

# Idiopathic Pneumoperitoneum

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## ABSTRACT

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Pneumoperitoneum is generally due to gastrointestinal perforation and need emergency laparotomy. We report three cases of pneumoperitoneum without definite cause. A six month old infant, who had ventriculoperitoneal shunt in place and on mechanical ventilation, was conservatively treated for pneumoperitoneum, and recovered. Two newborns underwent emergency laparotomy with diagnosis of perforation peritonitis; but no gastrointestinal pathology was found at operation. In one of them features of ruptured meconium-cyst could be found. All patients survived. The causes of idiopathic pneumoperitoneum are analysed.

**Keywords:** Benign Pneumoperitoneum, Idiopathic Pneumoperitoneum, Ruptured Meconium-Cyst

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## INTRODUCTION

Pneumoperitoneum generally indicates hollow viscus perforation. It is a surgical emergency which needs laparotomy. Pneumoperitoneum in newborn is most commonly the result of necrotising enterocolitis (NEC), but can be due to other causes also.<sup>1</sup> Benign pneumoperitoneum in adults and older child were reported;<sup>2</sup> thoracic causes such as positive pressure ventilation, pneumomediastinum/pneumothorax also can cause pneumoperitoneum. Herein we present 3 cases of pneumoperitoneum without obvious cause and the literature on the subject is reviewed.

## CASE REPORTS

**Case I:** Six month old boy with ventriculoperitoneal shunt insitu for hydrocephalus due to Dandy Walker malformation was transferred in from another

hospital. He was admitted there on the same day with pneumonia; he developed distended abdomen, swollen scrotum, anaemia and lethargy. He was taking feeds and passing stools as normal at home. He was put on mechanical ventilation due to very poor breathing-effort. On examination, he was inactive, flabby, and blood pressure was unrecordable. Abdomen was distended, tense with no bowel sounds. Digital rectal examination revealed empty rectum. Leucocyte count was 29x10<sup>3</sup>/ml, platelet count was normal, C-reactive protein level was raised (96mg/l). Blood-gas analysis showed severe acidosis. Abdominal roentgenograms (supine and left lateral) (**Figure 1**) showed pneumoperitoneum and air-fluid level. On paracentesis, no free air but 300ml opalescent fluid was drained. As life-saving procedure, bed-side peritoneal drainage tube was inserted, which drained another 400ml. Child was kept on medical treatment including nil per oral, nasogastric aspiration, intravenous fluids, antibiotics

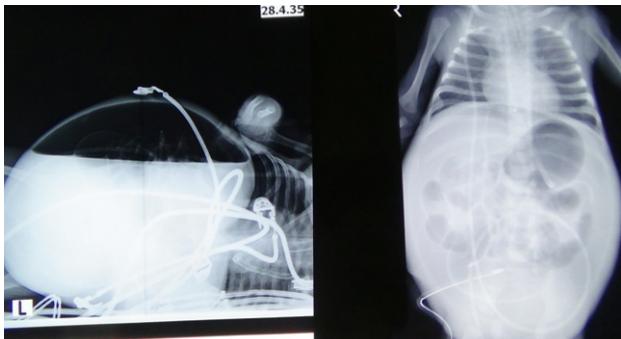


Figure 1. Case I, Pneumoperitoneum and ascites in 6m old infant with VP-shunt on mechanical ventilation due to pneumonia on day1



Figure 2. Case I, Lateral decubitus radiographs showing marked reduction of pneumoperitoneum on day2

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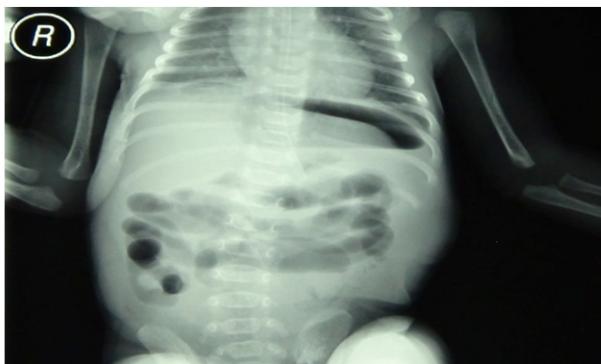


Figure 1. Case II, Erect and lateral decubitus radiographs showing pneumoperitoneum

and mechanical ventilation. Next day, neurosurgeon aspirated another 400ml of peritoneal fluid. He exteriorized the shunt tube from peritoneal cavity and connected to external drainage-bag. The fluid from shunt-tube was clear. Peritoneal fluid chemistry was suggestive of transudate; its cytology showed WBC count 700/ml; RBC count 1000/ml, but no organism including acid fast bacillus was seen and culture yielded no growth. Analysis of cerebrospinal fluid from the VP shunt was insignificant.

The next day, abdominal distension reduced; X-ray pictures of abdomen and chest (supine, erect, left lateral and right lateral) confirmed that the volume of free air in peritoneal cavity was less than before (**Figure 2**). On 3rd day, general condition of child improved, abdomen was less distended, soft, having normal bowel sounds, and he started passing stools. On 4th day, abdominal distension was relieved and pneumoperitoneum completely disappeared. As he showed progressive improvement he was weaned off mechanical ventilation. Peritoneal drain was kept closed on 4th day and removed on 7th day.

**Case II:** 1 day old full-term male having low birth-weight (2300g) was admitted in neonatology with asymptomatic polycythemia (at 6 hours of age, haemoglobin level was 24.6gm%, haematocrit was 70.6%). He underwent partial exchange transfusion. He was given feeding. Next day, he developed greenish vomiting and abdominal distension, but passed meconium. Examination showed sick-looking child. Abdomen was distended and tender, but without erythema. Nasogastric tube drained greenish fluid. Serum chemistry showed elevated levels of bilirubin, urea, creatinine, aspartate aminotransferase and, alkaline phosphatase and low protein levels. Abdominal roentgenograms showed pneumoperitoneum (figures 3&4). Emergency laparotomy was done. Moderate amount (about 50ml) of greenish fluid was found in peritoneal cavity. Stomach, small intestines including duodenum,

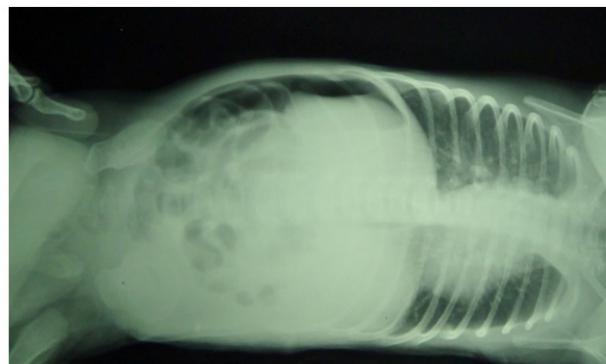


Figure 1. Case II, Erect and lateral decubitus radiographs showing pneumoperitoneum

large intestine and biliary tract were normal looking; injection of normal saline along nasogastric tube and then pushing down the whole bowel excluded leak. Peritoneal lavage done and peritoneal drains inserted into right paracolic gutter and pelvic area. Culture of peritoneal swab taken at laparotomy yielded staphylococcus sciuri.

Postoperatively, abdominal distension persisted for 4 days. Parenteral nutrition was given. X-ray examination on 2nd postoperative day showed no obstruction/pneumoperitoneum. Drain was removed on 7th day. Feeding was started on 8th day, and progressively increased. Full feeding was reached by 10 days and then intravenous fluid was discontinued.

**Case III:** Full-term newborn male having 2860g birth-weight, was born of normal spontaneous vaginal delivery. There was history of premature rupture of membranes by 26hours. Child showed drooling of milk from mouth and nose when he was 29hours old, following breast-feeding. Poor sucking, lethargy and abdominal distension followed. He passed meconium within 24 hours. Examination showed a critically sick, grunting child who was receiving oxygen. Peripheral pulsations felt feeble and capillary refilling time was more than 3sec. Abdomen was distended, tense, with absent bowel sounds. Greenish yellow aspirate came out from nasogastric tube. Blood investigations showed elevated bilirubin level and acidosis on blood-gas analysis. X-ray examination of abdomen showed pneumoperitoneum (**Figures 5&6**). Mechanical ventilation was started. Emergency laparotomy showed large amount of meconium in the peritoneal cavity surrounded by wall of meconium-cyst formed by intestines matted together. Meconium was sucked out, thorough inspection of stomach and intestines found healthy and no perforation. Peritoneal lavage was done, drain put and closed. Postoperatively mechanical ventilation was continued for one day. Child had uneventful recovery. Feeding was started after 5 days, and gradually increased. He was discharged on 16th day.

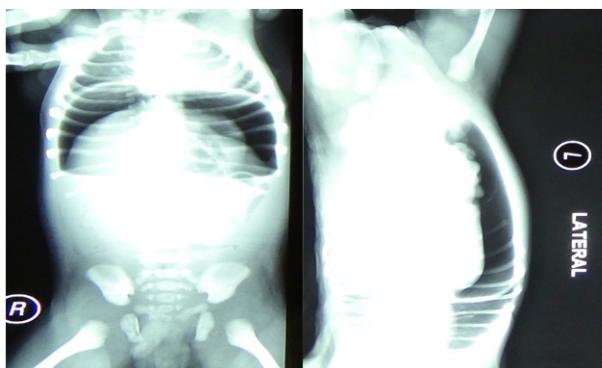


Figure 1. Case III, Erect and lateral decubitus radiographs showing pneumoperitoneum

## DISCUSSION

Pneumoperitoneum generally indicates perforation of hollow viscus and need emergency laparotomy. Khan studied 89 neonates with pneumoperitoneum. NEC remained the single major cause; in 44 (49.4%) patients the cause was not related to NEC.<sup>1</sup> Perforated pouch colon, isolated colonic perforations, caecal perforations, gastric and duodenal perforations were the main causes of pneumoperitoneum not related to NEC. There were seven patients in whom no cause of pneumoperitoneum could be ascertained. About 10% of the radiological pneumoperitoneum occurs without hollow viscus perforation.<sup>3</sup> Pseudopneumoperitoneum is defined when the subphrenic lucency does not correspond to free intraperitoneal air; the causes are subphrenic fat pad, linear lung atelectasis, abnormal subphrenic shape, Chilaiditi syndrome or subphrenic abscess.<sup>3</sup> Pneumoperitoneum without peritonitis can be from thoracic causes like positive pressure ventilation, pneumomediastinum/pneumothorax.<sup>2,4</sup> Ventilation-associated pneumoperitoneum has been most frequently reported in neonates with respiratory distress syndrome but has also been reported as a cause of unnecessary laparotomy in adults.<sup>2</sup>

In our first case, pneumoperitoneum was probably the result of pneumomediastinum from pneumonia and mechanical ventilation; this he developed on the very first day of treatment. Laparotomy was not done, instead bedside peritoneal drainage was done on that day, due to the extremely bad physiological condition of the patient. On continuation of same treatment, abdominal signs improved clinically and radiologically; thus operation seemed unnecessary. From the second day, there must have been no continued escape of air into peritoneal cavity, and the entire free air gradually got absorbed. Air leak can go into the adjacent loose connective tissue of pulmonary vascular sheaths and then produce peripheral gaseous dissection with inter-

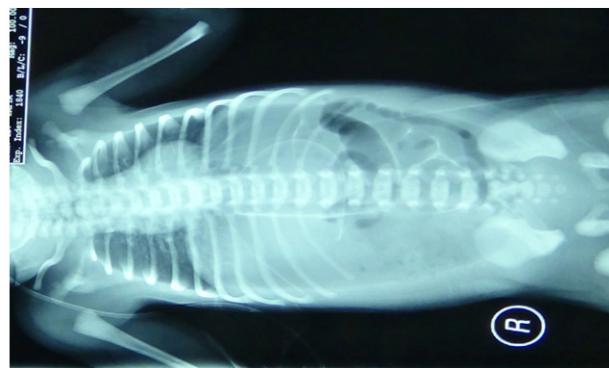


Figure 1. Case III: Supine X-ray picture of abdomen taken a few hours prior to the previous pictures

stitial emphysema, subpleural bleb formation, and pneumothorax. Gaseous dissection centrally can lead to subcutaneous and interstitial emphysema, pneumomediastinum, pneumopericardium, and pneumoperitoneum. Air from mediastinum may enter the peritoneal cavity via the diaphragmatic hiatuses. In the presence of pulmonary interstitial emphysema, air may escape into the peritoneal cavity via the pulmonary and peritoneal lymphatics. In the presence of pneumothorax and pneumomediastinum or both, air may also escape retroperitoneally and then burst into the peritoneal cavity leading to pneumoperitoneum. The detection of pneumomediastinum and retroperitoneal air in a patient with pneumoperitoneum on a ventilator allows recognition of positive pressure ventilation as the underlying cause and calls for a conservative approach. Medical pneumoperitoneum is commonly seen in critically ill neonates with respiratory distress where a laparotomy may be fatal. Nonsurgical pneumoperitoneum (NP) may be differentiated from pneumoperitoneum requiring surgery with the assistance of a diagnostic peritoneal lavage or paracentesis, contrast examination or endoscope.<sup>5</sup>

In our second and third case, emergency laparotomy was done with diagnosis of perforation peritonitis; but there was no evidence to support this diagnosis at operation. Both patients recovered without complications. Operation was beneficial in the sense that the bilious fluid (in the second case) and meconium (in the third case) in the peritoneal cavity could be evacuated. Vohra described a case of pneumoperitoneum in a newborn who had no evidence of an associated pulmonary air leak or bowel perforation.<sup>6</sup> Pathologic examination of the placenta showed associated acute chorioamnionitis and funisitis. Agarwal reported a new born with diagnosis of benign pneumoperitoneum who was managed conservatively.<sup>7</sup> He was kept fasting with elevated head end, abdominal girth monitoring and repeated tube suction. A laparotomy

was planned if air in the repeated x-rays increased or distension increased. Gradually the distension reduced, stool passed normally and the repeat x-ray after 48 hours was normal. Karaman reported six cases of NP.<sup>8</sup> Two of the six children underwent exploratory laparotomy when clinical examination suggested an acute abdomen; no intra-abdominal pathology was documented in one of these patients. In the other child, malrotation was found. Four patients, on ventilatory support, were managed conservatively after performing a diagnostic peritoneal lavage and/or contrast studies were negative. An appreciation of the condition and its likely etiological factors should improve awareness and possibly reduce the imperative to perform emergency laparotomy on an otherwise well patient with an unexplained pneumoperitoneum.

The operative findings of our third case were that of ruptured meconium-cyst. Meconium-cyst develops from prenatal perforation of bowel due to atresia or volvulus. But the associated pneumoperitoneum could develop only postnatally after child took breath, air swallowed and it leaked from bowel. In the absence of any apparent cause for meconium-cyst and of pneumoperitoneum, their cause is only speculative in this case. The first case of pneumoperitoneum and retroperitoneal meconium collection was reported by Al-Salem.<sup>9</sup> Pneumoperitoneum was seen on abdominal x-ray. At operation there was free intraperitoneal air with no free fluid in the peritoneal cavity. In addition there was localized tense retroperitoneal collection of air and meconium in the left paracolic gutter but there was no evidence of gastrointestinal perforation. The meconium was fresh. In some patients and in the event of intestinal mucosal damage from any cause, air may escape to enter the subserosa forming air cysts which can rupture leading to pneumoperitoneum without gastrointestinal perforation; the same is the possible pathogenesis of pneumoperitoneum in our second and third cases.<sup>9</sup> But the presence of meconium in Al-Salem's case and in our third case is more indicative of intestinal perforation. If there was a perforation it had already sealed.

## CONCLUSION

Three cases of pneumoperitoneum without definite aetiology are reported. In one case mechanical ventilation is the possible cause. In the other two newborns,

no cause could be detected at operation. In newborns with pneumoperitoneum, whenever abdominal signs indicate, laparotomy should be performed.

## END NOTE

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