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# Pneumatosis Cystoides Intestinalis Associated with Rotavirus Gastroenteritis and Syndrome of Inappropriate ADH in a Leukaemic Child

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**Abstract** A 21-month-old boy with newly diagnosed acute lymphoblastic leukaemia had Rotavirus gastroenteritis during the first two weeks of induction chemotherapy. During the third week of treatment, he developed status epilepticus and progressive abdominal distention simultaneously. The former was precipitated by severe hyponatraemia associated vincristine induced syndrome of inappropriate anti-diuretic hormone. Typical radiological features of pneumatosis cystoides intestinalis were also recognised with the presence of free intra-abdominal gas. Despite the signs of an acute abdomen, an exploratory laparotomy did not reveal any bowel perforation. The child eventually recovered on intensive supportive care. Pneumatosis cystoides intestinalis is a rare but significant complication in immunocompromised patients. Laparotomy is usually not beneficial even in the presence of free intra-abdominal gas.

**Key words** Pneumatosis cystoides intestinalis; Acute lymphoblastic leukaemia; Chemotherapy; Rotavirus gasteroenteritis; SIADH

## Case Report

A 21-month old boy with newly diagnosed common acute lymphoblastic leukemia underwent induction chemotherapy with prednisolone, vincristine, daunorubicin and L-asparaginase according to The Hong Kong Acute Lymphoblastic Leukaemia 1997 Protocol.[1] He had bloody diarrhea during the first two weeks of treatment. Rotavirus was the only pathogen detected and test for the Clostridium difficile cytotoxin was negative.

Twenty-four hours after receiving the second dose of vincristine in the beginning of the third week of treatment, the child suddenly developed status epilepticus and a progressive abdominal distention. There was no localising or lateralising neurological sign and fundoscopy did not reveal any papilloedema or bleeding. Diffuse abdominal tenderness was felt but examination for definitive signs of peritonitis was precluded by the effect of antiepileptic drugs. Bowel sounds were absent.

He was severely neutropenic ($0.1 \times 10^9$/L). The serum sodium was 110 mmol/L, potassium was 4.4 mmol/L, urea was 3.4 mmol/L, and creatinine was 35 μmol/L. The urinary sodium concentration was 98 mmol/L. Paired measurements for serum and urine osmolality were 229 mOsm/kg and 451 mOsm/kg, respectively. The biochemical features were compatible with syndrome of inappropriate anti-diuretic hormone (SIADH) secretion. Serum amylase concentration was normal.

The abdominal radiographs showed dilated bowels with extensive intramural gas (Figure 1). Free intra-abdominal gas was present (Figure 2). In view of the drastic change in clinical conditions and abdominal signs, gut perforation was strongly suspected and a laparotomy was performed. Cystic collections of gas were seen along the serosal surface of the large bowel but no perforation was found. The child recovered subsequently on intensive supportive care with antibiotics, total parenteral nutrition, and granulocyte colony stimulating factor treatment. Induction chemotherapy was temporarily withheld for 10 days until the abdominal and neurological signs resolved. Microbiological studies from the stool and peritoneal swabs were negative for bacteria, virus, fungus and Clostridium cytotoxin. Subsequent reinstitution of chemotherapy was uneventful and the child remained in first complete remission at 6 months of treatment.

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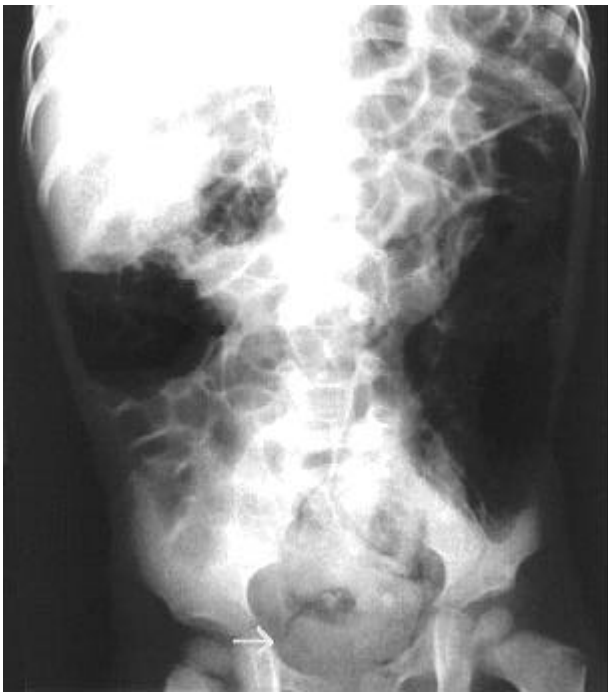

**Figure 1** Supine abdominal X-ray film. Pneumatosis intestinalis manifested as cresentic linear air lucency along walls of rectum and sigmoid colon (arrows).

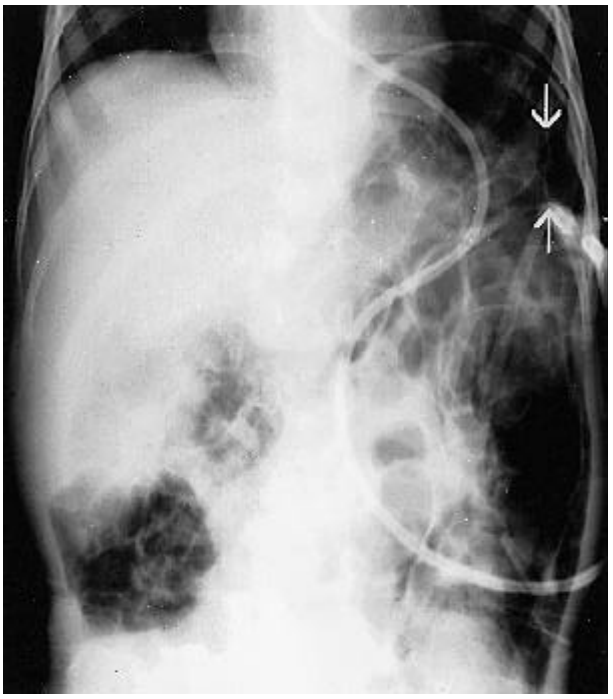

**Figure 2** Supine abdominal X-ray film. Pneumoperitoneum manifested by a triangular pocket of air in left upper quadrant (arrows) outling outer wall of adjacent bowel (double wall sign).

## Discussion

Pneumatosis cystoides intestinalis (PCI) is a radiological sign that is characterized by cystic collections of gas in the subserosa or submucosa of the gastrointestinal tract.[2] In paediatrics, it is well recognized in necrotizing enterocolitis in the newborn. The latter condition is associated with bowel perforation or infarction where surgical intervention is an essential management.[3] Little information is available for the pathogenesis, diagnosis and management of PCI in the older children, although the condition has been well described in adults. Of 919 cases reported in the literature, only 74 (8%) patients were aged under 20.[4]

Pathogenically PCI may originate from one of four mechanisms: (1) mucosal disruption, (2) bowel necrosis, (3) pulmonary air leak, and (4) increased bowel permeability.[2] PCI was first described in 1952 in a 59-year-old man in association with pyloric stenosis and ulceration. Mechanical disruption of the bowel mucosa has therefore been suggested as the pathogenic basis of PCI complicating bowel obstruction, trauma, or other surgical intervention. PCI is also thought to arise when there is extensive bowel necrosis such as necrotizing enterocolitis, bowel ischaemia, or caustic ingestion. Embolisation of gas to the portal venous system is an especially remarkable feature. Interestingly, PCI has also been described in obstructive airway diseases in which alveolar rupture is thought to give rise to air dissection along the vascular bundle into the abdominal viscera. In the latter condition, PCI is generally innocuous. Increased bowel permeability as a result of cytotoxic chemotherapy, immune-suppression or chronic inflammation account for the rest of the cases.

Though rare, both mechanical and immunological factors have been found to be important with reference to PCI occurring in children. West et al[5] reported 16 cases of PCI in children beyond the neonatal period and found that mechanical factors accounted for nine (56%) cases. These included eight cases of short bowel syndrome and a case of malrotation. Reynolds et al[6] described another 12 patients in which nine (75%) were immunocompromised. Most of them were receiving cytotoxic chemotherapy with or without steroid treatment. In addition, PCI has been described in children with leukaemia,[7] congenital and acquired immunodeficiency syndromes,[8,9] and in chidren receiving bone marrow transplantation.[10-12] The present case represents an example of the latter mechanisms.

How PCI is triggered in the immunosuppressed child is poorly understood. An infective aetiological has been suggested and searched in some cases but no single organism has been ascribed.[7,11] Rotavirus, however, has been identified in 13 out of the 47 paediatric cases,[5,8,9,11,12] suggesting that it may be an important pathogen in the initiation of PCI. The present report would add to the significant role of rotavirus. The additional stress due to

concurrent SIADH secondary to vincristine therapy[15] may be contributory to the appearance of PCI but such an association has not been documented before.[2]

The management of PCI in immunocomprised patients is intriguing. As an infective process is difficult to exclude, and indeed frequently present, broad spectrum antibiotics including those against anaerobic organisms are usually prescribed. Unlike neonatal necrotizing enterocolitis, surgical interventions is often discouraged even in the presence of free intra-peritoneal gas.[6,7,12] Indeed, when exploratory laparotomy is performed in the few cases where bowel perforation is suspected, the operative finding is often negative,[10] even in the case where a hemicolectomy was performed.[13] On the other hand, genuine intestinal perforation does occur in the immunosuppressed child with or without PCI.[10,14] Therefore, the decision to operate on a child in whom free intra-abdominal gas is demonstrated has not been resolved.

It is important for the paediatrician looking after immunocompromised children to be aware of the occurrence of PCI and to interpret the clinico-radiological signs on top of the published experience with regard to management.

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