas, mesenteric venous gas, pneumatosis intestinalis and gas noted intra-operatively within the splanchnic venous system associated with ischemic bowel. The article discusses the pathophysiology of portal venous gas and the ominous and benign conditions associated with this diagnosis.
Keywords: Portal Venous Gas, Ischemic Bowel, Pneumobilia, Pneumatosis, porto-mesentric pylephlebitis.

INTRODUCTION

Portal venous gas (PVG) has been reported in many conditions. They can be broadly divided into ischemic bowel and non- ischemic conditions. The occurrence of gas in the portal venous system was first described in infants dying of abdominal catastrophes in 1955 by Wolfe and Evans [1]. Later, Susman and Senturia, in 1960, reported this finding in adults [1]. Original descriptions of portal venous gas were made based on observations of abdominal x-ray studies. In the modern era, this has extended to detection on CT scans, abdominal sonography and Doppler studies. PVG can be seen in the hepatic and extra-hepatic portal veins or mesenteric veins and has been described in the literature as pneumoportogram, portal venous gas or gas embolization of the portal vein [1]. Presented below is a case demonstrating hepatic and extra-hepatic portal venous gas, mesenteric venous gas, pneumatosis intestinalis and gas noted intra-operatively within the splanchnic venous system associated with ischemic bowel.

CASE REPORT

A 50 year old male was brought to the ER in an obtunded state. He was hypotensive with systolic blood pressure in the 90's. He was intubated and large bore peripheral IV's placed for fluid resuscitation. Physical examination revealed abdominal rigidity. NGT and foley catheter were placed. ABG revealed a pH of 7 with severe metabolic acidosis. Blood work revealed leukocytosis and pre-renal azotemia. After fluid resuscitation CT scan of the abdomen and pelvis were performed. It revealed extensive intrahepatic portal venous air (fig. 1a), air within the gastric wall (fig.1a), extra hepatic portal and mesenteric venous air (fig.1b) and pneumatosis intestinalis (fig.1b). The toxicology screen was found to be negative. The patient was taken for an emergent exploratory laparotomy. The bowel extending from the proximal jejunum to the mid transverse colon was found to be infarcted. Interestingly, air within all the splanchnic veins (fig. 2a) and the inferior mesenteric veins (fig.2b) was seen. The abdomen was closed and after discussion with the family care was withdrawn.

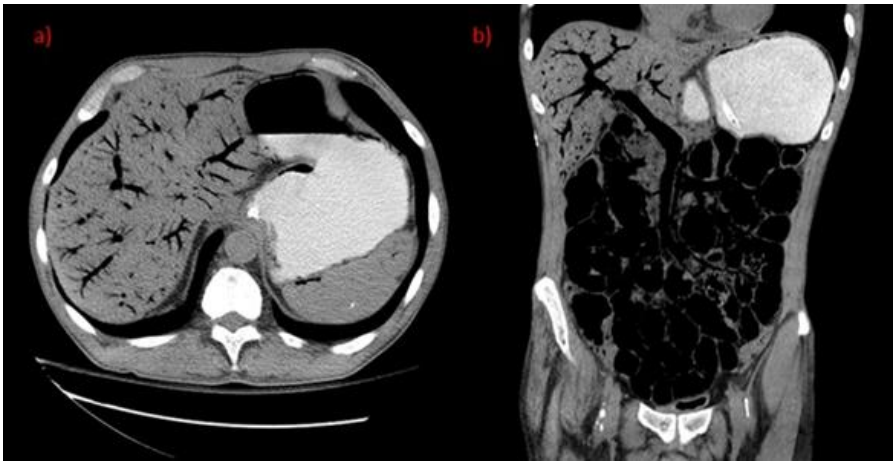

Fig-1: a)CT scan of the abdomen (axial cut) showing extensive intrahepatic portal venous air, air within the gastric wall b) CT scan of the abdomen (coronal cut) showing extra hepatic portal & mesenteric venous air and pneumatosis intestinalis

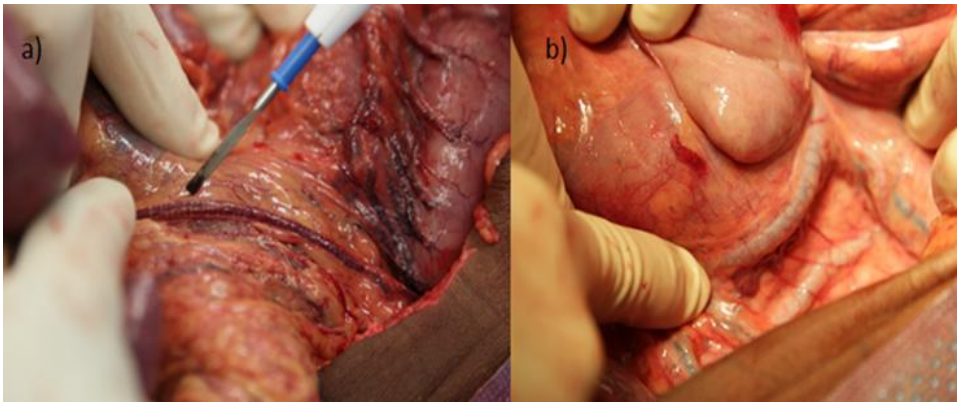

Fig-2: Intra-operative photograph showing a) air within all the splanchnic veins b) the inferior mesenteric vein

DISCUSSION

In a review of the literature by Liebman *et al*. [1] hepatic PVG was associated with necrotic bowel (72%), ulcerative colitis(8%), intra-abdominal abscess (6%), small bowel obstruction (3%) and gastric ulcer (3%). Mucosal damage, bowel distension and sepsis were found to be the predisposing factors to portal venous gas. X-ray studies usually reveal branching radiolucencies extending to within 2 cms to the liver capsule. X-rays are most revealing when the patient is placed in the lateral decubitus position [1]. Portal venous gas must be differentiated from gas within the bile ducts (pneumobilia). Here the radiolucencies are usually close to the porta hepatis. The centripetal flow of the bile and the centrifugal flow of blood within the portal vein radicals explain the above phenomenon [1]. The sonographic features of hepatic PVG are high echogenic particles flowing within the portal vein or poorly defined, highly echogenic patches within the hepatic parenchyma, especially in the non-dependent areas [2].

The gas within the portal veins has been analyzed and is found to be high in CO2 [1]. Depending on the site of entry into the porto-mesentric circulation gas may be encountered within the mesenteric veins, extra-hepatic portal vein or the intrahepatic radicals [3]. Within the liver it is usually encountered in the left lobe of the liver secondary to its ventral location. Bacterial fermentation or porto-mesentric pylephlebitis has been postulated as the mechanism of gas entry into the splanchnic venous system [4].

When PVG is associated with ischemic bowel, the constellation usually portends a poor prognosis [3]. Non-ischemic conditions associated with PVG include inflammatory bowel disease, diverticulitis, enteritis, appendicitis, intestinal obstruction, gastric ulcer, blunt abdominal trauma, intra-abdominal abscess, cholangitis, graft-versus-host disease, severe pancreatitis, bronchopneumonia, seizures, child abuse, consumption of corrosive agents, radiation, vasculitis and post procedural [2, 5]. PVG itself is not a predictor of mortality. There is no direct correlation between the amount of portal venous gas and mortality [2].

Liver transplantation and kidney transplantation are conditions where air is directly introduced into the venous circulation. When found after cardiac transplantation it is usually secondary to a poor flow state [5].

CONCLUSION

Traditionally, portal venous gas was considered an indicator of bad prognosis and was usually associated with a poor prognosis. This was secondary to the detection on abdominal x-rays indicating the advanced nature of the primary disease. Currently, detection on advanced imaging techniques and the association with much non-ischemic pathology allows management of the primary disease at an earlier stage. To our knowledge, this is the first report demonstrating air within the splanchnic venous system intra-operatively.

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