

Non-Surgical Pneumoperitoneum

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ABSTRACT

Pneumoperitoneum is mostly caused by visceral perforation and surgical intervention; however non-surgical pneumoperitoneum has been reported without evidence of visceral disease. Blunt chest trauma causing an abrupt rise in thoracic pressure can leak air through the microscopic diaphragmatic defects or the mediastinum along perivascular connective tissue and cause pneumoperitoneum. We hereby present a case of non-surgical pneumoperitoneum after blunt chest trauma that was brought to the emergency department of college of medical sciences teaching hospital with features of bilateral pneumothorax with subcutaneous emphysema and abdominal distension which was diagnosed and managed promptly with bilateral chest drain and other supportive treatments.

KEY WORDS

Blunt chest trauma, non-surgical pneumoperitoneum, pneumothorax, subcutaneous emphysema

INTRODUCTION

Blunt chest trauma is commonly encountered in our center and is more common than penetrating injury. Age of the patient is an important factor when assessing the severity of the injuries. Pediatric patients have immature chest wall when compared to adult, and are elastic and flexible with less fracture chance but intrathoracic injuries like pneumothorax and lung contusions are more significant in this pediatric patients. In the adult patients, the fragile bony thorax is highly susceptible to even low-impact forces and offers poor protection to the underlying viscera with high mortality even with minor injuries.¹

Pneumothorax can be unilateral or bilateral depending on the mechanism and severity of the injury. When pneumothorax causes a significant rise in intrathoracic pressure, pneumoperitoneum may result and such patients are difficult to manage. The leak of air into the peritoneal cavity may be through the microscopic diaphragmatic defects or through the mediastinum

along perivascular connective tissue.² This kind of non-surgical pneumoperitoneum without evidence of visceral perforation has been reported in 5-15% of cases. Often patients with such presentation have negative finding of visceral disease at laparotomy.³

In 1939 Macklins et al. performed basic scientific studies and concluded that the passage of air from the thorax into the peritoneum was via the perivascular sheaths.² Further, in case described by Leninger et al. tension pneumothorax caused pneumoperitoneum in a newborn which was managed by chest drainage and conservative management.⁴ Daly et al. classified non-surgical pneumoperitoneum into abdominal, thoracic and pelvic causes and blunt chest trauma causing pneumoperitoneum was uncommon.⁵ Mularski et al. systemic review on non-surgical pneumoperitoneum identified only a few cases due to thoracic trauma in children.³

CASE REPORT

A nine year old male child was brought to the emergency department of college of medical sciences teaching hospital, gasping with Glasgow Coma Scale of 8/15 (E2 V3 M3), surgical emphysema and abdominal swelling for one hour following trauma to chest while playing in the school. He was promptly managed with airway, oxygen supplement, intravenous cannulation and primary survey revealed bilateral pneumothorax which was confirmed by portable X-ray. He was given high flow oxygen and bilateral chest drain was placed in the safety triangle (fig 1). After that intubation was done and vital signs monitored. The secondary survey didn't reveal any other injury.

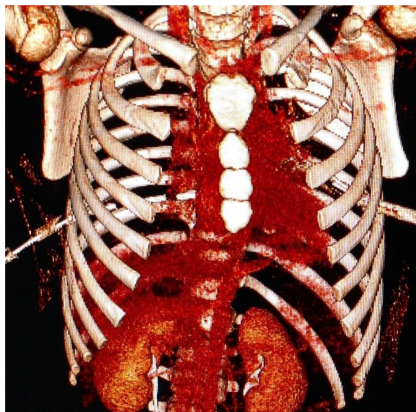


Figure 1. Showing bilateral chest drain placement.

Contrast enhanced CT head, chest and abdomen revealed normal brain scan with bilateral residual pneumothorax with lung contusion (fig 2) and subcutaneous emphysema (fig 3) along with pneumoperitoneum (fig 4). The child's solid organs were normal and there was no free fluid in the abdomen. His FAST scan, electrocardiography and echocardiography were normal. Additional examination including nasopharyngoscopy and laryngoscopy showed no gross injury. He denied any past medical or surgical illness and his birth, neonatal and family history was not significant. His routine blood tests like blood sugar random, complete blood count, renal function tests, bleeding time and urine routine examination were within normal range except slight increased in neutrophil count.

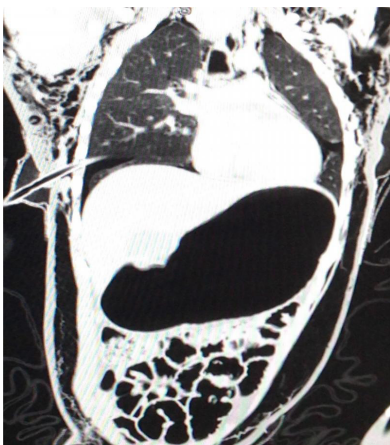


Figure 2. Showing bilateral residual pneumothorax



Figure 3. Showing subcutaneous emphysema and pneumoperitoneum

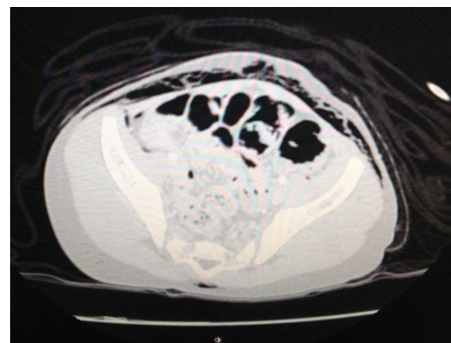


Figure 4. Showing air in the abdominal cavity

The child was managed in the intensive care unit with mechanical ventilation (one day) and intravenous broad spectrum antibiotics, fluids, analgesic and other supportive treatment. The abdomen was decompressed with a nasogastric tube and nil per mouth was kept for two days with only clear fluids allowed occasionally till the abdomen became soft and non-tender completely. The right chest drain was removed on the third day while the left chest drain was removed on the fifth day when the drain was minimal and when there was no air leak in the chest tube bag along with features of clear and expanded lung on x-ray (fig 5). Serial abdominal and radiographic examinations showed resolving pneumoperitoneum (fig 6). His surgical emphysema reduced significantly from the third day and was minimal during discharge on the tenth day. The child remained hemodynamically stable throughout the hospital stay. On follow-up visits, the child was doing fine with no residual symptoms.

DISCUSSION

Pneumoperitoneum is a condition characterized by the presence of radiolucent air below the diaphragm on chest x-ray or abdominal x-ray. It reflects visceral perforation in 80-95% of cases. However, in 5-15% of cases, pneumoperitoneum does not reflect visceral diseases and caused by intra-thoracic causes, gynecological causes, or after gastrointestinal procedure like endoscopy or Endoscopic Retrograde Cholangio-pancreatography.^{6,7}

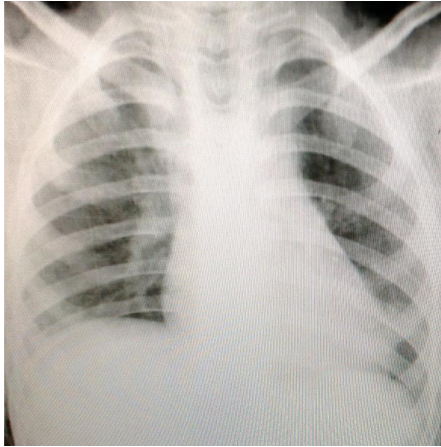


Figure 5. X-ray showing resolved pneumoperitoneum and expanded lung field after chest tube removal on the fifth day

Non-surgical pneumoperitoneum are usually managed conservatively when abdominal pain, distension are minimal and acute abdominal signs fever and leukocytosis are absent.⁷ In our case, the child had mild increase in abdominal pain and distension on the third day which slowly decreased on the fourth and fifth day of admission. The sure sign of resolving pneumoperitoneum was afebrile and improving general condition with normal leukocyte count. Further, abdomen x-ray erect, showed minimal radiolucency below the diaphragm.

Mackling et al. showed that air can leak from the thoracic cavity to the retroperitoneum and peritoneum via the perivascular sheath.² This mechanism can be possible in our case which was demonstrated in the contrast

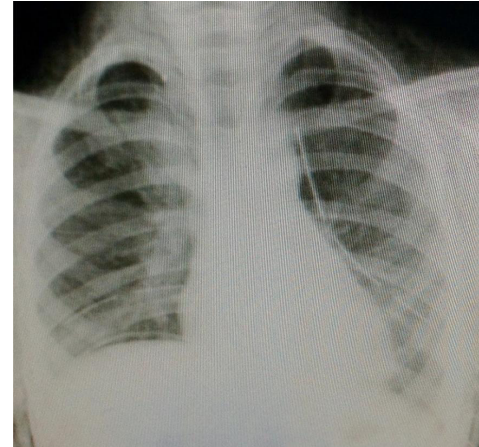


Figure 6. X-Ray showing residual pneumoperitoneum after the fourth day

enhanced CT abdomen. Pneumothorax occurs frequently after blunt chest trauma but few are associated with pneumoperitoneum. This is because the abdominal pressure is usually higher than intra-thoracic pressure by 20-30 centimeter of water.⁸ Pneumoperitoneum usually occur when the intra-thoracic pressure exceeds over 50 centimeters of water and in our case, severe bilateral pneumothorax and subcutaneous emphysema could have caused an increase in intrathoracic pressure significantly to push the air into the peritoneal cavity.

Non-surgical pneumoperitoneum caused by thoracic trauma can mislead to an invasive surgical procedure. However, in many such cases, it can be managed conservatively with supportive care and careful observation.

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