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Case report

Diagnostic laparoscopy for pneumatosis intestinalis in a very elderly patient: A case report

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HIGHLIGHTS

- Pneumatosis intestinalis (PI) may be associated with life-threatening emergencies.
- It is difficult to completely rule out the fatal conditions associated with PI without surgery.
- Very elderly patients are at high risk for a fatal outcome if surgery is delayed.
- Laparoscopy may be a useful option for diagnosing PI in very elderly patients.

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ABSTRACT

Introduction: Pneumatosis intestinalis is rare but may be associated with life-threatening intra-abdominal conditions such as intestinal ischemia or perforation. However, it can be difficult, particularly in the very elderly, to identify candidates for immediate surgical intervention.

Presentation of case: A 94-year-old man with abdominal distension underwent abdominal computed tomography, which demonstrated accumulation of air bubbles within the intestinal wall and some free intraperitoneal air, suggestive of pneumatosis intestinalis. His vital signs showed evidence of systemic inflammatory response syndrome, and laboratory examination revealed inflammation and hypoxia. As the patient was frail, with his age and concomitant conditions which may have masked the symptoms and severity of his illness, immediate diagnostic laparoscopy was performed, which confirmed the diagnosis of pneumatosis intestinalis, with multiple gas-filled cysts seen within the subserosa of the small intestine. No additional surgical procedure was performed. His symptoms improved postoperatively.

Discussion: Optimal management of pneumatosis intestinalis in a timely manner requires a comprehensive evaluation of factors in each individual. In patients with severe symptoms, PI might be a sign of a life-threatening intra-abdominal emergency. Despite the contrast-enhanced CT and prediction markers in previous reports, it considered to be difficult to completely rule out these fatal conditions without surgery, especially in very elderly patients with poor performance status.

Conclusion: Diagnostic laparoscopy may be a useful option for definitively ruling out the lethal conditions associated with pneumatosis intestinalis in frail elderly patients with severe conditions in the emergency setting.

1. Introduction

Pneumatosis intestinalis (PI) is a rare condition; its incidence is reportedly 0.3% based on computed tomography (CT) results [1] and 0.03% based on an autopsy series [2]. PI is defined as the presence of gas within the wall of the gastrointestinal tract. PI in adults is

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classified as idiopathic PI (15%), in which patients have no significant medical history or underlying disease, and secondary PI (85%), associated with a wide variety of gastrointestinal and non-gastrointestinal conditions [2–4]. PI may occur in a benign context, and in this case, PI is not considered a disease but rather a sign. However, PI can sometimes be considered a surrogate marker for a life-threatening intra-abdominal emergency such as intestinal ischemia or perforation. The seriousness of PI needs to be determined according to each patient's individual clinical condition and laboratory data. To prevent unnecessary surgery for patients with PI, in previous reports, authors have proposed the prediction models of mortality [4,5], mesenteric ischemia [6] and pathologic PI [7] based on the predictive markers. Even with these models and contrast-enhanced CT, it remains difficult to definitively identify patients who need immediate surgical intervention. This is particularly true in very elderly patients in whom severe abdominal symptoms might be masked. In addition, unfortunately, these patients are at high risk of a fatal outcome if surgical intervention is delayed. In this case report, we discuss the role of diagnostic laparoscopy in elderly patients with this rare but potentially life-threatening intra-abdominal condition. This report is consistent with the SCARE (consensus-based surgical case report guidelines) criteria [8].

2. Presentation of case

A 94-year-old Japanese man complaining of abdominal pain and distension was brought by ambulance to our hospital at night. He had no apparent abdominal tenderness or nausea, but he did have abdominal distension and dyspnea on arrival. His comorbidities included diabetes mellitus, hypertension, glaucoma and a previous cerebral infarction; he had no history of previous surgery. He was taking an α-glucosidase inhibitor (α-GI) for diabetes and an antiplatelet agent. His vital signs were as follows: temperature of 37.4 °C, heart rate of 106 beats/min, respiratory rate of 22/min, and blood pressure of 197/110 mm Hg; these vital signs indicated the presence of systemic inflammatory response syndrome (SIRS); therefore a urinary catheter was inserted to measure his urinary output. Laboratory examination revealed inflammation (white blood cell count, 11800/mm^2; C-reactive protein, 11.5 mg/dL). Arterial blood-gas analysis revealed pH of 7.425, bicarbonate of 30.3 mmol/L, base excess of 5.5 mmol/L, PaO_2 of 61.3 mm Hg, $PaCO_2$ of 47.1 mm Hg, oxygen saturation of 91.7% on 5 L/min oxygen via face mask and lactate level of 0.9 mmol/L, indicating acute respiratory distress syndrome (ARDS) with PaO_2/fraction of inspired oxygen (FiO_2) ratio of 153; there were no evidence of metabolic acidosis or hyperlactatemia. There were no other sings of organ failure. Plain radiography of the abdomen revealed “bubble” appearances in the lumen of the bowel (Fig. 1a). Abdominal CT showed accumulation of air bubbles within the wall of the distal small intestine and ascending colon (Fig. 1b) and a tiny amount of free intraperitoneal air. There was no apparent portal vein gas, ascites or bowel ischemia on contrast-enhanced CT.

In addition to the presence of SIRS, an elevated C-reactive protein level and free intraperitoneal air, the patient was frail, and his age and coexisting conditions may have masked the symptoms and severity of his illness. We therefore decided to perform a diagnostic laparoscopy immediately to completely rule out perforation and bowel ischemia. Under laparoscopy, multiple gas-filled cysts were observed at the subserosa of the small intestine (Fig. 2), a finding compatible with PI. There was no sign of peritonitis or bowel ischemia. No additional surgical procedure was performed. The patient's postoperative course was uneventful. The symptoms, such as abdominal distension, improved postoperatively. After recovering from the pneumonia that accompanied his initial presentation, the patient was discharged on postoperative day (POD) 15. At 3.5 months after surgery, the signs of PI on CT had substantially improved (Fig. 3). All diagnostic and surgical procedures concerning the patient were carried out after informed consent had been obtained. The patient anonymity was preserved.

3. Discussion

Multiple pathogenic mechanisms, including mechanical, bacterial, and biochemical, are involved in the formation of PI. The most likely underlying cause in our patient is a mechanical intestinal obstruction. CT revealed voluminous feces in the ascending and transverse colon, which were the distal side of the small intestine where we detected PI. He started to defecate in large quantities on POD 2, and abdominal distention was improved. Another possible cause is biochemical. The patient was administered an α-GI for diabetes, which reportedly suppresses the digestion of carbohydrates. Intestinal luminal bacteria produce a large volume of gas through carbohydrate fermentation, and this gas may be forced directly into the intestinal wall.

Given the potentially fatal outcome of PI, optimal management in a timely manner requires a comprehensive evaluation of factors in each individual, such as past history, underlying disease, clinical condition, physical examination findings, and laboratory and radiologic findings. Most patients with PI are asymptomatic and no specific therapy is needed. If patients are mildly symptomatic, clinicians may consider conservative treatment such as antibiotics therapy, an elemental diet, oxygen inhalation, and hyperbaric oxygen; surgical intervention is unnecessary. However, in patients with severe symptoms, PI might be a sign of a life-threatening intra-abdominal emergency such as intestinal ischemia or perforation. Although some previous reports describe successful nonoperative management, the mortality in patients with PI who do not undergo surgical intervention is 16.7–39.3% (Table 1) [1,3–7,9,10] indicating that it is essential to identify patients who need immediate surgical intervention.

To date, CT is the preferred imaging technique, and decreased bowel enhancement on CT, which is defined as decreased or absent enhancement after administration of contrast material, is considered the most useful finding to detect the bowel wall ischemia. This finding has a specificity of 95–100% but a variable sensitivity of 33%–78% [11]. In addition, decreased enhancement of the bowel wall during the arterial phase is difficult to evaluate, considering the rate of interobserver agreement [12]. Although the predictive markers for mortality or fatal conditions, such as pathologic PI and bowel necrosis, were reported in previous papers (Table 1), these predictive markers are not available universally. The P-POSSUM model is also useful for predicting postoperative mortality. Unfortunately, this risk prediction model cannot be used preoperatively; intraoperative information is required to predict mortality. Therefore, we considered that it was difficult to completely rule out the fatal conditions without surgery.

Using the prediction markers described in previous reports, abdominal distention [10] and vascular disease score ≥ 4 [6] indicate that surgery was necessary in our patient. In addition, the patient was very advanced age (94 years old) and he had hearing and vision disabilities, with Eastern Cooperative Oncology Group performance status of 3. These individual factors might have prevented the medical staff from sufficiently obtaining the background information, such as drug use, underlying diseases and co-morbidity. The information includes the conditions which are associated with PI, such as mucosal disruption (peptic ulcer disease, Crohn's disease, ulcerative colitis), infection (tuberculosis), pulmonary disorders (chronic obstructive pulmonary disease, asthma) and immunological disturbances (AIDS, steroids, chemotherapy), as well as co-morbidities that predict the mortality after surgery, such

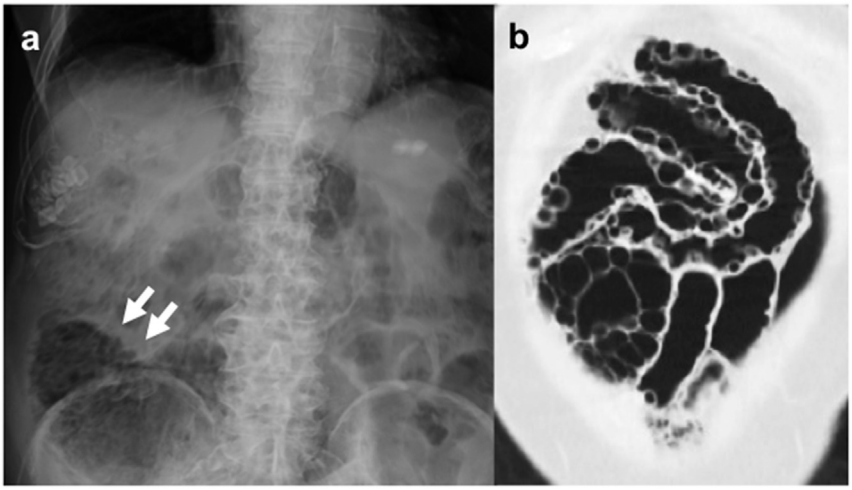

Fig. 1. **a** Plain abdominal radiography and **b** Computed tomography images, lung-window setting (coronal). Radiolucent shadows (**a**, arrows) in the intestinal lumen and multiple air pockets (**b**) in the intestinal wall were detected before diagnostic laparoscopy.

as diabetes, pulmonary disease, hypertension, congestive heart disease and renal insufficiency [13]. Although he did not have apparent peritoneal signs, we suspected that his poor overall condition might have contributed to masking potentially severe abdominal symptoms. Elderly patients are more frail and more vulnerable to acute stress than younger patients because of the diminished organ function resulting from physiological decline [14]. We therefore decided to perform diagnostic laparoscopy to definitively rule out any lethal conditions not to delay the surgical intervention, although we knew there was a possibility of a negative result, as has been previously reported in 5.9–20.0% of patients (Table 1). Although the geriatric population is growing worldwide, some elderly patients are in relatively good condition for their age, and they and their families often desire aggressive treatment. Our patient and his family wanted to rule out any lethal conditions and were satisfied with the results of his diagnostic laparoscopy.

The strength of this case report is that it describes a rare situation, i.e., PI in a very elderly patient; however, this situation could be encountered by any gastrointestinal surgeon since the growing geriatric population means that more elderly patients are seen in the emergency setting [14]. The limitation of this report is the lack of generalizability of the utility of diagnostic laparoscopy for all cases of PI in the geriatric population due to the negative results as our patient. Further study, using a large sample size, in the geriatric population is needed.

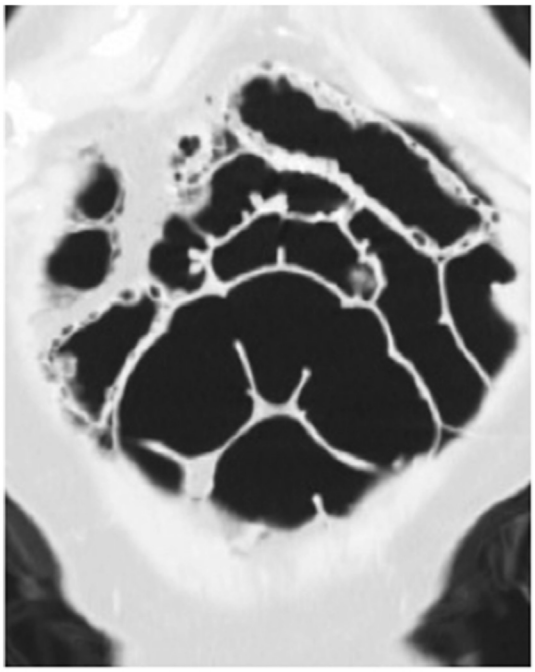

Fig. 3. Coronal CT image at the 3.5 month follow up after diagnostic laparoscopy demonstrating substantially disappearance of the sign of PI.

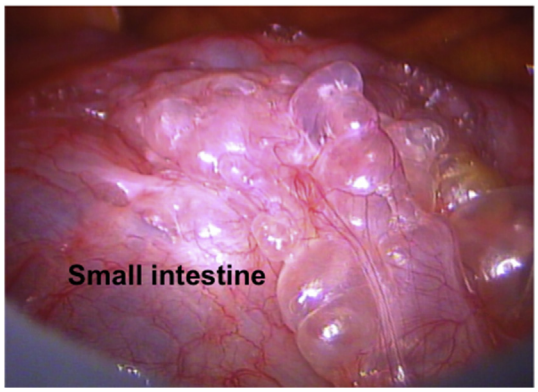

Fig. 2. Intraoperative images of the small intestine demonstrating multiple gas-filled cysts within the subserosa. There is no evidence of ischemia or perforation.

4. Conclusion

Diagnostic laparoscopy is a minimally invasive surgical procedure, making it especially useful in frail elderly patients with severe conditions in the emergency setting. It is an accurate method of diagnosing life-threatening forms of PI. If there is the slightest doubt as to the presence of a serious condition in an elderly patient in relatively good overall health, diagnostic laparoscopy may be a useful option for definitively ruling out the lethal conditions associated with PI since they are at high risk of a fatal outcome if surgical intervention is delayed.

Table 1
Reports of the prediction marker for PI.

Year (reported)	Study design	No. of Patients	Age[a] (years)	Surgery group		Nonsurgery group[d]	Prediction marker	Predicted (Associated) condition	Reference
				Mortality[b] rate	Negative exprolation[c] rate	Mortality[b] rate			
1990	prospective	27	51 (1month −83)	43.8% (7/16)	6.3% (1/16)	18.2% (2/11)	· clinical severity score ≥ 8 calculated using pain, diarrhea, fever, tenderness, blood per rectum, hypotension · pH < 7.3 · HCO_3 < 20 mmol/L · lactictate > 2 mmol/L · amylase > 200 IU/L	bowel necrosis	[3]
2004	retrospective	86	59.5 (11–87)	47.1% (16/34)	5.9% (2/34)	38.5% (20/52)	· lactictate > 2 mmol/L	mortality	[1]
2007	retrospective	40	60	25.0% (4/16)	6.3% (1/16)	16.7% (4/24)	· sepsis · age ≥ 60 · emesis · WBC > 12000 cells/mm3	mortality, surgical management	[5]
2008	retrospective	97	54	15.6% (5/32)	12.5% (4/32)	24.6% (16/65)	· high APACHE II score	mortality	[9]
2010	retrospective	84[e]	NA	26.0% (13/50)	20.0% (10/50)	26.5% (9/34)	· vascular disease score ≥ 4 calculated using follows ✓ total vascular risk factors (smoking, diabetes, hypertension, hyperlipidemia) ✓ coronary artery disease ✓ peripheral vascular disease ✓ at risk for low-flow state to gut (moderate/severe CHF, arrhythmia, sepsis, IV pressors) ✓ vasculitis or venous occlusion ✓ abdominal pain ✓ lactate ≥ 3.0 mg/dL ✓ small bowel pneumatosis	mesentric ischemia	[6]
2011	retrospective	150	NA	28.0% (21/75)	12.0% (9/75)	33.3% (25/75)	· abdominal distention · peritonitis · lactic acidemia	positive intraoperative findings	[10]
2013	retrospective	500	56.6	NA	NA	27.6% (83/301)	· lactictate > 2 mmol/L · hypotension or vssopressor need · peritonitis · acute renal failure · active mechanical ventilation · absent bowel sounds	pathologic PI[f]	[7]
2014	retrospective	123	62 (20–91)	46.2% (18/39)	10.3% (4/39)	39.3% (33/84)	· peritoneal irritation · decreased or absent enhancement of bowel wall on CT	mortality	[4]

PI, pneumatosis intestinalis; APACHE, Acute Physiologic and Chronic Health Evaluation; NA, not available; CT, computed tomography.
[a] Mean or median (range).
[b] Mortality include the PI unrelated death.
[c] Negative exprolation was defined that nothing requiring surgical intervention was identified on laparotomy.
[d] Nonsurgery group include patients with futile care.
[e] Patients with portal vein gas were included.
[f] Pathologic PI was defined as either transmural ischemia at endoscopy/surgery or the withdrawal of clinical care and subsequent mortality.

Ethical approval

An ethical approval was not required.

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Author contributions

SI and TM performed the operation. SI, AM and HM treated the patient. SI wrote the manuscript, performed the investigation and collected the data. TM, NH, MH, ST, KM and TI organized the writing of the manuscript. All authors read and approved the final manuscript.

Conflict of interest

The authors have no conflicts of interest to disclose.

Guarantor

Shuhei Ito (first author), Department of Surgery, Hiroshima Red Cross Hospital and Atomic Bomb Survivors Hospital, Hiroshima, Japan.

Consent of patient

Written informed consent was obtained from the patients for publication of this case report and accompanying images. A copy of the written consent is available for review by Editor-in-Chief of this journal on request.

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