Hepatic portal venous gas due to cryptosporidiosis in a patient with acquired immunodeficiency syndrome

Nilesh Lodhia, Atif Ali, Joel Bessoff

INTRODUCTION

The presence of hepatic portal venous gas (HPVG) on computed tomography (CT) is typically an ominous finding that is associated with significant morbidity and mortality. It is most commonly associated with bowel necrosis (72%), followed by ulcerative colitis (8%), intra-abdominal abscesses (6%), small bowel obstruction (3%) and gastric ulcers (3%) [1]. The frequent association with bowel necrosis can explain the 56%-90% mortality rate associated with HPVG [2].

We report a case of a patient with acquired immunodeficiency syndrome (AIDS) who was found to have HPVG on CT as a presumed result of gastrointestinal cryptosporidiosis. This association, to our knowledge, has never been reported.

CASE REPORT

A 47-year-old African American female with a history of AIDS with a CD4 count of 12 (confirmed by repeated measurements) presented with diarrhea, dizziness, and fatigue over a period of three weeks. Her vitals on admission were as follows: temperature 37.3°C, heart rate 103/min, blood pressure 93/65 mmHg, and respiratory rate of 20/min. On physical exam she had diffuse mild abdominal pain, tachycardia, and poor skin turgor. Initial laboratory results: white blood cell (WBC) 6.4 k/μL, hemoglobin (Hb) 8.3 g/dL, platelets (PLT) 252 000/μL, sodium 141 mmol/L, potassium 3.6 mmol/L, chloride 111 mmol/L, bicarbonate 22 mmol/L, BUN 14 mg/dL,
creatinine 3.8 mg/dL, and glucose 100 mg/dL. Her baseline creatinine was less than 1.0 mg/dL. Stool studies for Clostridium Difficile, acid-fast bacilli, fecal leukocytes, culture, and ova and parasites were all negative. A non-contrast computed tomography (CT) of the abdomen and pelvis did not show any acute findings. Colonoscopy was normal from the ileum to the rectum. Random biopsies were taken from the terminal ileum, colon, and rectum. The biopsy from the terminal ileum was identified as having numerous parasitic organisms morphologically consistent with Cryptosporidium Parvum (Figure 1A). The patient was discharged on a 7 d course of metronidazole with plans to start highly active antiretroviral therapy (HAART) as an outpatient.

Prior to initiating HAART therapy, the patient returned one week later with profuse bloody diarrhea, abdominal pain, and oliguria. She was alert and oriented, but appeared weak. She had a temperature of 37.0°C, heart rate of 101/min, blood pressure 88/61 mmHg, and a respiratory rate of 18/min. Her abdomen was soft and nontender with positive bowel sounds. Laboratory results: WBC 10.9 k/μL, Hb 11.6 gm/dL, PLT 250 000/ce³, sodium 135 mmol/dL, potassium 4.2 mmol/dL, chloride 109 mmol/dL, bicarbonate 9 mmol/dL, BUN 34 mg/dL, creatinine 13 mg/dL, and glucose 159 mg/dL. Alanine aminotransferase (ALT), aspartate aminotransferase (AST), bilirubin, and alkaline phosphatase were normal. The albumin was 2.1 g/dL, with an international normalized ratio (INR) of 1.24. She was admitted to the medical intensive care unit (MICU) for further management. Esophagastroduodenoscopy (EGD) showed normal findings from the proximal esophagus to the antrum. The duodenum had a 3-mm submucosal nodule in the duodenal bulb and a 5-mm submucosal nodule in the duodenal apex. Biopsy of the duodenal nodules showed ulcerated, active chronic duodenitis with numerous organisms morphologically consistent with Cryptosporidium Parvum present in the epithelial surface; Periodic acid schiff (PAS) stain was positive (Figure 1B).

Several days into her admission, she continued to have hypotension, tachycardia, and vague abdominal pain. A non-contrast abdominal CT was repeated, which showed diffuse portal venous gas. In addition, there were small bubbles of gas distributed in a linear fashion in the anterior abdomen, along the transverse colon, likely within venous branches, although no definite evidence of pneumatosis intestinalis was seen. The remainder of the CT, including the gallbladder, appeared normal (Figure 2). After confirming these findings with two board-certified radiologists, the patient was taken immediately to the operating room for exploratory laparotomy. The entire small bowel, colon, and rectum appeared grossly normal. The gallbladder appeared distended and necrotic; it was therefore removed. Pathologically, the gallbladder showed Cryptosporidium Parvum (Figure 3). The patient had an uneventful post-operative course. However, given the advanced nature of her AIDS and her poor functional status, she was discharged home with hospice services eight days after surgery.

**DISCUSSION**

HPVG occurs when intraluminal gas enters the portal-
mesenteric venous circulation as a consequence of mucosal damage from bowel ischemia, inflammatory bowel disease, bowel distention, intra-abdominal infection, or peptic ulcer disease. In some instances, the proliferation of non-pathogenic gas-forming bacteria in the lumen can lead to the radiographic findings of pneumatosis intestinals and subsequently HPVG. Similarly, increased intraluminal pressure during colonoscopy or intraperitoneal pressure associated with blunt trauma can also permit bowel gas to gain access to the portal venous circulation through microscopic mucosal injury\(^1\). 

Intra-abdominal infections associated with HPVG include diverticulitis, abdominal abscesses, cholecystitis, cholangitis, appendicitis, and colitis\[^1^\].\[^2^\]-\[^6^\]. The pathogenesis of infectious HPVG is not fully understood. Some theories include septicaemia in branches of the mesenteric and portal veins\[^1^\].\[^4^\], increased carbohydrate fermentation due to bacteria in the intraluminal region, or a mesenteric abscess causing intra-mesocolic perforation, allowing gas to access to the portal vasculature\[^1^\].\[^7^\]. Furthermore, the coexistence of a chronic disease, such as renal failure, diabetes mellitus or hypertension can predispose to HPVG by altering the intestinal microbial flora\[^1^\].\[^8^\],\[^9^\].

*Cryptosporidium* spp. is a major cause of gastrointestinal disease in both immunocompetent and immunodeficient individuals. Although these infections are typically self-limited in healthy individuals, they can have severe manifestations in immunocompromised patients, particularly those with AIDS\[^10^\]. When cryptosporidiosis presents as disseminated disease, there can be involvement of the small intestine, colon, biliary tract, pancreas, and the respiratory tract. Of patients with intestinal cryptosporidiosis, ten percent have biliary tract abnormalities\[^10^\]-\[^13^\]. The risk of faecal carriage, severity of illness, and development of severe complications of cryptosporidiosis are inversely related to the CD4 count\[^14^\]. Our patient had a CD4 count of 12, which placed her at a very high risk of complicated infection. To our knowledge, AIDS-related cryptosporidiosis as a cause for HPVG has not been reported.

In conclusion, the clinical significance of HPVG is variable, and it depends primarily on the underlying pathology. In the most severe conditions it can be the result of mesenteric ischemia; however, growing literature is showing that there are less catastrophic conditions in which HPVG may occur. We conclude that in a patient with AIDS, *Cryptosporidium* can cause HPVG. This case illustrates another cause of HPVG that should be considered in patients with AIDS.

**REFERENCES**

1. Liebman PR, Patton MT, Manny J, Benfield JR, Hechtman HB. Hepatic–portal venous gas in adults: etiology, pathophysiology and clinical significance. *Ann Surg* 1978; 187: 281-287
2. Muscari F, Suc B, Lagarrigue J. [Hepatic portal venous gas: is it always a sign of severity and surgical emergency?]. *Chirurgie* 1999; 124: 69-72
3. Draghetti MJ, Salvo AF. Gas in the mesenteric veins as a nonfatal complication of diverticulitis: report of a case. *Dis Colon Rectum* 1999; 42: 1407-1408
4. Sen M, Akpinar A, Inan A, Sişman M, Dener C, Akin K. Extensive hepatic-portal and mesenteric venous gas due to sigmoid diverticulitis. *World J Gastroenterol* 2009; 15: 879-881
5. Katz BH, Schwartz SS, Vender RJ. Portal venous gas following a barium enema in a patient with Crohn’s colitis. A benign finding. *Dis Colon Rectum* 1986; 29: 49-51
6. Pappas D, Romeu J, Tarkin N, Dave PB, Messer J. Portal vein gas in a patient with Crohn’s colitis. *Am J Gastroenterol* 1984; 79: 728-730
7. Sadhu VK, Brennan RE, Madan V. Portal vein gas following air-contrast barium enema in granulomatous colitis: report of a case. *Gastroinest Radiol* 1979; 4: 163-164
8. Ng SS, Yiu RR, Lee JF, Li JC, Leung KL. Portal venous gas and thrombosis in a Chinese patient with fulminant Crohn’s colitis: a case report with literature review. *World J Gastroenterol* 2006; 12: 5582-5586
9. Abboud B, El Hachem J, Yazeck D, Toumait C. Hepatic portal venous gas: physiopathology, etiology, prognosis and treatment. *World J Gastroenterol* 2009; 15: 3585-3590
10. Wiot JF, Felson B. Gas in the portal venous system. *Am J Roentgenol* 1961; 86: 920-929
11. Niki M, Shimizu I, Horie T, Okazaki M, Shirashi T, Takeuchi H, Fujiwara S, Murata M, Yamamoto K, Iuchi A, Atagi Y, Itô S. Hepatic portal venous gas disappearing within 24 hours. *Intern Med* 2002; 41: 950-952
12. Dennis MA, Pretorius D, Manco-Johnson ML, Bangert-Burroughs K. CT detection of portal venous gas associated with supplicative cholangitis and cholecystitis. *AJR* 1985; 145: 1017-1018
13. Tuite DJ, Byrne A, Colhoun E, Torreggiani WC. Pneumatosis intestinals and portal-venous gas: an unusual presentation of acute appendicitis. *Australas Radiol* 2007; 51 Spec No.: B137-B139
14. Bach MC, Anderson LG, Martin TA Jr, McAfee RE. Gas in the hepatic portal venous system. A diagnostic clue to an occult intra-abdominal abscess. *Arch Intern Med* 1982; 142: 1725-1726
15. Hussain A, Rateb R, El-Hasani S, Portal vein gas in emergency surgery. *World J Emerg Surg* 2008; 3: 21
16. Yoshida M, Mitsu M, Kutsumi H, Fujita T, Soga T, Nishimura K, Kawabata K, Kadotani Y, Kinoshita Y, Chiba T, Kuroiwa N, Fujimoto S. A successfully treated case of multiple liver abscesses accompanied by portal venous gas. *Am J Gastroenterol* 1996; 91: 2423-2425
17. Current WL, Reese NC. A comparison of endogenous development of three isolates of Cryptosporidium in suckling mice. *J Protozool* 1986; 33: 98-108
18. Chan SC, Wan YL, Cheung YC, Ng SH, Wong AM, Ng KK. Computed tomography findings in fatal cases of enormous hepatic portal venous gas. *World J Gastroenterol* 2005; 11: 2953-2955

*Figure 3* Gallbladder showing *Cryptosporidium* located on the surface of the epithelium.
Sorvillo FJ, Lieb LE, Kerndt PR, Ash LR. Epidemiology of cryptosporidiosis among persons with acquired immunodeficiency syndrome in Los Angeles County. *Am J Trop Med Hyg* 1994; 51: 326-331

Soave R, Armstrong D. Cryptosporidium and cryptosporidiosis. *Rev Infect Dis* 1986; 8: 1012-1023

Cello JP. Human immunodeficiency virus-associated biliary tract disease. *Semin Liver Dis* 1992; 12: 213-218

S- Editor Zhang HN  L- Editor Herholdt A  E- Editor Liu N