CASE REPORT

Bedside decompression of abdominal compartment syndrome caused by spontaneous pneumoperitoneum: A case report

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ABSTRACT

Pneumoperitoneum is the presence of free air within the peritoneal cavity and indicates perforation of a hollow viscus. However, it may also occur in the absence of perforation and in this case, it is called spontaneous pneumoperitoneum (SP). A 57-year-old female patient who was intubated and mechanically ventilated due to respiratory failure developed abdominal compartment syndrome (ACS) secondary to massive SP. Peritoneal lavage was performed for the patient both to achieve decompression and to support the diagnosis. Many surgeons proceed with laparotomy as a reflex response for SP due to lack of awareness of the condition. However, laparotomy has no place in this setting. SP coexisting with ACS is extremely rare. With this case report, we aimed to raise awareness of SP among physicians and help avoid unnecessary laparotomies.

Keywords: Abdominal compartment syndrome; massive; spontaneous pneumoperitoneum.

INTRODUCTION

Pneumoperitoneum is the presence of free air within the peritoneal cavity and often indicates perforation of a hollow organ.[1] Rarely, pneumoperitoneum may also occur in the absence of a hollow viscus perforation. This is called as "non-surgical pneumoperitoneum (NSP)" or "spontaneous pneumoperitoneum (SP)."[2] In such cases, surgical intervention is not required. Physicians should be aware of NSP and proactively avoid unnecessary laparotomies.[3]

Intra-abdominal pressure (IAP) may increase due to many reasons, resulting in organ dysfunction. This condition is known as abdominal compartment syndrome (ACS). Risk factors for ACS include pneumoperitoneum, in which intra-abdominal contents increase.[4,5]

SP in combination with ACS has been reported in a few cases. Many physicians are not aware of SP and perform unnecessary laparotomy. Moreover, SP may cause a diagnostic dilemma for the surgeon with the fear of missing a perforation. Avoiding laparotomy would protect the patient from the complications associated with anesthesia and surgery.

With this case report, we aimed to raise awareness of spontaneous pneumoperitoneum among physicians and help avoid unnecessary laparotomies.

CASE REPORT

A 57-year-old female patient underwent Continuous Positive Airway Pressure therapy for the past 3 days in the intensive care unit at the Department of Anesthesia for hypercarbic respiratory failure associated with chronic obstructive pulmonary disease. The patient was intubated following an increase in hypercarbia and deepening of hypoxia and subsequently sudden abdominal distention ensued. After intubation, only 400–450 ml of tidal volume could be achieved at a maximum ventilation pressure (Pmax) of 42 mmHg using the PC mode of synchronized intermittent mandatory ventilation (SIMV) (FiO_2: 100%, Fr:16, Ins/Exp:1/2.5, Pinsp:33, Psupp:28, PEEP:10). Decompression was attempted on the suspicion

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of abdominal distention using a nasogastric (NG) tube, but it could not be advanced to the stomach. General surgery consultation was requested 24 h later on further increase in abdominal distention and examination of the patient showed massive distention and tympanic sound on percussion. Mechanic ventilation failed to produce adequate oxygenation and an intra-abdominal pressure of 21 mmHg was measured through the indwelling urinary catheter. The patient had oliguria. An abdominal computed tomography (CT) scan without contrast material revealed massive pneumoperitoneum compressing the intestines (Fig. 1).

However, after 24 h have elapsed since the onset of distention in the patient, there were still no findings of pneumomediastinum, pneumothorax, or free fluid related to abdominal organ perforations on CT that could explain her condition. The laboratory workup at that time showed the following: WBC 11,000/μL, Hb 12.1 g/dl, Hct:39.7%, Plt:212,000 μL, CRP:17 mg/L, Urea:52 mg/dl, Creatinine:1 mg/dl, Na:149 mmol/l, and K:3.6 mmol/L.

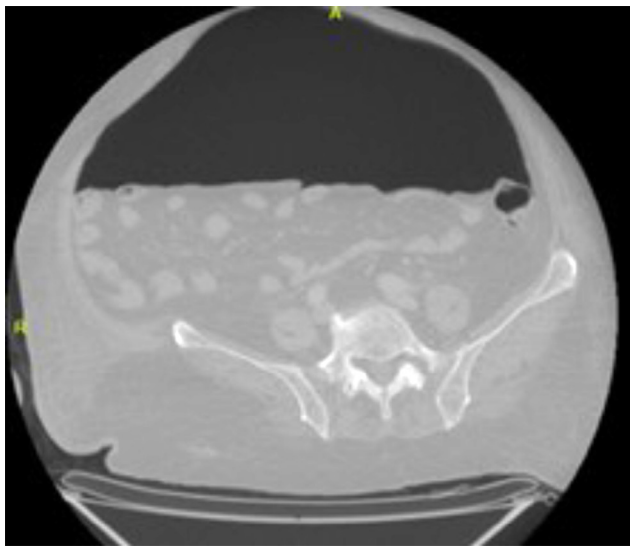

Figure 1. Massive pneumoperitoneum causing bowel compression.

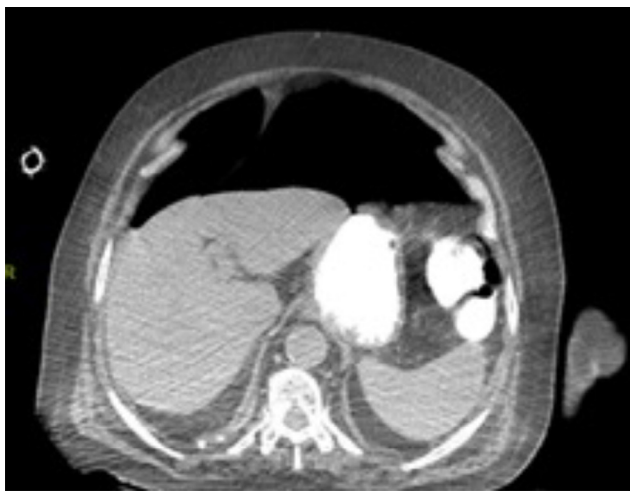

Figure 2. No extravasation of oral contrast agent.

Since the general condition of the patient was poor, a repeat abdominal CT scan was performed to demonstrate hollow organ perforation through IV (intravenous) (Iohexol 300 mg/100 ml), NG and rectal administration of contrast agent (100 ml diatrizoate deglumine and diatrizoate sodium 1500 ml were added into the drinking water of the patient. 1000 cc was given through NG route and 500 cc through rectal route), which showed no extravasation of the contrast agent into the extraluminal space (Fig. 2).

This led to consideration of a diagnosis of NSP for the patient and a bedside mini-incision was done approximately 2 cm above the umbilicus both to provide decompression of abdominal pressure and to support the diagnosis. When the peritoneum was opened, pressurized air spurted out from the abdomen and abdominal distention resolved dramatically. Surgical sponges placed at the incision site contained minimal amount of serous fluid and a drain was inserted into the pouch of Douglas. Peritoneal lavage was performed with 1500 cc saline and a clear fluid was recovered (this procedure was performed twice, 1 day apart) (Fig. 3).

Following decompression, a tidal volume of 500–520 ml was achieved at a Pmax of 31 mmHg with sufficient oxygenation of the patient (SIMV-PC mode, FiO_2: 80%, Fr:14, Ins/Exp: 1/2.5, Pins: 24 Psupp:21, and PEEP:7). At the follow-up, the patient was no longer oliguric with approximately 300 cc urine output per hour and had no further distention.

A collective review of the assessment findings strongly suggested NSP for this patient. However, follow-up was continued since making this diagnosis was highly challenging for the surgeon. Abdominal drain was not withdrawn and drain was followed for 3 days with the administration of methylene blue through NG tube (100 cc methylene blue was administered 3 times at 1 day intervals). A CT scan was performed on the

Figure 3. Peritoneal lavage fluid.

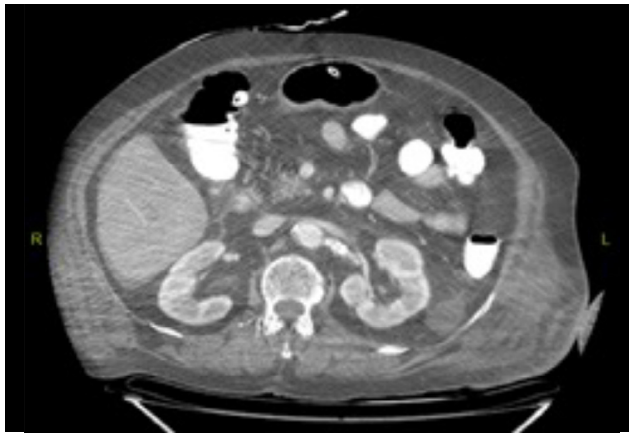

Figure 4. Follow-up abdominal CT image.

4th day with the administration of contrast agent through NG and showed no extravasation or fluid in the abdomen but minimal pneumoperitoneum (Fig. 4). With these findings, the possibility of surgical pneumoperitoneum was definitively excluded. It was decided to leave the drain in place until she had weaned from mechanical ventilator support. The patient underwent periodical abdominal examinations which revealed no pathological findings and serous drain fluid was observed. The patient died on the 23rd day of her admission due to renal failure after initiation of tigecycline therapy and mechanical ventilation-associated pneumonia.

DISCUSSION

Pneumoperitoneum is defined as the presence of free air within the peritoneum and mostly indicates perforation of a hollow organ.[1] It can occur without organ perforation in about 10–15% of the patients and in this case, it is called NSP.[2,6] Physicians should be aware of the possible causes of NSP and play a decisive role in avoiding unnecessary laparotomy in these patients. Chandler et al.[7] reported a laparotomy frequency of 28% in patients with NSP. Furthermore, Ayana et al.[8] found that among 115 patients with pneumoperitoneum related to mechanical ventilation, 57 patients underwent laparotomy without any evidence for perforation of a hollow organ. Although NSP is a commonly reported condition, it is not always recognized by the physicians.[9] Other surgeons and intensive care physicians of our hospital who were involved in the current case were not aware of NSP and approached it in a skeptic way.

Etiology of NSP includes abdominal, gynecological, and thoracic causes.[3] Free air in the abdomen after abdominal surgeries is a usual finding on plain abdominal radiograph and resolves within 48 h but rarely continues for up to 5 days postoperatively.[10] Pneumoperitoneum after laparoscopic procedures is of shorter duration.[11]

Thoracic causes of NSP are most commonly reported.[3] It was suggested that positive pressure mechanical ventilation may result in the introduction of air through microscopic diaphragmatic defects or through the mediastinum along perivascular connective tissue.[3] Mularski et al.[12] showed accumulation of radioactive tracer below the right diaphragm using xenon lung perfusion scintigraphy in a case of intrathoracic NSP. A peak inspiratory pressure of 40 cm H_2O and an end-expiratory positive pressure >6 cm H_2O at mechanical ventilation are associated with an increased risk of NSP.[12,13] In the currently presented case, peak inspiratory pressure and end-expiratory pressure were high.

Reported abdominal causes of NSP include endoscopic procedures, pneumatosis intestinalis, sepsis, and peritoneal dialysis. Gynecological causes include coitus, unusual sexual experiences such as oro-vaginal air insufflation, pregnancy, and postpartum knee-chest exercises.[3]

Clinical picture of the patient is important for the diagnosis. NSP should be considered in incidentally detected cases and patients with a positive history of NSP etiology, no signs of abdominal sepsis, or no concurrent abdominal free fluid.[3] Abdominal free fluid was not observed on the CT scan of our patient, although she had developed the condition on the previous day. Furthermore, leukocytosis and fever were absent. Peritoneal irritation could not be examined since the patient was intubated. The patient had sudden-onset abdominal distention despite no malposition of the endotracheal tube.

Abdominal CT with oral, rectal, and IV contrast agents can be helpful in establishing the correct diagnosis. Serial CT scans may be obtained using oral contrast materials. In doubtful cases, peritoneal lavage and bedside laparoscopy may be performed.[6] Our patient underwent abdominal CT scans with oral contrast agents, peritoneal lavage, and oral methylene blue administration to exclude the possibility of gastric or duodenal perforation.

Abdominal hypertension is when the IAP is >12 mmHg. Organ failure may develop if the pressure within the abdominal cavity increases above 12 mmHg due to any reason.[14] ACS is considered to be present when the IAP is above 20 mmHg which associated organ dysfunction. Urgent decompression is the definitive treatment of ACS. Ahmed et al.[9] reported a case of ACS resulting from SP and performed laparotomy for urgent decompression. A number of similar cases have been reported in the literature.[15] Our patient had increased IAP and organ failure and her organ functions improved following decompression (intra-abdominal pressure was not monitored but clinically, abdominal distention resolved immediately). Moreover, she was no longer oliguric and her respiratory parameters improved.

In the case of symptomatic NSP, decompression of air through a percutaneous catheter may improve impaired cardiopulmonary parameters.[9]

However, due to suspected diagnosis, we performed bedside compression through a 2 cm incision and peritoneal lavage

both as a means to support the diagnosis and for urgent decompression in our patient. In practice, surgeons proceed with laparotomy as a reflex when they encounter with a patient with pneumoperitoneum. Chandler et al.[7] reported that 28% of patients with NSP were subjected to laparotomy.

Our patient died on the 23rd day of her hospitalization. However, abdominal sepsis was not considered as the cause of death. Collectively, the presence of serous fluid coming through the indwelling catheter and normal clinical examination findings during the follow-up (absence of distension, normal intestinal functions, and gas and fecal excretion) and the absence of any localized or diffuse intra-abdominal fluid on serial abdominal CTs were considered as evidence in support of this consideration.

Conclusion

NSP may not be recognized by intensive care physicians and even general surgeons, as is the case in our clinic. In addition, it poses a dilemma for the physician even when a diagnosis had been made. Recognition of the condition may avoid the risks of laparotomy and anesthesia, particularly in patients with comorbidities. Urgent decompression is the definitive treatment of ACS. Peritoneal lavage through a 2 cm bedside incision under local anesthesia will both support the diagnosis and achieve decompression.

Surgeons may have medicolegal concerns about missing a surgical pneumoperitoneum and diligent care should be exercised to avoid excessive workup and unnecessary procedures (a 2-cm incision was performed to remove the air that could be potentially purged using a catheter). The patient history is an integral part of the diagnostic process.

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Conflict of Interest: None declared.

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OLGU SUNUMU - *ÖZ*

Spontan pnömoperitoneuma bağlı abdominal kompartman sendromunun yatak başı dekompresyonu: Nadir bir olgu

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Pnömoperitoneum periton boşluğunda serbest hava bulunmasıdır. Gastrointestinal sistem perforasyonunun bir bulgusudur. Ancak perforasyon olmadanda gözlenir. Bu durum spontan pneumoperitonium olarak adlandırılır. Elli yedi yaşında solunum yetersizliği nedeniyle entübe edilerek mekanik ventilasyona başlanan kadın hastamızda massif spontan pnömoperitoneum ve buna bağlı abdominal kompartman sendromu gelişti. Hastaya peritoneal lavajla hem dekompresyon yapıldı hemde tanı desteklendi. Spontan pneömoperitoneumda farkındalığın az olması nedeniyle çoğu cerrah refleks bir yanıt olarak laparatomi uygulamaktadırlar. Ancak laparatominin yeri yoktur. Spontan pneumoperitonium ve abdominal kompartman sendromu birlikteliği ise son derece nadirdir. Bu yazıda amacımız, spontan pnömoperitoneumun farkındalığını artırmak ve gereksiz laparatomilerin önlenmesine katkıda bulunmaktır.

Anahtar sözcükler: Abdominal kompartman sendromu; masif; spontan pnömoperitoneum.

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