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**Pneumatosis Cystoides Intestinalis:**

The Report of a Case Associated with Severe Pulmonary Disease and Chronic Lymphocytic Leukemia

Russell J. Crider, Jr., M.D.* and Philip Bentlif, M.D.**

Pneumatosis cystoides intestinalis is discussed with emphasis on its clinical, radiologic, sigmoidoscopic, surgical and pathological characteristics. The four theories of the etiology of P.C.I. are neoplastic, infectious, nutritional, and mechanical. These theories are discussed, and a case of P.C.I. associated with severe pulmonary disease and chronic lymphocytic leukemia is presented to lend support to the mechanical theory.

First noted by Duvernoy in 1730, pneumatosis cystoides intestinalis (P.C.I.) is a rare disorder characterized by submucosal or subserosal gas cysts in the intestinal wall. Other names given to the disorder include diffuse emphysema of the intestinal wall, multiple gas cysts of the intestine, emphysema of the cecum and gas cysts of the intestine.

**Gross Anatomy**

1. Appearance at laparotomy and autopsy.
   The gross appearance of P.C.I. has been described as resembling soap bubbles, hydatid cysts, hydatidiform moles, clusters of grapes, etc. Not readily apparent on laparotomy, the submucosal cysts are characterized chiefly by the firm, spongy sensation they present on palpation. Although size varies, the majority are 0.5 to 1.0 cm in diameter with thin, smooth, bluish walls, which are usually tense but break readily with the release of enclosed gas.

   Often there are associated lesions such as pyloric stenosis, volvulus, or appendicitis. Although the distribution of the lesions is variable, the small bowel is most commonly affected and is often associated with other pyloric lesions (eg, stenosis). Involvement of the iliocecal region is also common and is usually associated with no other demonstrable gastrointestinal lesion. Only 13 of the 213 cases investigated by Koss had lesions distal to the hepatic flexure, indicating the rarity of P.C.I. in the distal colon, sigmoid and rectum.

2. Appearance at sigmoidoscopy.
   In 1944 K. Rojel made the first diagnosis of P.C.I. by proctoscopy. He
recorded the following description of the circumferential lesion: “From the appearance of the nodules, they could have acted like mucous cysts, but when the top of two were pierced, they deflated without evidence of mucus. They seemed to be filled with air.” The diagnostic feature seen at sigmoidoscopy is the rapid deflation of the cysts upon biopsy. In a case report by Doub and Shea, “Each bleb when biopsied yielded a report as of a balloon popping, clearly audible throughout the room.”

**Microscopic Appearance**

The microscopic features of P.C.I. vary with the stage of development of the lesion. Koss postulates the following microscopic stages in the development of P.C.I.:

1. Formation of cysts with simple endothelial lining;
2. Formation of giant cells;
3. Inflammatory reaction in the surrounding connective tissue;
4. Sloughing off of giant cells with concomitant fibrosis of surrounding stroma;
5. Diminution of the size of the cysts to the point of complete fibrosis with ultimate disappearance as scarring progresses.

The lesions are usually submucosal in infants, but in adults (except those with so-called primary P.C.I.), they are generally subserosal.

Analyses of the gaseous content of the cysts is estimated at 70%-90% nitrogen, 3%-20% oxygen and 0%-15% carbon dioxide with traces of methane. Intraluminar bowel gas contains about 0.5% oxygen, 45% nitrogen, 40% carbon dioxide and 14% hydrogen. By comparison, air at sea level is 80% nitrogen, 20% oxygen and .04% carbon dioxide.

There are, however, several difficulties in determining accurate average values for the gas contents of the cysts. The major problem is that the methods of obtaining the gas samples are inaccurate, especially since the cystic gas contents change drastically in 20 minutes (eg, oxygen concentration changes from 1.4% to 13.1% in 20 minutes). Thus all postmortem analyses are unacceptable.

**Radiologic Appearance**

In 1924 Reverdin made the first roentgenographic description of P.C.I. However, it was diagnosed by laparotomy. Lerner and Gazin were the first to make the diagnosis by x-ray before surgery by noting in 1946 that, “The presence of inconsistent filling defects of increased translucency is pathognomonic.” The radiologic finding of interposition of bowel between the liver and the diaphragm (the Moreau-Chilaiditi sign) is common in P.C.I. and should immediately arouse suspicion of its presence.

**Theories of Etiology**

Although the etiology of P.C.I. is not known, four major theories have been put forth:

1. The neoplastic theory;
2. The infectious theory;
3. The nutritional theory, and
4. The mechanical theory.

The neoplastic and infectious theories have few supporters and little supporting evidence. The nutritional theory is based on the premise that the imbalance of certain nutritional factors changes the permeability of the bowel wall allowing the collection of
gas in the intestinal lymphatics. P.C.I. has been produced in 100% of a test group of swine fed 78% polished rice and 20% skimmed milk. If 5% baker's yeast or 50% whole grain were added to this diet, very few of the swine developed P.C.I. However, similar dietary deficiencies in humans do not appear to produce P.C.I.\(^\text{15}\)

Some investigators believe the disorder is due to malnutrition, eg, as caused by pyloric stenosis.\(^\text{12}\) However, there is no increased incidence of P.C.I. in people who are malnourished because of lack of food.

Some authors have proposed that an increase of lactic acid in the intestine (possibly secondary to the high milk intake on an ulcer diet) causes the lactic acid to be absorbed into the lacteals where it combines with alkaline chyme producing carbon dioxide and nitrogen (from the blood).\(^\text{16,17}\) Added support for this theory comes from Domini and Matolise who support an eclectic theory of "biochemical dystrophic and nutritional deficiency," after reviewing 711 cases of enteroperitoneal pneumatosis.

Many authors subscribe to some form of the nutritional theory, even though lesions often occur in the bowel in the area of least absorbency.

The mechanical theory states that the air arrives in the cysts by dissecting along fascial and vascular planes. Subgroups of the mechanical theory are that the cysts are: 1. secondary to gastrointestinal lesions resulting from a disease process, 2. secondary to gastrointestinal lesions from operative trauma, and 3. secondary to severe pulmonary disease.

1. **Secondary to a gastrointestinal lesion from a disease process.**

Koss found that 75% of 213 cases of P.C.I. had other gastrointestinal lesions. Of these, 76% had pyloric or gastric disease, the most common being pyloric stenosis with peptic ulcer. He postulates that, under increased pressure at the site of the stenosis, the gas enters the lymphatic channels via the ulcer and is forced along the gut lymphatics by peristalsis. On the other hand, Keyting\(^\text{13}\) suggests that the ulcer often allows communication with the blood vessels at the roots of the mesentery and the gas follows these vessels to the subserosal of the gut wall. It was found that, in dogs, air entering through experimentally produced ulcers passed along the bowel via lymphatics with vigorous peristalsis.\(^\text{19}\) A great deal of direct support was given to the mechanical theory when a patient vomited during laparotomy under spinal anesthesia. The cysts were seen to increase in size during the act of vomiting with no increase of the bowel size.

2. **Secondary to a gastrointestinal lesion resulting from a surgical procedure.**

It was first noticed in 1956 that there had been several instances when P.C.I. of the descending colon closely followed proctoscopy, with and without biopsy.\(^\text{20-23}\) It also followed rectal surgery.\(^\text{24}\)

3. **Secondary to severe pulmonary disease.**

The most recent addition to the mechanical theory was introduced by Keyting\(^\text{13}\) in 1961. He notes that several of his cases of P.C.I., as well as others from the literature,\(^\text{2,21,25}\)
Crider and Bentif

had severe pulmonary disease usually of the obstructive type.* The proposed mechanism of the pulmonary cause of P.C.I. is that coughing or straining to exhale leads to dissection of air from ruptured alveoli to the mediastinum, then by perivascular tissue to the mesentery and the intestinal wall. There is a great deal of experimental evidence to support this theory on animals and on cadavers. It should be noted that most of the so-called primary lesions and the lesions associated with pulmonary disease occur distal to the splenic flexure.

Clinical Picture of P.C.I.
The incidence of all forms of adult P.C.I. is highest in the 30- to 50-year-old group with a 3.5 to 1 ratio of males to females. Before 1951, only 44 cases of pediatric P.C.I., a much more serious disorder, had been reported. The adult disease seems to be world-wide with no apparent racial predisposition.

The presenting symptoms of P.C.I. are usually those of an associated disorder (eg, pyloric stenosis). When the P.C.I. is symptomatic, the patient usually complains of vague abdominal cramping pain, intermittent constipation and mucoid (sometimes blood-tinged) diarrhea, flatulence and intermittent abdominal distention. The disorder is very often asymptomatic and may appear and disappear rapidly. Often the disease may become asymptomatic with no appreciable change in the radiologic and sigmoidoscopic findings. Physical examination is usually negative except for a tympanitic per-

* Since this article there have been many reports of the association of respiratory disease and P.C.I.: 2, 9, 15, 18, 25, 27, 28, 29.

cussion note over the distended abdomen and a palpable abdominal mass.

Other symptoms may arise from complications of P.C.I. including spontaneous pneumoperitoneum, volvulus, malabsorption syndrome, irritable bowel syndrome, and a sprue-like syndrome.

The symptoms are so nonspecific that the diagnosis is usually made by radiological examinations, sigmoidoscopy, or laparotomy.

Treatment and Prognosis
Most authors prefer conservative treatment with the use of stool softeners, because lesions will often regress spontaneously. Resection is reserved for localized disease that is intractable or life threatening. It should be noted that surgical correction of a lesion causing P.C.I. (eg, pyloric stenosis and peptic ulcer) cures the P.C.I.

Comparative studies of the treatment of P.C.I. were done by Pemberton and Smith. Because of the generally poor conditions of the patients, conservative measures should be attempted with surgery as a final measure or for correction of other lesions or complications. The prognosis for adult P.C.I. in any location is good, so the patient's ultimate course usually depends upon underlying disease.

Case Report
Mrs. A. O., a 62-year-old white housewife, was diagnosed as having chronic lymphocytic leukemia in August 1962. She had chronic bronchitis with a severe chronic cough, occasional shortness of breath on exertion and occasional wheezing. Leukeran therapy was begun in 1963 with good results until a sudden drop in her white cell count and red blood cell count necessitated multiple transfusions with the discontinuance of Leukeran. Prednisone therapy then proved effective with no serious side effects.

On March 13, 1967, she was admitted to
Pneumatosis Cystoides Intestinalis

Figure 1
Photomicrograph of sigmoid biopsy specimen showing the typical pathologic changes of pneumatosis cystoides intestinals (see text).

289
The Methodist Hospital, Houston, Texas, with the complaint of diarrhea which had begun one month earlier and had progressed to a watery, mucoid diarrhea without blood the week before. Although her appetite during this period remained normal, she lost ten pounds. She also reported intermittent abdominal bloating, increased flatulence and belching and an occasional mild intermittent cramping gastric pain. She had no previous history of changing bowel habits, tarry stools or abdominal discomfort.

She had smoked heavily until 1957, when she stopped because of her chronic bronchitis. Surgical operations included removal of a portion of granulomatous bowel in 1948. This came as a result of an acute intestinal obstruction due to volvulus following a unilateral oophorectomy and appendectomy in 1947. No note was made of P.C.I. at this time.

Physical examination showed an obviously Cushingoid woman, not chronically or acutely distressed, with a blood pressure of 160/70, temperature 98.4°F, pulse 96/min and regular, and respiratory rate 22/min. Pertinent physical findings included dry, thin skin with multiple ecchymotic lesions; a slightly distended, tympanitic abdomen with normal bowel sounds; a firm splenic edge felt 3-4 cm below the left costal margin at the mid-clavicular line and a large, fixed, non-tender mass palpable in the left lower quadrant. Her chest was clear to auscultation and percussion, and there were no palpable lymph nodes.

Admitting laboratory results were: hemoglobin, 14.9 gms; hematocrit, 46%; white blood count, 12,600/cu mm, with 36% segmented cells, 62% mature lymphocytes, 1% eosinophils, and 1% basophils. Reticulocytes, 3.4%; platelets, 176,000; urinalysis, normal; serology, nonreactive; BUN, 43 mg %; creatinine, 2.0 mg %; electrolytes, normal; prothrombin time, 100%; total serum protein, 6 mg %; serum electrophoresis showed normal protein fractions; ova and parasite study of stools was negative; BSP, 25% (on repeat, 21% retention in 30 minutes); alkaline phosphatase, 1.7 Bessey-Lowry units; total bilirubin was 0.4 mg %; thymol turbidity, 1 unit; SGOT, 126 units; and SGPT was 250 units.

Proctoscopy performed the day after admission revealed large, boggy, polypoid lesions scalloped into the lumen from 18 to 23 cm. Biopsies of the pale friable mucosa gave the initial impression of rectal polyps. The pathologic specimen showed the typical changes of P.C.I. (Fig 1 and 2) with multiple small submucosal lesions partly lined by multinucleated giant cells. Later, barium examination of the bowel showed typical radiologic features of P.C.I. Multiple radiolucent filling defects extended from the lower sigmoid to the upper portion of the descending colon (Fig 3).

A liver biopsy showed hemachromatosis, thought to be secondary to multiple earlier blood transfusions.

Normal bowel movements began 10 days after the patient was treated conservatively with the stool softeners, magnesium sulfate and sulfonamides, which were continued after discharge. On March 28, 1967, another barium study showed no significant change in her P.C.I. Although she has remained asymptomatic, except for occasional abdominal cramping, repeat proctoscopy and barium enema studies six months later showed no significant changes from the examinations on the day after her admission to The Methodist Hospital.

Discussion

This is the second reported case of P.C.I. associated with chronic lymphocytic leukemia, although there is one previously reported case of P.C.I. with lymphosarcoma. Our case differs from these other two in that our patient's leukemia is well controlled and there is no lymphocytic infiltrate surrounding the cysts. Since the lesions were of the descending and sigmoid colon and the patient had severe lung disease with vigorous coughing episodes, the pulmonary etiology seems to be the most likely basis for her P.C.I.

The correct diagnosis was made both by proctoscopic biopsy and by x-ray. It saved unnecessary surgery on a poor-risk patient.
Figure 2
Higher power of Figure 1 showing giant cells and gas cysts (top) immediately under the colonic mucosa (bottom).
REFERENCES

14. Bang, B.L.F.: Luftholdige Kyster i Vaggen af ileum og i nydannet bindevav pa sammes serosa (Gaseous cysts in wall of ileum and in serous part of newly formed connective tissue). Nord med Ark 8:1-16, 1876.

292
Pneumatosis Cystoides Intestinalis

Figure 3
Roentgenogram of barium enema of patient on March 14, 1967. Note the radiolucent filling defects in the descending and sigmoid colon of air density characteristic of P.C.I.


