A rare case of simultaneous pneumoperitoneum and pneumomediastinum with a review of the literature

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ABSTRACT

Simultaneous pneumoperitoneum and pneumomediastinum is a rare clinical occurrence. It has been reported in the literature as a complication of various medical and dental procedures. To our knowledge, we present the first case of a non-iatrogenic and traumatic simultaneous pneumoperitoneum and pneumomediastinum in a previously independent 91-year-old man who presented to hospital with back and chest wall pain following mechanical fall from standing. A new radiological diagnosis of diverticular disease with possible perforation was made following admission. Despite appropriate management and supportive measures, the patient died 12 days after admission from a kidney injury.

KEYWORDS

Pneumoperitoneum – Pneumomediastinum

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Case report

A previously independent 91-year-old man presented to the accident and emergency department following a mechanical fall from standing. His presenting complaints included musculoskeletal left-sided chest pain and back pain. The patient denied any precipitating symptoms before the fall. There was no abdominal pain, nausea or vomiting before and following the fall. His past medical history was significant for atrial fibrillation, stage-3 chronic kidney disease, metastatic prostate cancer, osteoarthritis of the cervical spine and non-perforated duodenal ulcer.

On admission, his respiratory rate was 18 beats/minute, with oxygen saturation maintained at 98% on 3 litres of oxygen through a nasal cannula. His heart rate was irregular at 89 beats/minute and blood pressure was 113/73 mmHg. Electrocardiography showed atrial fibrillation with no acute ischaemic changes. The patient was afebrile, with a temperature of 36.8 degrees C and he had a Glasgow Coma Scale of 15. Examination revealed extensive bruising on his back and right posterior chest. Subcutaneous crepitations were felt upon palpation of his trachea, which was not deviated. His abdomen was grossly distended, with tenderness on deep palpation of the lower quadrants; there were no signs of peritonitis or intestinal obstruction. Respiratory examination revealed fine bi-basal crepitations and reduced

air entry on the left lower lobe. Heart sounds were normal but there was mild bilateral pedal pitting oedema.

Full blood count revealed non-elevated white cell count of $7.6 \times 10^9/L$ with $5.8 \times 10^9/L$ neutrophils. Haemoglobin was 105 g/L. C-reactive protein and venous lactate were raised: 277 mg/L and 1.7 mmol/L, respectively. Renal functions revealed urea of 28.5 mmol/L, creatinine of 220 $\mu\text{mol/L}$ and estimated glomerular filtration rate of 25 mL/minute. Amylase, liver function tests and electrolytes were within normal limits.

An erect anteroposterior chest radiograph showed free gas under the right hemidiaphragm continuing across the midline and streaky lucency in the mediastinum with linear translucency to the left of the aortic arch. These findings were suggestive of pneumoperitoneum and pneumomediastinum (Fig 1).

Computed tomography with intravenous contrast of chest, abdomen, pelvis confirmed the presence of gas in the mediastinum (Fig 2), peritoneal cavity (Fig 3) and adjacent to the trachea (Fig 4). It also revealed evidence of diverticular disease of the sigmoid colon (Fig 5).

The patient was diagnosed with subcutaneous emphysema, pneumoperitoneum, pneumomediastinum and acute on chronic kidney injury. Empirical antibiotics for diverticular perforation were commenced, despite low clinical

Figure 1 Erect anteroposterior chest radiograph with free gas under the right hemidiaphragm (red arrows) and linear translucency in the mediastinum to the left of the aortic arch (white arrows).

Figure 2 Computed tomography of the chest demonstrating gas along the descending thoracic aorta (arrows) within the mediastinum.

suspicion of diverticular perforation being the cause of air in peritoneal and mediastinal cavities. Acute on chronic kidney injury was treated with intravenous fluids. Supportive management with oxygen and analgesia was provided for subcutaneous emphysema, pneumoperitoneum and pneumomediastinum.

The patient remained haemodynamically stable and apyrexial and did not develop any further abdominal signs or symptoms throughout admission. His renal function worsened with the development of gross oedema. On day six of admission, a renal ultrasound showed no evidence of hydronephrosis or urinary obstruction. Renal input was sought and decision was made for ward-level care with no attempt at cardiopulmonary resuscitation being agreed. On the tenth

Figure 3 Computed tomography of the abdomen demonstrating a large amount of gas within the peritoneal cavity (arrows).

Figure 4 Computed tomography of the neck demonstrating gas adjacent to the trachea (arrows).

day of admission, treatment was withheld and palliative anticipatory medications were commenced. The patient passed away on the twelfth day of admission.

Discussion

We present the case of a non-iatrogenic and traumatic pneumoperitoneum associated with pneumomediastinum. To our knowledge, this is the first such presentation of simultaneous pneumoperitoneum and pneumomediastinum in the literature. One previous case report describes non-iatrogenic and non-traumatic pneumoperitoneum associated with pneumomediastinum following malignant infiltration of the sigmoid colon leading to perforation.¹ Five previous case reports describe the simultaneous presence of iatrogenic pneumoperitoneum and pneumomediastinum following mechanical ventilation,^{2,3} colonoscopy,⁴ endoscopic retrograde cholangiopancreatography⁵ and dental extraction.⁶ No other cases of simultaneous pneumoperitoneum and pneumomediastinum were found in the literature.

Figure 5 Computed tomography of the pelvis demonstrating gas in the mesentery (arrows) around the sigmoid colon.

The anatomical communication between the two cavities is not fully understood but various explanations for the phenomenon have been proposed. The first states that air can flow into the mediastinum along the fascial planes of the perivascular spaces and oesophagus from the retroperitoneal space, which in turn can potentially communicate with the peritoneal cavity if the retroperitoneum is breached.^{6,7} Laparoscopic surgery rarely leads to pneumomediastinum as the retroperitoneum is usually left intact. Building on this, it has also been proposed that the neck and mediastinum communicate with the peritoneal and retroperitoneal cavities through sharing a common visceral space that inverts the oesophagus and the trachea and then follows the oesophagus down through the diaphragmatic hiatus.^{5,8} The second explanation relies on the occasional presence of diaphragmatic hernias in concurrence with an anatomical variation of an absent parietal peritoneal layer over these hernias, leading to a communication between the two cavities.^{1,2,9} These potential communications have been termed

the foramina of Morgagni, a parasternal diaphragmatic defect and foramina of Bochdalek, a posterolateral diaphragmatic defect.^{1,2,9}

In conclusion, simultaneous pneumoperitoneum and pneumomediastinum is a rare occurrence which has primarily been reported in the literature secondary to iatrogenic causes. Although poorly understood, potential anatomical communications between the mediastinum and peritoneum have been proposed. Management is conservative unless there is evidence of gastrointestinal tract perforation. Antibiotic treatment is recommended in patient with signs of associated infection.

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