

Intestinal and portomesenteric pneumatosis secondary to intra-abdominal sepsis. Case report

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Case Report

GENERAL SURGERY



Abstract: Intestinal, mesenteric, intrahepatic and splenic pneumatosis are findings that are usually associated with intra-abdominal catastrophes that often require emergency surgical intervention. These findings have been associated with high mortality even with timely surgical treatment. The gas within the portal venous system is often considered a premorbid radiological sign. Currently, there is no precise etiology, although several series describe a wide range of etiologies, among them the most common; the fulminating intestinal ischemia. Although other non-life-threatening, reversible etiologies have been attributed which are candidates for conservative treatment as an alternative to laparotomy. The use of computed tomography has led to the detection of intestinal pneumatosis and portal venous gas in a variety of abdominal catastrophes.

Keywords: Portal pneumatosis, intestinal ischemia, mesenteric ischemia.

Introduction

Portomesenteric vein gas and massive intestinal pneumatosis, which extends to intra-abdominal organs are rare conditions whose physiopathogenesis is not fully understood. The most common cause of portomesenteric vein gas is bowel ischemia. Portomesenteric gas has been reported in many surgical diseases such as inflammatory bowel disease, bowel obstruction, intra-abdominal sepsis, and blunt abdominal trauma, as well as non-surgical disease such as graft-vs.-host disease, cystic fibrosis, after laparoscopic and endoscopic procedures, chemotherapy, organ transplantation, radiofrequency tumor ablation, arterial catheterization,^(1,2) patient subjected to hemodialysis^(3,4), Portal venous gas in combination with pneumatosis intestinalis might be a sign of intestinal ischemia but might also occur after blunt abdominal trauma or abdominal surgery⁽⁵⁾, an unusual finding is presented in a postoperative patient where the spleen, gallbladder, liver and the bowel small and large developed a venous gas of pneumatosis.

Case report

Male patient, 45 years-old, farmer, mestizo, resident of rural area of norther of Mexico, with a history of chronic alcoholism and type 2 diabetes without adherence to treatment. He is received in the emergency department brought by family members due to abdominal pain with 24 h of evolution after suffering a fall from three meters high, he traveled in a drunken state, hitting himself in mesogastrium, he did not receive medical attention immediate, upon arrival

at the shock room at urgency service after 24 h evolution, with generalized abdominal pain, muscular resistance involuntary, evident data of peritoneal irritation, hemodynamically unstable to arrival, with tension arterial of 80/50 mm hg; heart rate ,114 per min; respiratory rate 20 per min, corporal temperature,36.5 Celsius degrees; oxygen saturation, 90% in ambiental disposition, arterial blood gas values; pH, 7.03; $p\text{CO}_2$, 31 mm hg; $p\text{aO}_2$, 42 mm hg; HCO_3 , 8.2 mmol/L; Lactate, >15 mmol/L; BE, -22.6. At initial physical exploration with Glasgow scored 12; rhythmic heart sounds without alteration, pulmonary fields without alteration, generalized abdominal pain, absent peristalsis. Respect to clinical laboratory parameters: white blood cells, 2.43×10^3 ; neutrophils, 51.1%; lymphocytes, 48.2%; monocytes, 0.49%; eosinophils, 0.21%; basophils 0.02%; hemoglobin 15.0 g/dL; platelet 155×10^3 , amylase, lipase and others hepatic function tests within reference parameters, others biochemical parameters including, seric glucose, 112 mg/dL; blood ureic nitrogen, 32 mg/dL; creatinine, 5.4 mg/dL; sodium, 130 mmol/L; potassium, 4.9 mmol/L, chloride 92 mmol/L; other biochemical parameters were within the reference values. On arrival at the emergency room, first achievement with fluid resuscitation was performed with 1000 mL/20 min with a crystalloid solution of hartmann, supplemental oxygen with 5 L/min trough nasal tips and 60 mg ketorolac a bolus intravenous. In the context of the patient, with he history of closed trauma of the abdomen with 24 h of evolution, with findings in the physical examination that shows evident data of peritoneal irritation,

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Figure 1. Frontal plain abdominal radiograph obtained in the supine position demonstrates distended loops of bowel and extensive hepatic portal venous gas.

hemodynamically unstable, laboratory studies of indicatives of sepsis, and metabolic acidosis. Bases on the foregoing it was decided to place to emergency exploratory laparotomy. During surgical achievement the findings were purulent free liquid and intestinal drainage, colon and small intestine with changes of color, characteristics to ischemia, others finding were emphysema in the liver, spleen and wall of the entire intestine extending at gallbladder and stomach; in addition, after careful inspection other intestinal perforation was identified with approximately 5 mm extension located to 130 and 150 cm of Treitz angle, which was managed by intestinal resection and anastomosis in 2 planes posteriorly, abdominal cavity washing was performed. Post-operative management was carried out as follow: a nasogastric drift probe was placed; intravenous fluids with Hartman solution; 1000 cc/8 h; intravenous omeprazole infusion 8 mg/h; double antibiotic scheme consistent of ceftriaxone 2 gr/12 h and metronidazole 500 mg/8 h, as well as, tramadol infusion 300 mg/24 h, for pain treatment; and finally advanced management of the airway under sedation. After hemodynamically stable period in the surgical recover room, the patient is carried to general surgery floor, where it is requested studies of radiographic image of thorax, abdomen (**Figure 1**) with follow characteristics, a linear radiolucent foci in thickened intestinal walls, compatible with intestinal pneumatosis and branched radiolucent images on the hepatic silhouette distributed from hilum to periphery,

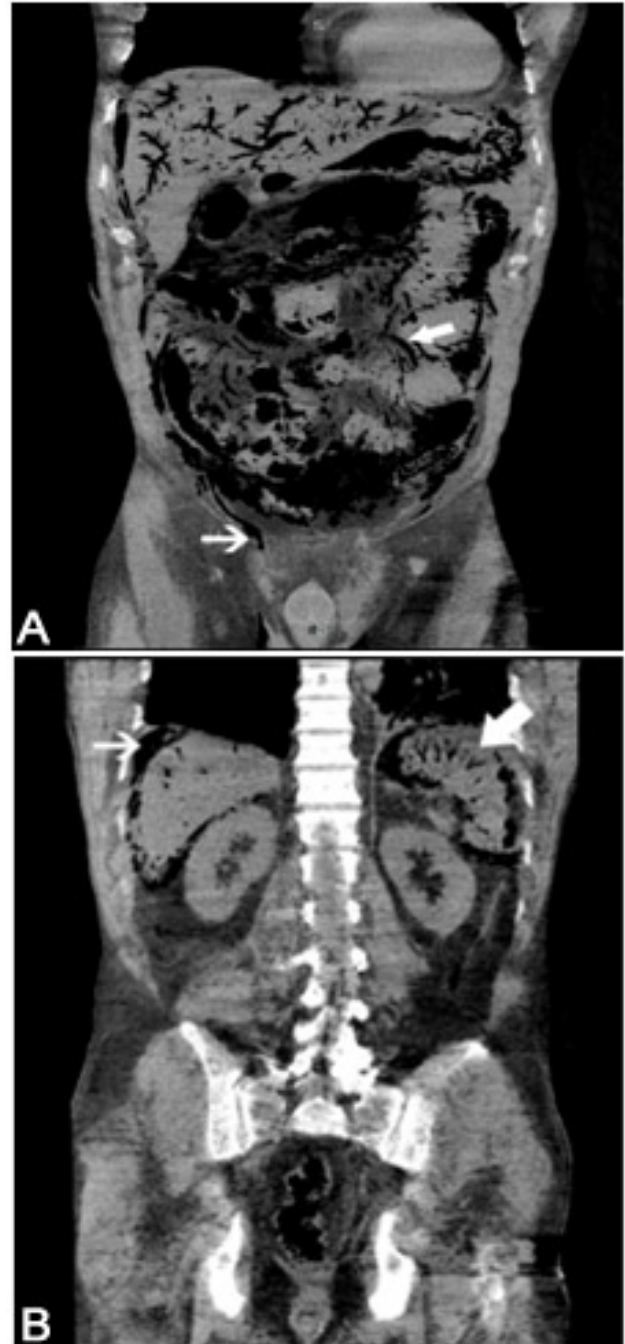


Figure 2. A. Computed tomography scan of the abdomen with coronal reconstruction. Portal venous gas, gas in wall bowel and mesenteric is observed. Mesenteric gas is observed in branched form towards the wall of the large intestine (thick arrow). Low attenuation path at right inguinal channel level corresponding to gas (thin arrow). **B.** Computed tomography images with coronal reconstruction. There are branching paths of low attenuation in spleen corresponding to pneumatosis (thick arrow). Collection of suprahepatic air corresponding to pneumoperitoneum (thin arrow).

where portal gas are evident. Simple abdominopelvic computed tomography (CT) was performed, the findings in the CT of the abdomen and pelvis showed abundant portal venous gas with extension to spleen, gallbladder, intrahepatic, stomach, mesentery and intestinal pneumatosis of the duodenum, jejunum, ileum and colon (**Figure 2**); coronal plane of CT shows gas presence in the vessels of the mesenteric arch

adjacent to the intestinal loops; as well as is evident presence of intestinal pneumatosis, portomesenteric gas and intrahepatic gas suggestive of pneumatosis generalized in abdominal cavity. In addition the figure 3 shows an unusual finding of splenic pneumatosis which has been rarely reported in the literature. (Figure 4A and 4B) Images of axial-CT shows intra-hepatic venous portal gas disseminated to the right lobe organ periphery. Also, vein splenic and, stomach wall and gallbladder wall were observed gas presence. These unusual finding of gas have been rarely reported. Due to it, patient was management with hyperbaric oxygen, and double broad-spectrum antibiotic scheme, presenting a clinical improvement in arterial arterial gasometry; however, his evolution was torpid despite treatment and resumption with fluids, he was deteriorating, until presenting oliguria and multiple organ failure, Finally he died 24 hours after admission due to a septic shock.

Discussion

Intestinal pneumatosis is a rare pathology in which gas accumulates in the wall of the gastrointestinal tract; two types of intestinal pneumatosis have been described: Primary pneumatosis also known as intestinal cystic pneumatosis, first described in 1973 by the pathologist Du Vernoi, which consists of cysts in the subserosa or submucosa of the intestine. Secondary pneumatosis is caused by other pathological processes as abdominal sepsis or intestinal ischemia, among others. However, so little descriptions have been published about pneumatosis in other abdominal organs mainly hepatic gas. In our patient it is of secondary pneumatosis because it was presented by presenting abdominal sepsis.⁽⁶⁾ The hepatic portal venous gas (HPVG) x-ray finding has been widely reported in the pediatric and radiology literature. HPVG appears as a branched radiotransparency extending up to 2 cm from the hepatic capsule. As shown in our patient's post-operative chest and abdomen x-ray, it is suggested to complement preoperative imaging studies in hemodynamically stable patients and thus have a better picture of what the surgeon is going to face. HPVG occurs in a variety of clinical settings and pathologic conditions. There is no difference in incidence between men and women. However, intestinal necrosis need not be present and even in patients with necrotic bowel, HPVG cannot provide information on the extent of necrosis. This pathology was first described in 1955 by Wolfe et al in newborns with necrotizing enterocolitis and in adults in 1960 by Susman et al in patients with extensive intestinal necrosis.^(7,8) Intraabdominal sepsis is also associated

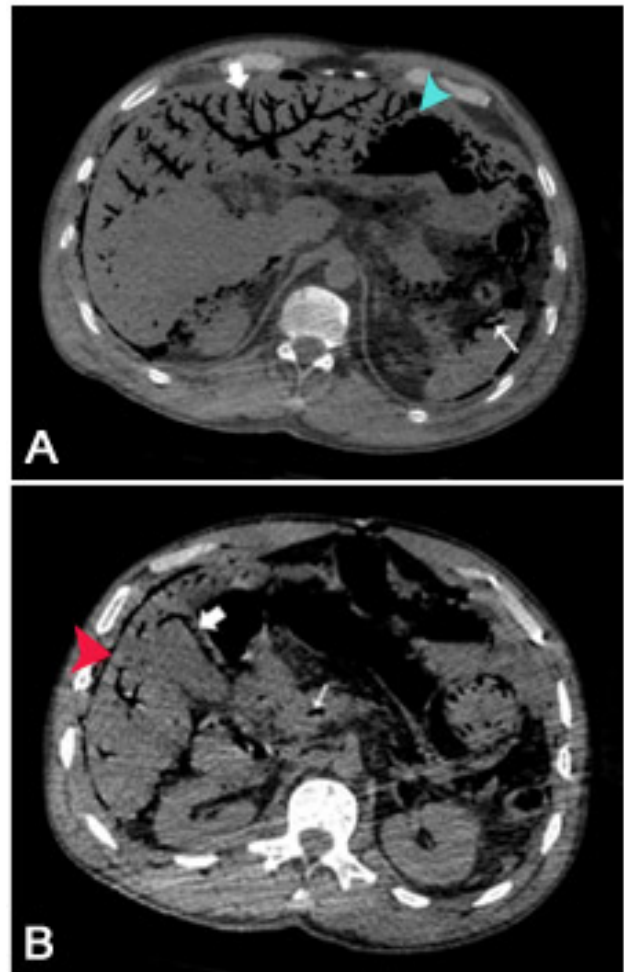


Figure 3. A. Computed tomography of the abdomen in axial section. Shows a collection of air in the periphery of the liver corresponding to pneumoperitoneum (red arrow). The gallbladder is observed with air bubbles in the wall (thick white arrow) and the splenoportal venous junction shows gas inside (thin white arrow). You can see the small bowel loops distended with scarce collections of air in your wall. B. Computed tomography image in axial section. The branched form of intrahepatic portal venous gas (thick white arrow) is observed. The thin arrow indicates the gas at the level of the splenic and intrasplenic vein. There are also small gas bubbles in the wall of the stomach (blue arrow).

with HPVG. Although the pathophysiology is not well established, it is known that there are factors that predispose to the formation of HPVG, such as: damage to the mucosa of the infarcted intestine, intestinal distension and abdominal sepsis secondary to intestinal perforation with positive culture of gas-forming bacteria. In this case, the patient developed early abdominal sepsis, presented hemodynamically unstable and with a history of closed trauma to the abdomen, it was thought of a hepatic or splenic lesion, which is why it was decided to move to exploratory laparotomy. It is suggested to correlate the physical examination with laboratory studies and to decide if this in conditions to complement with studies of image or tomography. The pathogenesis of this sign is not clearly understood. There are few hypotheses that attempt to explain it: escape of gas from the intestinal

lumen that can be transferred to the liver or microorganisms that can produce gas inside the organs and transport it to the blood system.^(7,8) Gastric pneumatosis is a rare radiographic finding representing a spectrum of conditions ranging from benign pathologies to patients who developed abdominal sepsis, associated with intestinal pneumatosis and portal venous gas that increases mortality by up to 75%. This case presents the unusual finding with gastric pneumatosis with extension to organs not normally affected by presenting intestinal pneumatosis secondary to abdominal sepsis.⁽⁹⁾ Currently, tomography is the study of the image to establish the diagnosis of this type of pathology.⁽¹⁰⁾ The diagnostic tool of choice is computerized angiography since it has greater specificity and sensitivity, in addition to being a non-invasive method found in most specialized medical centers⁽¹¹⁾ Angiography is the best imaging study to evaluate the extent, Distribution and severity in patients with portomesenteric pneumatosis⁽¹¹⁻¹³⁾ Imaging studies should be requested to complement an adequate diagnosis, as long as the patient is hemodynamically stable and make a good decision whether or not the patient is a candidate for surgical treatment.

The treatment in this type of pathology depends on the etiology and can be an aggressive surgical treatment or a conservative treatment with hyperbaric oxygen and general measures.⁽¹²⁾ When it is secondary to abdominal sepsis, the cause that originated the sepsis must be treated and an adequate resuscitation must be performed, in this case the origin was intestinal perforations secondary to closed trauma of the abdomen.

Conclusion

Intestinal pneumatosis represents a condition of great severity and high morbidity and mortality. It generally represents the final stage of multiple etiologies, among which is intestinal perforation and sepsis, as in the case of our patient. Although it is a rare condition, the surgeon must be alert to its presentation, as well as rely on imaging studies to make a timely diagnosis. Computerized tomography has made it possible to make descriptions of great precision, which is why it is an essential study. It is important to establish proper management, since it is a disease with high mortality. The treatment must be carried out by a multidisciplinary team that includes an intensivist and surgeon, and know how to identify those patients who require surgery and those who will benefit from conservative management.

Conflicts of interest

The authors have no conflicts of interest to declare.

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References

1. Biondi, A., Traversone, A., Costa, S., Oreggia, B., Vitale, F., Zefelippo, A., & Avesani, E. C. (2012). Massive portomesenteric gas and intestinal pneumatosis. *Journal of Emergency Medicine*, 43(4), e249-e250.
2. Sen, I., Samarasam, I., Chandran, S., & Mathew, G. (2013). Gastric intramural and portal venous gas following blunt abdominal injury. *Archives of trauma research*, 2(2), 95.
3. Torigoe, K., Arai, H., Yamashita, A., Muraya, Y., Obata, Y., & Nishino, T. (2016). Improvements in pneumatosis cystoides intestinalis and hepatic portal venous gas with conservative therapy in a patient on maintenance dialysis. *Internal Medicine*, 55(13), 1735-1738.
4. Siciliani, L., Riccardi, L., Favuzzi, A., Pompili, M., & Rapaccini, G. (2011). A case of non-occlusive mesenteric ischemia and hepatic portal venous gas: not everyone knows that.... *Internal and emergency medicine*, 6(6), 563-565.
5. Fahrner, R., Rauchfuss, F., Scheuerlein, H., & Settmacher, U. (2018). Posttraumatic venous gas in the liver—a case report and review of the current literature. *BMC surgery*, 18(1), 1-4.
6. Granero, L. E., Ballario, F., García, S., Badra, R., Galetti, C., & Marangoni, A. (2010). Neumatosis intestinal asociada a neumatosis portal intrahepática por oclusión intestinal. Presentación de un caso. *Revista argentina de radiología*, 74(1), 63-65.
7. Liebman, P. R., Patten, M. T., Manny, J. O. N. A. H., Benfield, J. R., & Hechtman, H. B. (1978). Hepatic-portal venous gas in adults: etiology, pathophysiology and clinical significance. *Annals of surgery*, 187(3), 281.
8. Mitsuyoshi, A., Hamada, S., Tachibana, T., Momono, T., Aoyama, H., Kondo, Y., ... & Okabe, H. (2015). Pathogenic mechanisms of intestinal pneumatosis and portal venous gas: should patients with these conditions be operated immediately?. *Surgical Case Reports*, 1(1), 1-8.
9. Shah, N. R., Dossick, D. S., Madura, J. A., & Heppell, J. P. (2013). Use of diagnostic laparoscopy in a patient with gastric pneumatosis and portal venous gas. *Case reports in gastroenterology*, 7(2), 261-265.
10. Sierocka, A., Kalbarczyk, K., Pawlus, J., Sulikowski, T., & Ostrowski, M. (2013). A Case of Portomesenteric Venous Gas Detected on Computed Tomography. *Polish Journal of Surgery*, 85(9), 517-519.
11. Milone, M., Di Minno, M. N. D., Musella, M., Maietta, P., Iaccarino, V., Barone, G., & Milone, F. (2013). Computed tomography findings of pneumatosis and portomesenteric venous gas in acute bowel ischemia. *World journal of gastroenterology: WJG*, 19(39), 6579.
12. Naguib, N., Mekhail, P., Gupta, V., Naguib, N., & Masoud, A. (2012). Portal venous gas and pneumatosis

intestinalis; radiologic signs with wide range of significance in surgery. *Journal of surgical education*, 69(1), 47-51.

13. Nelson, A. L., Millington, T. M., Sahani, D., Chung, R. T., Bauer, C., Hertl, M., ... & Conrad, C. (2009). Hepatic portal venous gas: the ABCs of management. *Archives of Surgery*, 144(6), 575-581.

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