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Pneumatosis intestinalis Is it always a surgical emergency?

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Πνευμάτωση εντέρου: Αποτελεί σε κάθε
περίπτωση οξύ χειρουργικό πρόβλημα;

Περίληψη στο τέλος του άρθρου

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Pneumatosis intestinalis (PI) is an imaging phenomenon representing the presence of gas in the bowel wall. Based on autopsy studies, its incidence has been estimated at 3 per 10,000 individuals in the general population. Intramural gas may originate from intraluminal gastrointestinal gas, bacterial gas production and pulmonary gas; its collection in the bowel wall may be explained by the following pathophysiological mechanisms: (a) bowel necrosis; (b) mucosal disruption; (c) increased mucosal permeability; and (d) pulmonary disease.¹

PI can be divided into primary and secondary which attribute to 15% and 85% of cases, respectively. Primary PI is a benign condition, usually asymptomatic and discovered incidentally on imaging. Secondary PI may be the result of a variety of non-ischemic and non-obstructive gastrointestinal conditions, pulmonary and systemic conditions (tab. 1). Bowel obstruction, perforation, ischemia and severe colitis are potentially life-threatening causes of PI.²

In clinical practice, it is often challenging for the physician to distinguish between benign and life-threatening PI which would dictate non-surgical and surgical management, respectively; the decision-making process is presented below (tab. 2).

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Table 1. Causes and pathophysiology of pneumatosis intestinalis (PI).

Primary PI

Secondary PI

Gastrointestinal causes

Life-threatening

Mesenteric ischemia
Intra-abdominal infection
Intestinal obstruction
Severe colitis-toxic megacolon

Benign or potential life-threatening

Blunt trauma
Ileus
Inflammatory bowel disease
Enteritis and colitis
Bowel stenosis
Carcinoma
Peptic ulcer
Celiac sprue

Non-gastrointestinal benign or potential life-threatening causes

Drug induced

Corticosteroids
Chemotherapy

Transplantation

Bone marrow
Kidney, liver, lung
Graft versus host

Iatrogenic

Endoscopy
Intestinal anastomosis
Enteric tube placement
Barium enema

Infectious

HIV
Virus
Candida albicans
Mycobacterium tuberculosis

Autoimmune and systemic

Systemic lupus erythematosus
Inflammatory arthritis
Inflammatory myopathies
Systemic sclerosis
Sarcoidosis

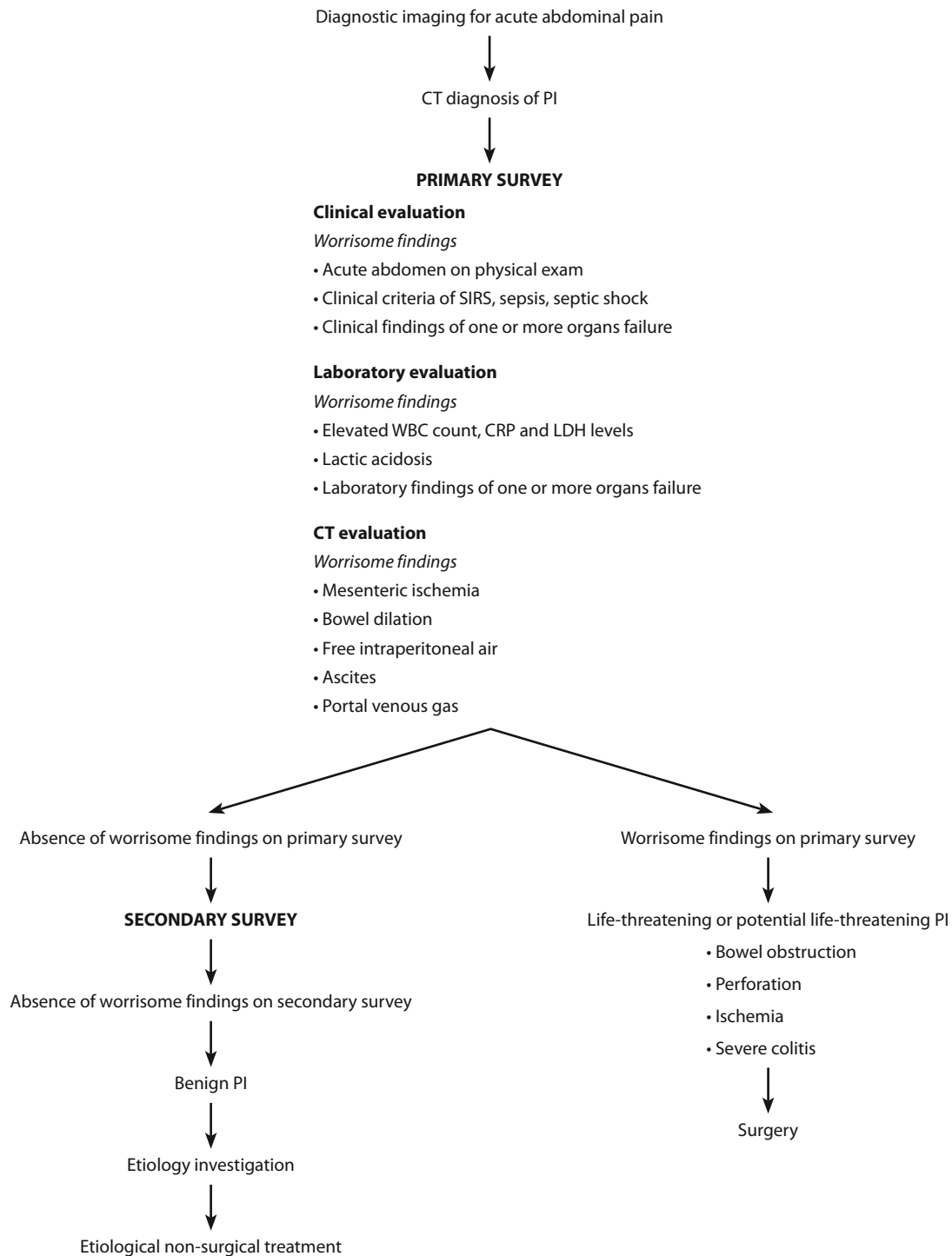
Pulmonary

Asthma
Chronic obstructive pulmonary disease
PEEP ventilation
Cystic fibrosis

Intramural
induction of
intraluminal gas
or production
of bacterial gas
due to

- Mucosal
disruption
- Increased
mucosal
permeability

Table 2. Decision making flow chart for patients diagnosed with pneumatosis intestinalis (PI).



STEP 1 – BENIGN OR LIFE-THREATENING “WORRISOME” PNEUMATOSIS INTESTINALIS? CLINICAL AND LABORATORY EVALUATION

In 2013, the Eastern Association for the Surgery of Trauma, in a retrospective multicenter study of 500 pa-

tients with PI, showed that a blood lactate level of over 2.0 mmol/L, hypotension, peritonitis, acute renal failure, active mechanical ventilation and absent bowel sounds were significantly correlated with worrisome PI. Specifically, a lactate level of >2.0 mmol/L and hypotension had

a predictive probability for life-threatening PI of 93.2%.³ In 2017, the American Association for the Surgery of Trauma, in a prospective multicenter study of 127 patients with PI, showed that clinical findings of ileus, peritoneal signs on physical examination, sepsis, hypotension and laboratory findings of elevated international normalized ratio (INR), decreased hemoglobin and lactate level >2.0 mmol/L were significantly correlated with worrisome PI. The authors concluded that surgical exploration should be strongly recommended for patients with PI presenting with a lactate level >2.0 mmol/L and peritonitis.⁴

STEP 2 – BENIGN OR WORRISOME PNEUMATOSIS INTESTINALIS? IMAGING EVALUATION

In 2017, Goyal and colleagues, in a retrospective study of 167 patients with PI, showed that location in the small bowel, bowel dilatation, mesenteric stranding, bowel enhancement, portal vein gas, mesenteric vein gas and moderate mesenteric edema were imaging findings significantly correlated with worrisome PI.⁵ In 2013, Lee and colleagues, in a retrospective study of 84 patients with PI, showed that bowel wall thickening, mesenteric stranding, ascites, bowel dilatation, location in the small bowel, portal vein gas and mesenteric vein gas were imaging findings significantly correlated with worrisome PI.⁶

STEP 3 – IDENTIFYING ETIOLOGY

On primary survey it is of primary priority for the physician to ascertain whether a life-threatening cause of PI, such as bowel obstruction, perforation, ischemia and severe colitis, is present or not, based on the presence of worrisome clinical, laboratory and imaging findings. The above surgical emergency situations should always be kept in mind during secondary surveys and once excluded further delineation of the exact etiology should be initiated, as shown in table 1.

STEP 4 – DETERMINING MANAGEMENT: SURGICAL OR NON-SURGICAL TREATMENT?

Patients with PI with worrisome clinical, laboratory and imaging findings should undergo surgical treatment. In the absence of worrisome findings, patients should undergo a trial of non-surgical treatment under strict re-evaluation. Non-surgical management should focus on treating the underlying gastrointestinal or systemic cause and discontinuation of possible instigating medications. Antibiotics, especially metronidazole 500 mg per os three times daily

for up to 3 months or until documented resolution of PI, can be used to target intraluminal and intramural bacteria in order to reduce anaerobic production of hydrogen gas.⁷ Cessation of oral diet and introduction of an elemental diet, which is totally absorbed in the small intestine, appears to be useful, by decreasing production of gas by colonic flora, but is not always well tolerated and bowel hypomotility may increase intraluminal pressure and worsen the PI. Limited case reports document investigative therapy with pro-motility agents such as metoclopramide and erythromycin.⁸

Oxygen therapy has long been recognized as effective for PI, leading to cyst regression on imaging and symptom resolution by the following mechanisms: (a) Increased tissue oxygenation may facilitate phagocytic activity and directly target the gas-producing organisms via anaerobic impairment; and (b) increased arterial oxygen tension forces oxygen into the hydrogen-containing cysts by diffusion from areas of high oxygen tension in the artery to low oxygen tension in the cysts. Oxygen accumulation in the cysts increases the partial pressure of hydrogen in the cysts causing hydrogen to diffuse out of the high-pressure cyst into the low-hydrogen bloodstream. Cyst resolution follows, as the oxygen leaves the cyst via re-absorption for use in cellular metabolism. A trial of hyperbaric oxygen therapy can be applied at 2.5 ATA for 2.5 hours for at least three sessions, or until 2 days after the disappearance of cysts to reduce the risk of recurrence.⁹

ΠΕΡΙΛΗΨΗ

Πνευμάτωση εντέρου: Αποτελεί σε κάθε περίπτωση οξύ χειρουργικό πρόβλημα;

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Λέξεις ευρητηρίου: Πνευμάτωση εντέρου, Συντηρητική αντιμετώπιση, Χειρουργική αντιμετώπιση

References

1. LASSANDRO F, VALENTE T, REA G, LASSANDRO G, GOLIA E, BRUNESE L ET AL. Imaging assessment and clinical significance of pneumatosis in adult patients. *Radiol Med* 2015, 120:96–104
2. BRAUMANN C, MENENAKOS C, JACOBI C. Pneumatosis intestinalis – a pitfall for surgeons? *Scand J Surg* 2005, 94:47–50
3. DuBOSE JJ, LISSAUER M, MAUNG AA, PIPER GL, O'CALLAGHANTA, 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
4. 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, 82:457–460
5. GOYAL R, LEE HK, AKERMAN M, MUI LW. Clinical and imaging features indicative of clinically worrisome pneumatosis: Key components to identifying proper medical intervention. *Emerg Radiol* 2017, 24:341–346
6. LEE KS, HWANG S, HURTADO RÚA SM, JANJIGIAN YY, GOLLUB MJ. Distinguishing benign and life-threatening pneumatosis intestinalis in patients with cancer by CT imaging features. *AJR Am J Roentgenol* 2013, 200:1042–1047
7. 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, 14:437–448
8. JOHNSTON BT, McFARLAND RJ. Elemental diet in the treatment of pneumatosis coli. *Scand J Gastroenterol* 1995, 30:1224–1227
9. FEUERSTEIN JD, WHITE N, BERZIN TM. Pneumatosis intestinalis with a focus on hyperbaric oxygen therapy. *Mayo Clin Proc* 2014, 89:697–703

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