



Pneumatosis intestinalis and hepatic portal venous gas on computed tomography – a non-lethal outcome

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DECLARATIONS

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SM wrote the case report; SM, OJW and SH were the operating surgeons and edited the manuscript; RK was the consultant radiology who helped with compiling the most educative images for this patient

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Improved imaging techniques mean that findings traditionally associated with poor outcome no longer necessarily carry the same prognosis.

Introduction

The combination of pneumatosis intestinalis (PI) and hepatic portal venous gas (HPVG) is a rare but important radiological sign. HPVG in isolation has been reported in severe cases of inflammatory or infective colitis, and after colonoscopy, barium enema, abdominal trauma and liver transplant and does not always require intervention. Abdominal radiograph or computed tomography (CT) findings of isolated pneumatosis intestinalis can be due to a variety of causes like coeliac disease, chronic obstructive pulmonary disease and post-organ transplants, but when seen in combination with HPVG is most frequently secondary to bowel ischaemia. Traditionally this is regarded as a pre-morbid sign but the increasing use of CT, which is more sensitive than plain radiograph, has resulted in earlier and increased detection of both PI and HPVG. This report presents the case of a 66-year-old man who had CT evidence of both PI and HPVG with a non-lethal outcome.

Case report

A 66-year-old man with significant vasculopathy and other medical co-morbidities, including insulin-dependent diabetes mellitus, hypertension, previous stroke and myocardial infarction, hypercholesterolaemia, atrial fibrillation, chronic obstructive airway disease and chronic renal

failure presented with a three-day history of worsening central abdominal pain, abdominal distension, vomiting and absolute constipation. Initial assessment revealed shock, peritonism and marked metabolic acidosis. Plain radiographs of the abdomen showed some dilated small bowel loops but little else. Non-contrast CT of the abdomen and pelvis revealed air within the walls of the ascending colon and ileum, air in the mesenteric vessels and air within the portal vein branches of the left lobe of the liver (Figure 1).

An emergency laparotomy confirmed ischaemia of the ileum, caecum and ascending colon with band-like skip necrosis of bowel from proximal ileum to caecum. A right hemicolectomy and small bowel resection was performed. After a protracted postoperative course involving 38 days on the intensive care unit and a re-laparotomy for a localized anastomotic leak, the patient was discharged home. Histology of the resected bowel revealed acute inflammation and varying degrees of necrosis of the bowel wall including patches of full-thickness necrosis (Figure 2).

Discussion

HPVG and PI are rare, but very important radiological diagnostic signs which, when occurring in combination, usually indicate ominous intra-abdominal pathology.

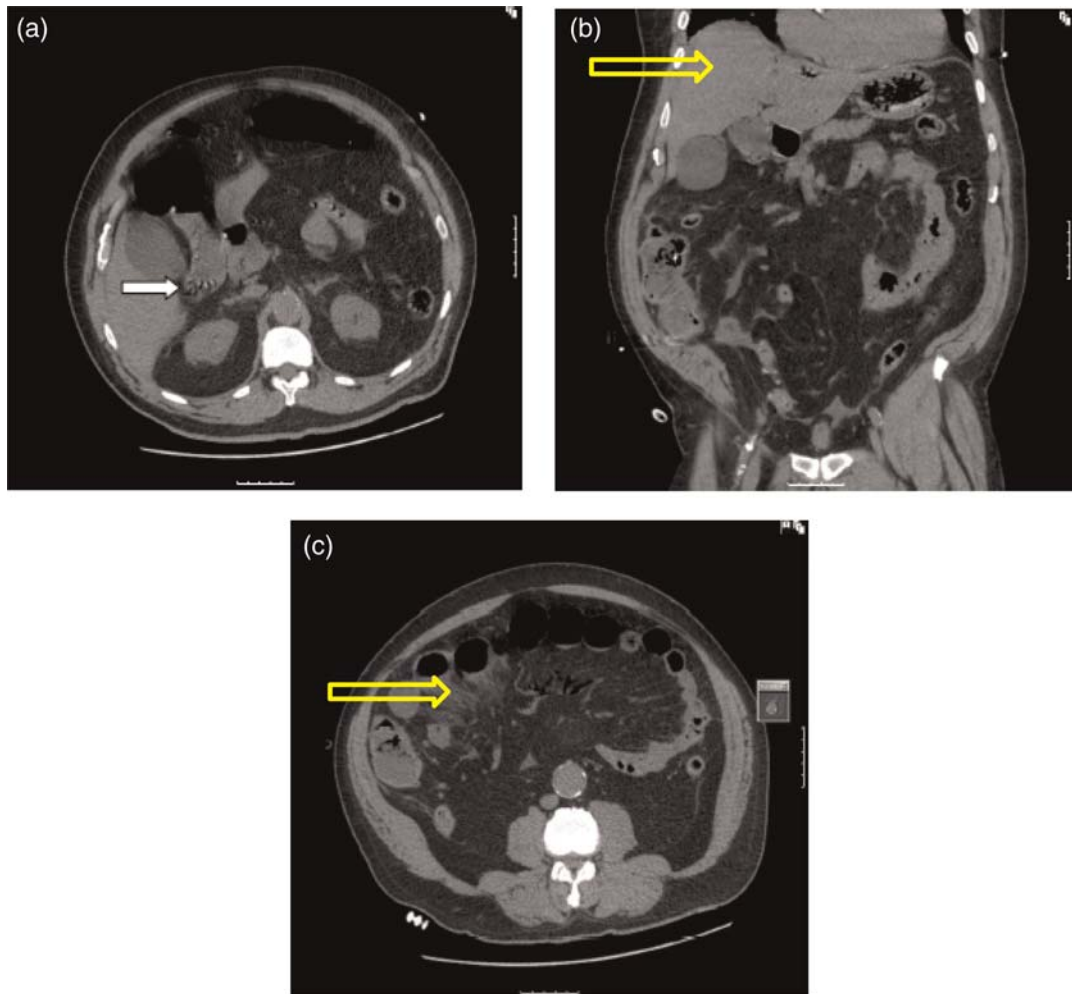
HPVG was first described in infants by Wolfe and Evans in 1955 and in adults by Susman and Senturia in 1960,¹ and is identified by the presence of tubular, branching translucencies in the non-dependent part of the liver, distributed within 2 cm of the periphery owing to centrifugal blood flow. HPVG can result from various clinical

case; the authors also thank Fred Barker for providing them with the hisopathology pictures of the patient. There have been previous presentations of this work: Oral presentation – 11th International Colorectal Forum, Verbier, Switzerland in January 2010; Poster and Oral presentation – Alan Edwards Prize meeting, Royal Society of Medicine, London, UK in November 2009

Reviewer
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Figure 1

Non-contrast axial CT of abdomen showing: a. air in the bowel wall (pneumatosis intestinalis) – white arrow; b. air in the portal vein radicles in the left lobe of liver (hepatic portal venous gas) – yellow arrow; c. axial CT image showing air in the mesenteric vessels – yellow arrow



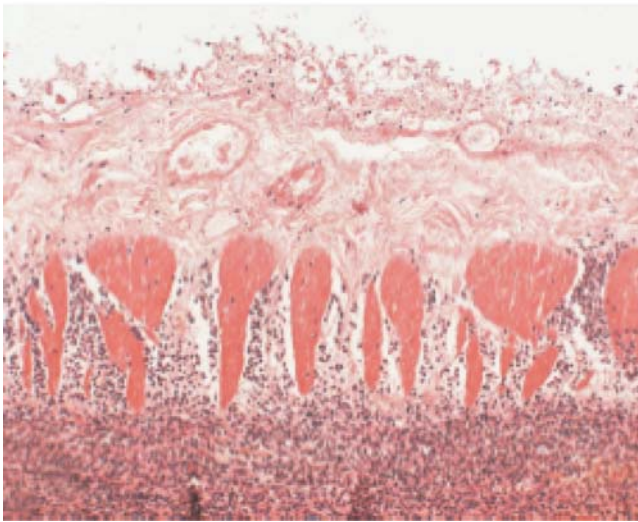
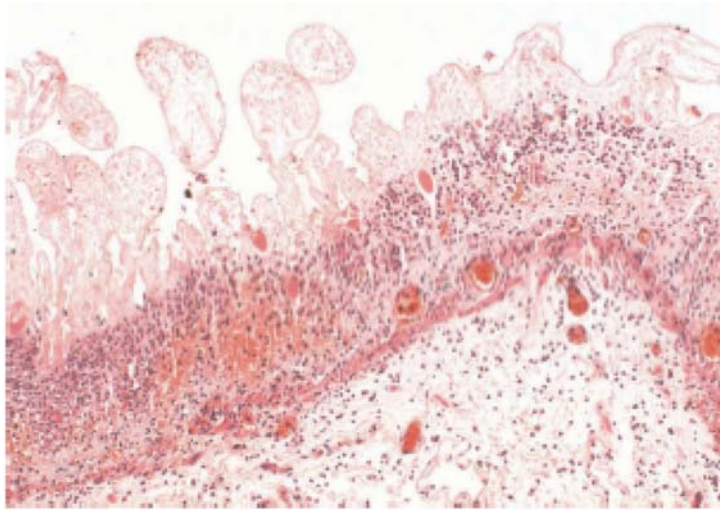
conditions that may be benign or potentially critical such as infectious and inflammatory abdominal diseases, post-interventional procedures like barium enema or colonoscopy in patients with inflammatory bowel disease, post-abdominal trauma and post-transplant surgery.^{1,2}

The exact mechanism for the formation of gas in the portomesenteric venous system is still unclear. The major predisposing factors for the development of portomesenteric vein gas are intestinal wall alterations, bowel distension and sepsis. In many cases, a combination of any two or all three predisposing factors exist which facilitate luminal gas

from the intestine to pass through the intestinal wall and travel via the mesenteric veins to the portal vein and into the liver. In some cases, it is idiopathic.¹

De Vernoi first documented PI in 1730. There is a spectrum of disease states that produce this abnormality, ranging from the innocuous to the fatal. Traditionally, pneumatosis was considered a sign of bowel wall ischemia that, without emergency intervention, would lead to infarction and certainly when combined with HPVG this appears to be the case. However, recently several non-ischemic causes of pneumatosis intestinalis

Figure 2
Histology of resected bowel showing various degrees of bowel necrosis



have been described, including infectious and inflammatory bowel disease, celiac disease, intestinal dilation, chronic obstructive pulmonary disease, connective tissue disease, transplantation, steroids and chemotherapy. Based on radiological characteristics, PI can be classified as 'bubble-like' or 'band-like'. In a study conducted by Weisner *et al.*, bubble-like PI was associated with

transmural bowel infarction in 70% of patients whereas band-like PI was seen to be worse, being associated with transmural infarction in 88% of patients.³ The risk of transmural infarction is also higher when PI is seen combined with HPVG on CT and when PI affects many different bowel segments.^{3,4}

The time delay between diagnosis and surgical intervention is a key determinant of the prognosis of patients with intestinal ischemia. CT can help detect PI and HPVG earlier and in less pronounced stages, making it possible to implement early aggressive treatment, which may, as in our report, increase the likelihood of survival.^{3,5}

Conclusion

The combination of PI and HPVG in a symptomatic adult is usually indicative of a potentially life-threatening acute abdominal pathology. HPVG and PI are important radiological signs predictive of a potential dismal prognosis in a symptomatic patient.

Increasing use of CT has resulted in earlier and increased detection of PI and HPVG, and as this case demonstrates, with timely detection and appropriate management, these signs are no longer always predictive of a mortal outcome.

References

- 1 Sebastia C, Quiroga S, Espin E, *et al.* Portomesenteric vein gas: pathologic mechanisms, CT findings, and prognosis. *Radiographics* 2000;**20**:1213–24
- 2 Peloponissios N, Halkic N, Pugnale M, *et al.* Hepatic portal gas in adults: review of the literature and presentation of a consecutive series of 11 cases. *Arch Surg* 2003;**138**:1367–70
- 3 Weisner W, Mortelet KJ, Glickman JN, *et al.* Pneumatosis intestinalis and portomesenteric venous gas in intestinal ischaemia: correlation of CT findings with severity of ischaemia and clinical outcome. *Am J Roentgenol* 2001;**177**:1319–23
- 4 Kernagis LY, Levine MS, Jacobs JE. Pneumatosis intestinalis in patients with ischaemia: correlation of CT findings with viability of the bowel. *Am J Roentgenol* 2003;**180**:733–6
- 5 Hou SK, Chern CH, How CK, Chen JD, Wang LM, Lee CH. Hepatic portal venous gas: clinical significance of computed tomography findings. *Am J Emerg Med* 2004;**22**:214–18

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