

Available online at [www.sciencedirect.com](http://www.sciencedirect.com)

ScienceDirect

journal homepage: [www.elsevier.com/locate/radcr](http://www.elsevier.com/locate/radcr)

## Case report

# Pneumatosis intestinalis: Not always bowel ischemia<sup>☆</sup>

Adele Hwee Hong Lee, MBBS<sup>a,\*</sup>, Shanthapriya Tellambura, MBBS, FRACS<sup>b</sup>

<sup>a</sup>Department of General Surgery, St Vincent's Hospital Melbourne, 41 Victoria Parade, Fitzroy, Victoria 3065, Australia

<sup>b</sup>Department of General Surgery, Swan Hill District Health, Swan Hill, Victoria, Australia

## ARTICLE INFO

## Article history:

Received 25 November 2021

Revised 20 January 2022

Accepted 22 January 2022

## Keywords:

Ischemia

Mesenteric ischemia

Gastrointestinal disease

Radiography

Conservative treatment

Fecal impaction

## ABSTRACT

Pneumatosis intestinalis or abnormal intramural gas within the digestive tract usually suggests bowel ischemia necessitating urgent surgery. We report the case of an 82-year-old female presenting with hypotension and nausea, with a past history of schizophrenia, low grade chronic lymphocytic leukemia, stroke, bronchitis and rheumatoid arthritis. Computed tomography performed demonstrated extensive submucosal gas within the entire small bowel, associated with free gas in the peritoneal cavity. Bowel ischemia was diagnosed radiologically. However, a benign diagnosis of fecal impaction was ultimately made due to the patient's stable clinical status. Clinical correlation and close monitoring of clinical status in this context is of greatest diagnostic assistance when encountered with this phenomenon, to prevent unnecessary harm to the patient.

© 2022 The Authors. Published by Elsevier Inc. on behalf of University of Washington.

This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

## Introduction

Pneumatosis intestinalis is a common radiological sign with over 60 known causes [1]. With the improvement in radiological technology and increase in uptake of computed tomography, it is important to explore the various causes of this phenomenon as detection increases in frequency [2–4]. Although most commonly associated with bowel ischemia [5], the incidence of an association with benign pathology can reach 26% [6]. Determining the cause would be vital to guiding the correct management for the patient and the outcome. This should be guided primarily by clinical correlation.

## Case report

An 82-year-old female was reviewed for hypotension with a systolic blood pressure of 80. The patient was well, only complaining of nausea. Her past medical history was significant for schizophrenia, low grade chronic lymphocytic leukemia treated conservatively, stroke, bronchitis, and rheumatoid arthritis. She is a non-smoker. As an inpatient under the medical team, her stay was complicated by episodes of hypoglycemia, associated with a loss of appetite, as well as constipation.

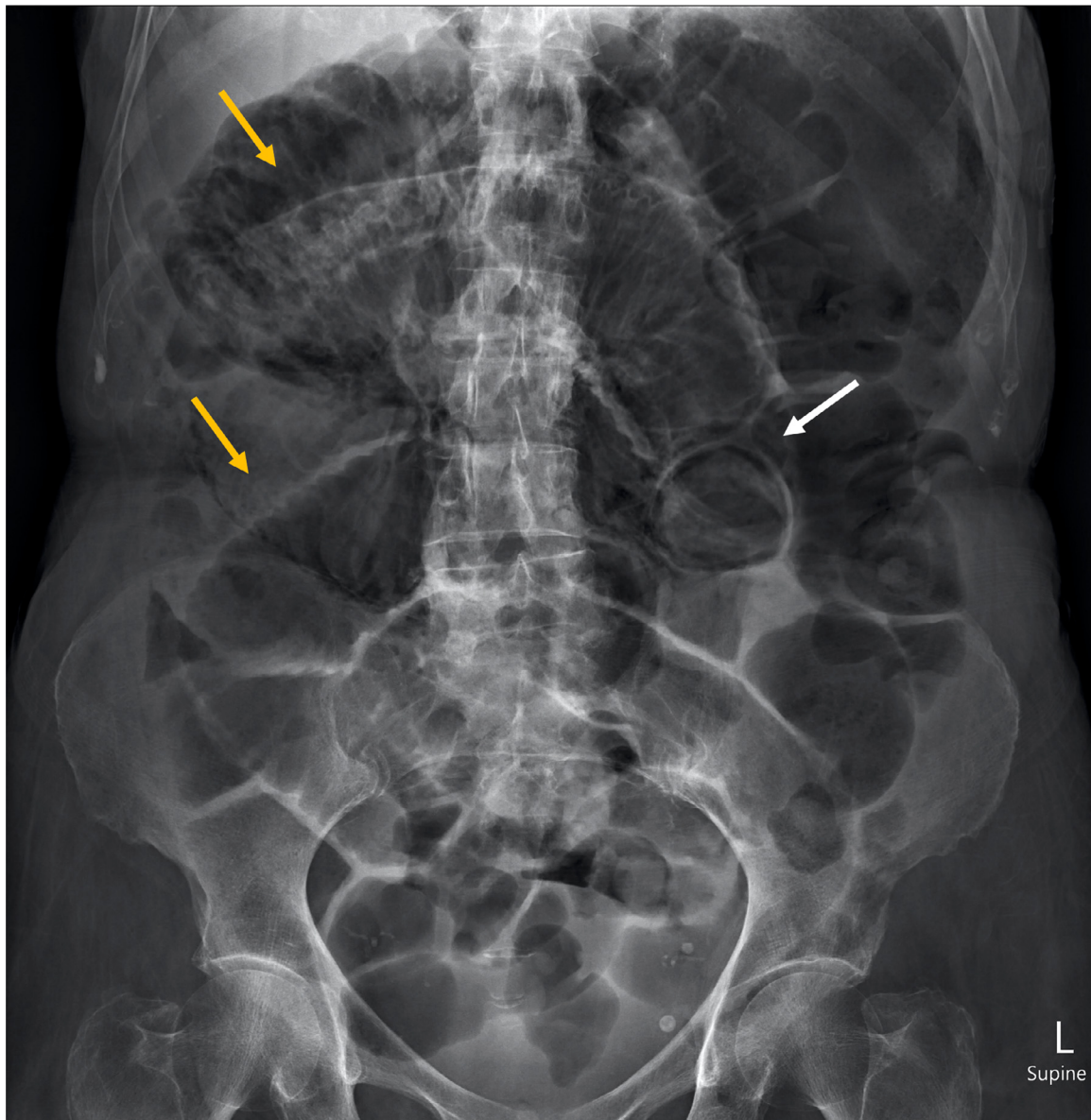
<sup>☆</sup> Competing Interests: The authors have declared that no competing interests exist.

\* Corresponding author. A. Lee.

E-mail address: [adele.lee@svha.org.au](mailto:adele.lee@svha.org.au) (A. Hwee Hong Lee).

<https://doi.org/10.1016/j.radcr.2022.01.062>

1930-0433/© 2022 The Authors. Published by Elsevier Inc. on behalf of University of Washington. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

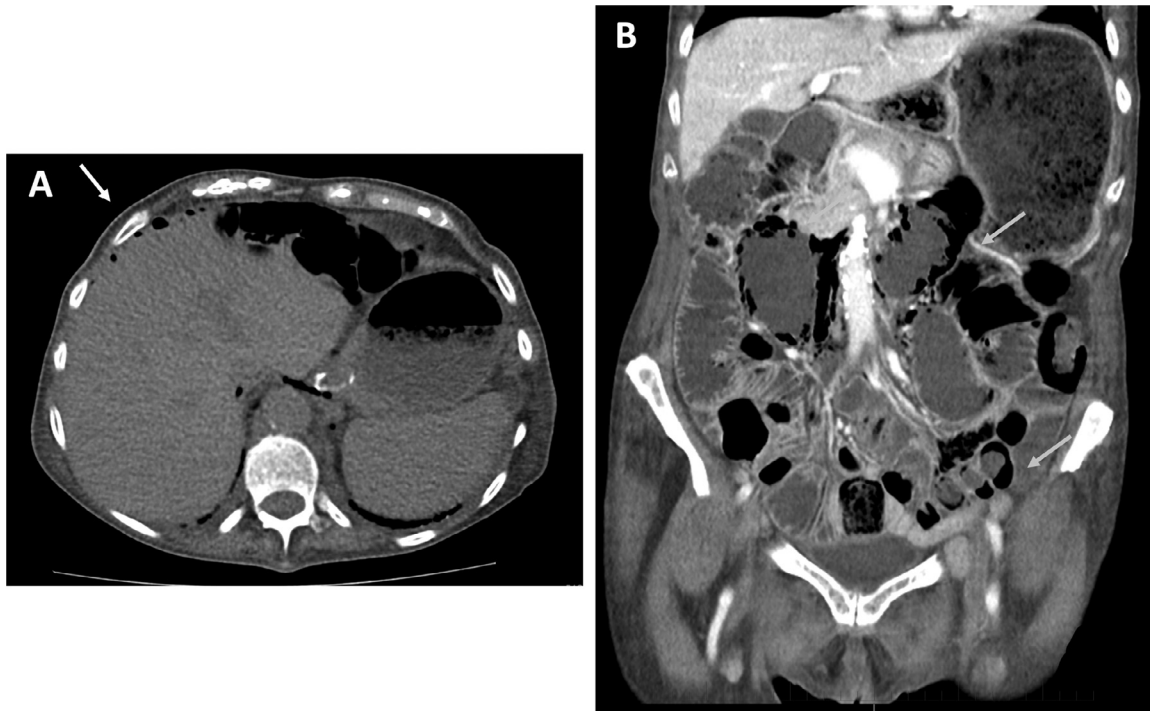


**Fig. 1 – Abdominal x-ray demonstrating marked distension of small bowel loops (yellow arrows) with gas in the submucosal plane (white arrow).**

On examination, she appeared comfortable. She was afebrile, not tachycardic, saturating at 98% on room air. Her abdomen was flat, with mild suprapubic tenderness and no signs of peritonism. Bowel sounds were present. Her blood tests revealed a white cell count of  $10 \times 10^9/L$ , and a serum lactate of 1.1 mmol/l. Renal function was at baseline with an estimated glomerular filtration rate of 56 mL/min/1.73m<sup>2</sup>. Abdominal x-ray showed marked distension of small bowel loops, with gas in the submucosal plane (Fig. 1). Computed tomography (CT) of the abdomen and pelvis demonstrated extensive submucosal gas within the entire small bowel, associated with free gas in the peritoneal cavity (Fig. 2). It was reported as small bowel ischemia likely due to an embolus from the superior

mesenteric artery, given the distribution of the ischemia and atheroma present in the aorta.

A radiological diagnosis of bowel ischemia was made. After review by the surgical team, the patient was not offered further investigations or surgery due to refusal to proceed. However, the patient's stable clinical status and absence of signs of significant bowel ischemia the next day raised our suspicions of benign pneumatosis intestinalis (PI), likely secondary to fecal impaction, and the patient was commenced on regular osmotic laxatives. The patient was discharged a few days later with regular bowel motions and improved appetite. No radiological follow-up was sought due to the observable clinical improvement.



**Fig. 2 – Computed tomography of the abdomen and pelvis demonstrating extensive submucosal air within the entire small bowel (yellow arrows), associated with free gas in the peritoneal cavity (white arrow). (A) Axial view. (B) Coronal view.**

## Discussion

Pneumatosis intestinalis (PI) or abnormal intramural gas within the digestive tract, usually suggests bowel ischemia necessitating emergent surgery. However, there are other causes of PI where surgery is not indicated. Clinical correlation is key in order to avoid unnecessary surgical intervention and associated morbidity [7]. A benign etiology should be considered if the patient's clinical status does not reflect a sinister pathology.

Up to 60 causes have been associated with PI [1]. Other than bowel ischemia, life-threatening causes include toxic megacolon, bowel obstruction or strangulation, and trauma. Benign causes can be divided into idiopathic, or secondary to various diseases. These include respiratory disease, inflammatory bowel disease, autoimmune disease, immunosuppression, chemotherapy and post-operative sequelae [8,9].

The physiology of PI depends on etiology. In respiratory disease, alveolar rupture due to high interalveolar pressure leads to the emanation of gas which spreads via the mediastinum to the bowel wall. Elevated intra-abdominal pressures in these patients, may also cause intraluminal gas to track intramurally. Factors which compromise the intestinal mucosa, such as corticosteroid therapy, or damage the mucosa, due to ischemia, inflammation, trauma, surgery and ulcers can also cause intraluminal gas to diffuse intramurally [1,8]. Constipation can damage the bowel mucosa causing gas-forming bacteria to invade the intestinal wall, which may be the mechanism of PI in our patient [9,10].

Patients are often asymptomatic with benign PI. Factors which point to a sinister etiology include a serum lactate of  $\geq 2$ mmol, airway or hemodynamic compromise, peritonitis, abdominal tenderness, acute kidney injury and the absence of bowel sounds [1,11–14].

Radiographic features on CT associated with pathological PI include portal venous gas, bowel distension, free fluid and pneumoperitoneum. However, these signs can be non-specific and should be interpreted with caution. Pneumoperitoneum may be due to extravasation of intramural gas to the peritoneal cavity from benign PI rather than a perforated viscus [8,10]. More specific findings for ischemia include absent bowel wall enhancement, solid organ infarctions and signs of arterial or venous mesenteric occlusion [1].

Management of PI should be guided by serial assessments of the patient, especially if impressive radiological findings do not correlate with the initial assessment. If a benign cause of PI is suspected, the patient should be treated conservatively. Otherwise addressing the causes of PI, such as aperients for constipation or oxygen therapy for respiratory disease can be instituted. A diagnostic laparoscopy could be performed in a surgical candidate to rule out ischemic bowel or perforation if findings are equivocal.

PI is a radiological sign, not a diagnosis. Although life-threatening causes need to be excluded first, benign causes of PI should be considered when clinical and biochemical findings do not reflect bowel ischemia. Clinicians need to rely on their clinical expertise rather than radiographic findings when PI is encountered, to avoid inappropriate management and unnecessary harm to the patient.

---

## Authors' contributions

Adele HH Lee drafted and revised the manuscript; Shan-thapriya Tellambura conceptualized the research project, provided advice and guidance and revised the manuscript; all authors read and approved the final version of the manuscript.

---

## Patient consent

Written, informed consent for publication of the case was obtained from the patient.

---

## REFERENCES

- [1] Torres US, Fortes CDFM, Salvadori PS, Tiferes DA, D Ippolito G. Pneumatosis from esophagus to rectum: a comprehensive review focusing on clinico-radiological differentiation between benign and life-threatening causes. *Semin Ultrasound CT MR* 2018;39:167–82.
- [2] 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;20:127–32.
- [3] Sebastià C, Quiroga S, Espin E, Boyé R, Alvarez-Castells A, Armengol M. Portomesenteric vein gas: pathologic mechanisms, CT findings, and prognosis. *Radiographics* 2000;20:1213–24.
- [4] Moussa M, Marzouk I, Abdelmoula K, Manamani A, Dali N, Farhat LCB, et al. Role of computed tomography in predicting prognosis of hepatic portal venous gas. *Int J Surg Case Rep* 2017;30:177–82.
- [5] Ho LM, Paulson EK, Thompson WM. Pneumatosis intestinalis in the adult: benign to life-threatening causes. *AJR Am J Roentgenol* 2007;188:1604–13.
- [6] Wayne E, Ough M, Wu A, Liao J, Andresen KJ, Kuehn D, et al. Management algorithm for pneumatosis intestinalis and portal venous gas: treatment and outcome of 88 consecutive cases. *J Gastrointest Surg* 2010;14:437–48.
- [7] Ooi S, Das K, Toh JWT. Pneumatosis cystoides intestinalis: a benign differential diagnosis for computed tomographic evidence of pneumoperitoneum in a stable patient. *ANZ J Surg* 2018;88:E210–11.
- [8] Than VS, Nguyen MD, Gallon A, Pham MT, Nguyen DH, Boyer L, et al. Pneumatosis intestinalis with pneumoperitoneum: Not always a surgical emergency. *Radiol Case Rep* 2020;15:2459–63.
- [9] Tsang CLN, Lim CSH, Chen MZ, Tay YK, Phan-Thien K-C. Pneumatosis intestinalis: benign or life-threatening? *ANZ J Surg* 2020;90:1790–2.
- [10] Ko S, Hong SS, Hwang J, Kim H-J, Chang Y-W, Lee E. Benign versus life-threatening causes of pneumatosis intestinalis: differentiating CT features. *Rev Assoc Med Bras* 1992;64:543–8 2018.
- [11] Hawn MT, Canon CL, Lockhart ME, Gonzalez QH, Shore G, Bondora A, et al. Serum lactic acid determines the outcomes of CT diagnosis of pneumatosis of the gastrointestinal tract. *Am Surg* 2004;70:19–23.
- [12] Ferrada P, Callcut R, Bauza G, O'Bosky KR, Luo-Owen X, Mansfield NJ, et al. Pneumatosis intestinalis predictive evaluation study: a multicenter epidemiologic study of the American Association for the Surgery of Trauma. *J Trauma Acute Care Surg* 2017;82:451–60.
- [13] DuBose JJ, Lissauer M, Maung AA, Piper GL, O'Callaghan TA, Luo-Owen X, et al. Pneumatosis Intestinalis Predictive Evaluation Study (PIPES): a multicenter epidemiologic study of the Eastern Association for the Surgery of Trauma. *J Trauma Acute Care Surg* 2013;75:15–23.
- [14] Umapathi BA, Friel CM, Stukenborg GJ, Hedrick TL. Estimating the risk of bowel ischemia requiring surgery in patients with tomographic evidence of pneumatosis intestinalis. *Am J Surg* 2016;212:762–8.