CT Characteristics Of Portal Venous Gas Due To Ischemic Bowel Disease - A Case Report

Apostoloska V[1*], Gligorievski A[2], Nakova E[1], Apostoloski B[3] and Lazarova A[2]

[1]University Clinic of Surgical Diseases "St. Naum Ohridski" - Skopje, Faculty of Medical Sciences, University ''Goce Delchev'' - Shtip, North Macedonia

[2]Radiology department, University Clinic of Surgical Diseases "St. Naum Ohridski" - Skopje, Faculty of Medical Sciences, Goce Delcev University, - Stip, North Macedonia

[3]Medical Faculty, Skopje, "Ss. Cyril and Methodius" University Skopje, Republic of North Macedonia

[4] Radiology department, University Clinic of Surgical Diseases "St. Naum Ohridski" - Skopje, North Macedonia

***Corresponding author:** Veronika Apostoloska, University Clinic of Surgical Diseases "St. Naum Ohridski" - Skopje, Faculty of Medical Sciences, University ''Goce Delchev'' - Shtip, North Macedonia

Citation: Veronika Apostoloska, Ct Characteristics Of Portal Venous Gas Due To Ischemic Bowel Disease - A Case, Ann Med Clin Cas Rept, 2025; 1(2): 1-5.

Published Date: 25-03-2025 **Accepted Date:** 20-03-2025 **Received Date:** 13-03-2025

Keywords: Hepatic Portal Venous Gas, Ischemic Bowel Disease, Mesenteric Ischemia, Pneumatosis Intestinalis

Abstract

Hepatic Portal Venous Gas (HPVG) or portal venous gas detected on CT imaging is evaluated in patients struggling from ischemic bowel disease or mesenteric ischemia. HPVG is more rarely seen with treatable abdominal infection as well as with multiple benign conditions. Results of HPVG from an ultrasound or Computed Tomography (CT) scan should be carefully observed in the context of the clinical findings. The prognosis of patients with HPVG is usually good, in the absence of features of bowel ischemia. We are reporting a case of 78-year old male patient who manifested extensive intrahepatic portal venous gas and pneumatosis intestinalis as a consequence of bowel ischemia. The condition ended lethally for the patient.

1. Introduction

Portal venous gas (Pneumatosis Portalis) is the accumulation of gas in the portal vein and its branches. It needs to be distinguished from pneumobilia, when associated findings are taken into account along with the pattern of gas (i.e. peripheral in portal venous gas, central in pneumobilia).

Wolfe and Evans in 1955 first described the presence of gas in the intra-hepatic portal system in children with Necrotizing Entero-Colitis (NEC) [1,2]. Susman and Senturia reported it in adult patients five years later [1]. The most common cause of PVG was bowel ischemia, which was associated to a 75 per cent mortality rate [3]. The presence of intestinal ischemia is considered an ominous sign [1,4,5]. HPVG is related most commonly with bowel necrosis (72%), than with ulcerative colitis (8%), intra-abdominal abscess (6%), small bowel obstruction (3%) and gastric ulcer (3%). This was observed by Liebman et al [1]. HPVG has been recognized as a serious condition that is associated with poor prognosis and requires urgent surgical treatment. The mortality of HPVG was reported to be 75%-90% [1,6], but recently is 29%-56% [7,8,9]. The outcome of these patients is affected by coexistence of a chronic disease, such as diabetes mellitus, hypertension or chronic renal failure, which reduces immune functions and affects the intestinal microbial flora.

2. Case Presentation

78-years old male patient was hospitalized in general hospital in Veles and then is sent to University Clinic of Surgical Diseases "St. Naum Ohridski" - Skopje, for further examination. The patient was feeling abdominal pain, flatulence and vomiting. The blood

test show high glycemia to 35.59 mmol/l, CRP to 110 mg/l, high AST and degradational products. It was ordered a CT scan, native and arterial phase.

The CT evaluation showed branching gaseous foci of low density, in portal vein and its tributaries in the liver consistent to portal venous gas. Typically, the gas in the liver was peripheral which helps differentiate it from more central gas due to pneumobilia.

Figure 1a

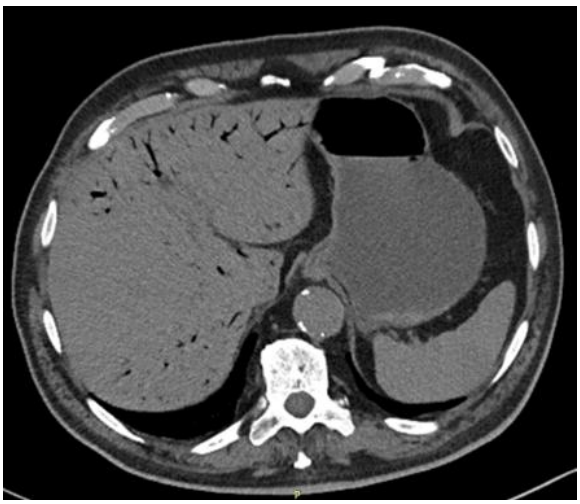

Figure 1b

Figure 1a & 1b: CT native phase, branching gaseous foci of low density, in portal vein and its tributaries in the liver consistent to portal venous gas

Branching gaseous foci of low density also persisted in the mesenteric venous blood system.

Figure: 2a (CT Axial Plane – Native phase)

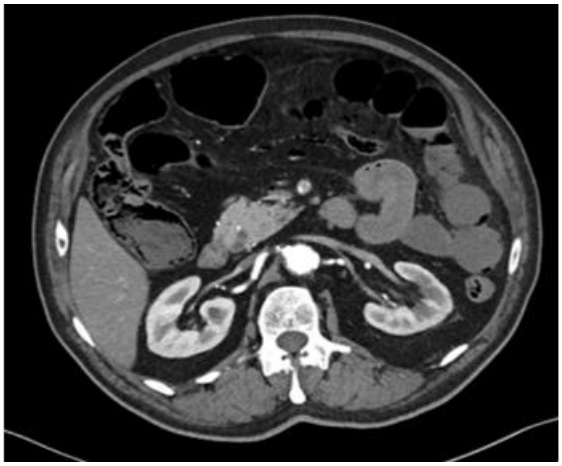

Figure: 2b (CT Arterial Phase - Arterial phase)

Figure: 2a&2b: Branching gaseous foci of low density also persisted in the mesenteric venous blood system

- A few inorganic calculi persisted in the gallbladder with normal presentation of ductus choledochus.
- A larger triangular hypodense zone with a wide base towards the periphery was detected, which is in addition to an infarct lesion.
- Hypodense oval changes were noted in both adrenal glands, the larger one on the right one with a dimensions of 28x16mm, on the left one with a diameter of up to 17mm, which according to their CT characteristics were are in addition to benign formations.
- There were no CT signs of pathological focal changes in the pancreas and both kidneys, after intravenous contrast there was no pathological accumulation of the same in the described parenchymal organs.
- In the interpolar part of the right kidney were noticed cortical cysts, the larger one to 17 mm and in the left one several small cortical cysts and one larger in the lower pole, up to 32 mm.

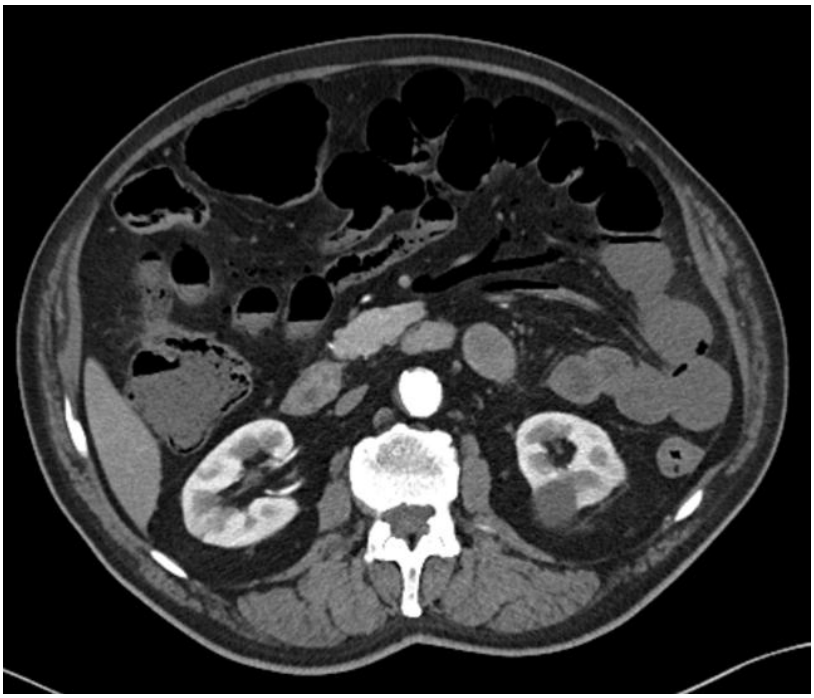

Figure 3: CT abdomen, axial plane, arterial phase - cortical cyst in the lower pole, 32 mm. Intramural gas which refers to gas within the wall of the bowel - pneumatosis intestinalis

- Urinary bladder was empty with a placed Foley catheter.
- There were no significantly increased lymph nodes or free fluid in the abdomen and the pelvis.
- In the small intestines and in the lower sections of the abdomen were noticed hydroaeric levels. There was present intramural gas which refers to gas within the wall of the bowel (also known as pneumatosis intestinalis) and can be associated with ischemia and infarction. (Figure:3, 4a, 4b)
- Atheromatous plaques were observed along the wall of the abdominal aorta and both common iliac arteries. V. cava inferior appeared reduced with a transverse diameter of 8mm.

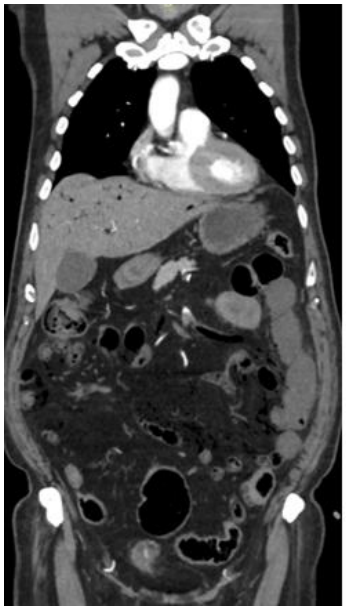

Figure: 4a

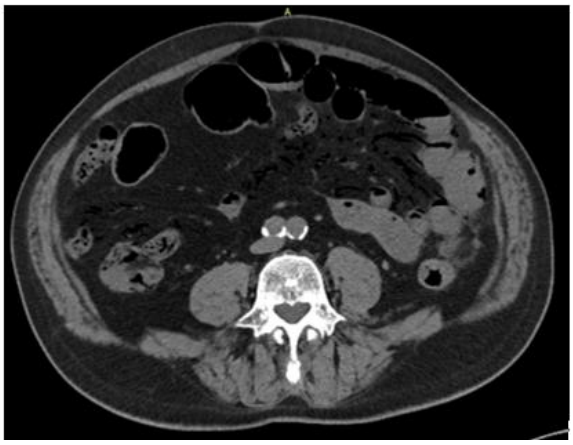

Figure: 4b

Figure: 4a, 4b – Hydroaeric levels in the small intestines and in the lower sections of the abdomen. Intramural gas (pneumatosis intestinalis). Atheromatous plaques along the wall of both common iliac arteries.

- The patient had comorbidities: diabetes mellitus and chronic renal failure.

3. Discussion

The three main theories for presence of gas in the portal system are:

- Through a defect of the intestinal mucosa there is passage of gas from the intestinal lumen
- The presence of gas-forming-bacteria in the portal system
- In bowel obstruction or gastrointestinal endoscopies there is increase in luminal gas pressure

These theories had been proven in animal models and similar changes had been found in humans [2,10]. Based on PVG pathophysiology, the clinical presentation can be classified in three categories: bowel obstruction, infectious processes and ischemic pathology [13].

- The diagnosis can be confirmed with radiologic studies such as plain abdominal radiography, ultrasound and abdominal CT imaging.
- Nowadays, the most sensitive imaging modality for the diagnosis is computed tomography.
- CT scans [2,13,15] allows visualization of tubular areas of diminished attenuation in the liver, predominantly in the left lobe, because of its more ventral position [1,15].

The differentiation from pneumobilia has to be made. Due to the centrifuge circulation of the blood, the gas in the portal system extends within 2 cm of the hepatic capsule. The gas in the biliary system it is primarily located centrally, due to the centripetal circulation of bile [1,14]. The quantity of gas seen in the CT is not associated to the severity of the disease. Another advantage of this imaging modality is that in patients with a suspicion of intestinal ischemia, CT offers more information compared to the other diagnostic imaging [2,12,5,13,16]. The radiologist should look for other signs of a probable illness or pathology that causes PVG. When the clinical findings aren't clearly enough this will help the surgeon to decide surgical or medical management [13].

Essential is a thorough evaluation of the patients [12,17]. Many cases could be managed medically, do not require surgical treatment so CT scans cannot replace proper history-taking examination [18]. In patients with abdominal symptoms and findings compatible with intestinal ischemia that require surgery an early diagnosis is vital because a delay increases the mortality rate significantly [12,4,18]. The patients who were too ill to survive surgery, need conservative treatment, but with a very high mortality rate. The CT scan findings that leads to the diagnosis of intestinal ischemia are: thickening of the intestinal wall, pneumatosis intestinalis, alterations to the mesenteric vessels and ascites [5,16,17].

The cause of the gas is correlated with the prognosis of PVG. Identification of gas in the abdominal radiographs is linked with a poor prognosis, but the quantity of gas is not. The presence of gas is an ominous sign because more than half of the patients have intestinal ischemia. The most adequate treatment is surgery in patient with mesenteric ischemia, abdominal signs and with an undetermined pathology. In cases in which the origin of the gas is iatrogenic (endoscopy, imaging studies) or is a finding in a patient with no abdominal pain or signs, then a conservative management could be the best one.

5. Conclusion

A radiologic observation of HPVG does not necessarily indicate a severe pathology. It can be evaluated in benign situations such as endoscopic procedures and gastric dilatation which only need conservative therapy. In the past, HPVG was thought to be an indicator of bad prognosis and as being correlated with a high mortality rate. Today, there is significantly decreased mortality rates with the development of highly advanced imaging techniques. Severe pathologies, such as bowel ischemia are diagnosed at much earlier stages, allowing the clinician prompt treatment. The treatment depends mainly on the underlying disease, HPVG is not by itself a surgical indication. The prognosis is related mainly to the pathology.

In the majority of patients hepatic portal vein gas is a diagnostic sign which indicates a serious intra-abdominal pathology demanding emergency surgery. To set the management plan is necessary to make a correlation between clinical and diagnostic findings.

References

1. Liebman PR, Patten MT, Manny J, Benfield JR, Hechtman HB. Hepatic--portal venous gas in adults: etiology, pathophysiology and clinical significance. Ann Surg. 1978;187(3):281-7.
2. Griffiths DM, Gough MH. Gas in the hepatic portal veins. Br J Surg. 1986;73(3): 172-6.
3. Najafian H, Habibi M, Reilly T. Hepatic portal vein gas: clinical features and outcomes. Am Surg. 2003; 69(6): 526-9.
4. Weinstein GE, Weiner M, Schwartz M. Portal vein gas. Am J Gastroenterol. 1968; 49(5): 425-9.
5. Chan SC, Wan YL, Cheung YC, Ng SH, Wong AMC, Ng KKl..Computed tomography findings in fatal cases of enormous hepatic portal venous gas.World J Gastroenterology; 2005: 2953-2955.
6. Fred HL, Mayhall CG, Harle TS. Hepatic portal venous gas. A review and report on six new cases. Am J Med. 1968; 44(4): 557-65.
7. Faberman RS, Mayo-Smith WW. Outcome of 17 patients with portal venous gas detected by CT. AJR Am J Roentgenol. 1997; 169(6): 1535-8.
8. Kinoshita H, Shinozaki M, Tanimura H, Umemoto Y, Sakaguchi S, Takifuji K, Kawasaki S, Hayashi H, Yamaue H. Clinical features and management of hepatic portal venous gas: four case reports and cumulative review of the literature. Arch Surg. 2001; 136(12): 1410-4.
9. Seak CJ, Hsu KH, Wong YC, Ng CJ, Yen DH, Seak JC, Seak CK. The prognostic factors of adult patients with hepatic portal venous gas in the ED. Am J Emerg Med. 2014; 32(9): 972-5.
10. Hong JJ, Gadaleta D, Rossi P, Esquivel J, Davis JM. Portal vein gas, a changing clinical entity. Report of 7 patients and review of the literature. Arch Surg. 1997; 132(10): 1071-5.
11. Monneuse O, Pilleul F, Barth X, Gruner L, Allaouchiche B, Valette PJ, Tissot E. Portal venous gas detected on computed tomography in emergency situations: surgery is still necessary. World J Surg. 2007; 31(5): 1065-71.
12. Sebastia C, Quiroga S, Espin E, Boye R, Alvarez-Castells A, Armengol M. Portomesenteric vein gas: Pathologic mechanisms, CT Findings, and Prognosis. Radiographies. 2000; 1213-1224.
13. Chiu HH, Chen CM, Lu YY, Lin JC, Mo LR. Hepatic portal venous gas. Am J Surg. 2005; 189(4): 501-3.
14. Bodewes HW, Puylaert JB. Ultrasound in detection of portal venous gas in adults. Gastrointest Radiol. 1991; 16(1): 35-7.
15. Schindera ST, Triller J, Vock P, Hoppe H. Detection of hepatic portal venous gas: its clinical impact and outcome. Emerg Radiol. 2006; 12(4): 164-70.
16. Smerud MJ, Johnson CD, Stephens DH. Diagnosis of bowel infarction: a comparison of plain films and CT scans in 23 cases. AJR Am J Roentgenol. 1990; 154(1): 99-103.
17. Wiesner W, Mortelé KJ, Glickman JN, Ji H, Ros PR. Pneumatosis intestinalis and portomesenteric venous gas in intestinal ischemia: correlation of CT findings with severity of ischemia and clinical outcome. AJR Am J Roentgenol. 2001; 177(6): 1319-23.
18. Paran H, Epstein T, Gutman M, Shapiro Feinberg M, Zissin R. Mesenteric and portal vein gas: computerized tomography findings and clinical significance. Dig Surg. 2003; 20(2): 127-32.