

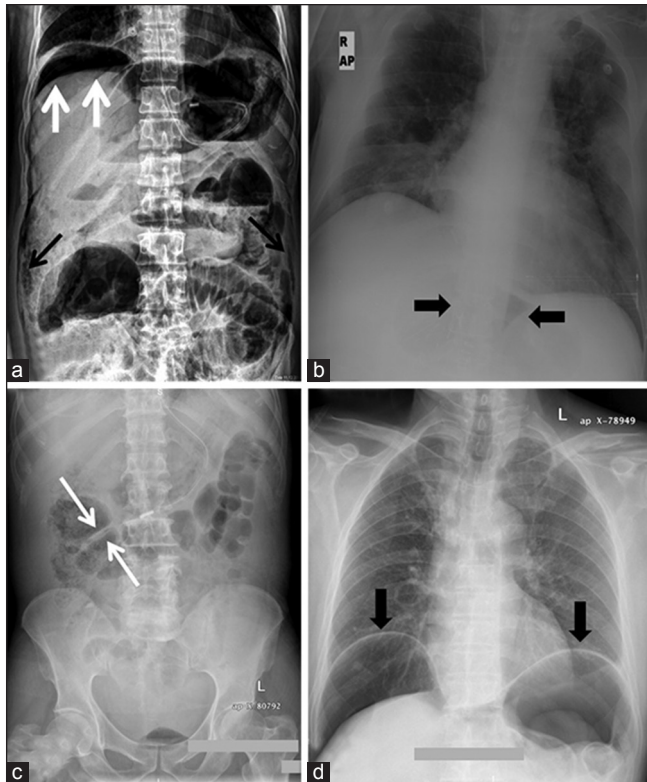
## Pneumoperitoneum: What to look for in a radiograph?

Sir,

Pneumoperitoneum is the presence of air or gas in the abdominal (peritoneal) cavity. It is usually detected on x-ray, but small amounts of free peritoneal air may be missed and are often detected on computerized tomography (CT).<sup>[1]</sup> The most common cause of a pneumoperitoneum is a perforation/disruption of the wall of a hollow viscus. The causes of pneumoperitoneum occurring in children are different from the adult population.

An erect chest x-ray is the most sensitive plain radiograph for the detection of free intraperitoneal gas in an emergency setting. On chest x-ray, any subdiaphragmatic free gas can be seen [Figure 1]. Abdominal radiography is routinely done in cases of acute abdomen. The various relevant signs described in an abdominal radiograph are as follows:<sup>[1,2]</sup>

1. Cupola/saddlebag/mustache sign — Seen on a supine radiograph, refers to air accumulation underneath the central tendon of the diaphragm in the midline.



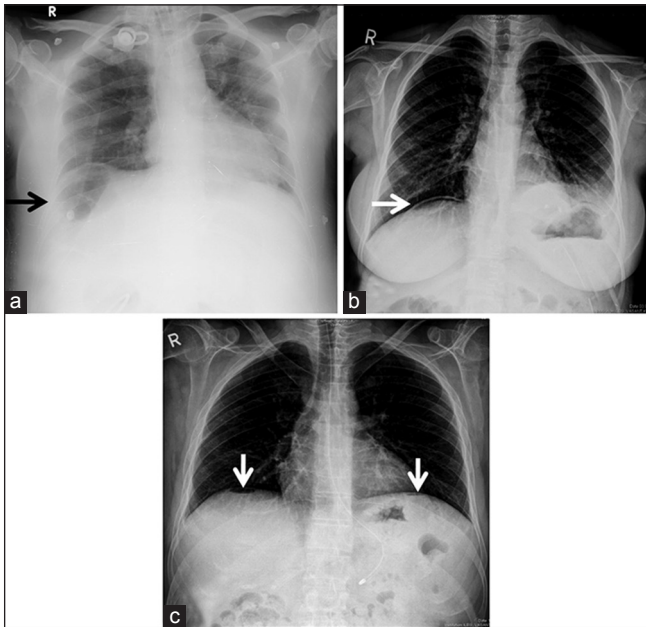
**Figure 1:** (a) X-ray of abdomen, erect view, showing subdiaphragmatic free air (white arrows), air outlining the properitoneal fat stripe (black arrows) (b) Cupola sign (arrowheads) (c) Rigler's sign (arrow) (d) Chest radiograph showing free air under the diaphragms (arrowhead)

2. Rigler's sign — Air outlining both sides of the bowel wall.
3. Lucent liver sign - Reduction of liver opacity due to air located anterior to the liver.
4. Football sign — Seen in massive pneumoperitoneum, where the abdominal cavity is outlined by gas.
5. Silver's sign — Also called a falciform ligament sign, where air outlines the falciform ligament.
6. Inverted V sign — Air outlining lateral umbilical ligaments (inferior epigastric vessels).
7. Doge's cap sign — Triangular collection of gas in Morison pouch.
8. Telltale triangle sign — Triangular air pocket between three loops of bowel.
9. Urachus sign — Outline of middle umbilical ligament.

A gastrointestinal perforation constitutes one of the commonest surgical emergencies. The causes of pneumoperitoneum in adults are perforation, peritoneal dialysis, immediate postoperative status, vaginal aspiration, and mechanical ventilation. Mechanical perforation may be seen after colonoscopy, endoscopy, etc. Sometimes pneumomediastinum and pneumothorax may also result in pneumoperitoneum. The causes of pneumoperitoneum in children are perforation (necrotizing enterocolitis, Hirschsprung's disease, and meconium ileus) and iatrogenic effects, such as from use of rectal thermometer, enema, and postintubation or mechanical ventilation.<sup>[3]</sup>

Bali *et al.* in their study of 400 patients found that the commonest cause of perforation peritonitis in their study was acid peptic disease (45%), followed by appendicitis (18.5%), typhoid fever (12%), tuberculosis (10%), and trauma (9%).<sup>[4]</sup> Similar results were seen by Jhobta *et al.* in their study of 504 consecutive cases.<sup>[5]</sup>

Common signs and symptoms are abdominal pain, vomiting, abdominal distension, constipation, fever, diarrhea, tachycardia (pulse >110/min), hypotension (systolic blood pressure <100 mmHg), urine output (<30 mL/h), and tachypnea (respiratory rate >20/min). The clinical presentation of the patients varies according to the site of perforation. Patients of duodenal ulcer perforation usually have a short history of epigastric pain along with generalized tenderness and guarding. An associated history of nonsteroidal anti-inflammatory drug (NSAID) consumption may be present. Patients with small bowel perforation may present with a prolonged history of fever followed by the appearance of pain in lower abdomen. Appendicular perforations usually have a classical history of pain starting in the periumbilical area or right iliac fossa, along with vomiting and fever. Perforations of the proximal gastrointestinal tract are more common in India, in sharp contrast to findings from studies in developed countries, such as the USA, Greece, and Japan, where distal gastrointestinal tract perforations are more common.<sup>[6-9]</sup>



**Figure 2:** Cases of pseudopneumoperitoneum (a) Chest radiograph in a case of Chilaiditi syndrome showing large bowel loops (arrow) under the diaphragm (b) Linear atelectasis (arrow) (c) Loculated air beneath the diaphragms following colonoscopy (arrows)

In our country, perforation peritonitis is a frequently encountered surgical emergency, most commonly affecting young men, compared to findings from studies in developed countries where the mean age is 45-60 years. Due to the scarcity of specialized care, in the majority of cases presentation to the hospital is late, with full-blown generalized peritonitis with purulent/fecal contamination and varying degrees of septicemia. Thus, it is necessary to recognize these cases early, at the primary care level, so that prompt referral to a specialized center can be made.

Pseudopneumoperitoneum describes gas within the abdomen that mimics pneumoperitoneum. The various causes of pseudopneumoperitoneum are basal linear atelectasis, pneumomediastinum, Chilaiditi syndrome, gas within skin folds, subdiaphragmatic lipomatosis, properitoneal fat stripe, and diaphragmatic undulations [Figure 2].

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