Case Report

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Spontaneous hemopneumothorax after laparoscopy: a case report and literature review

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Abstract

Background: Spontaneous hemopneumothorax (SHP) is defined as the accumulation of >400 mL of blood in the pleural cavity in association with spontaneous pneumothorax. This rare clinical disorder may be life-threatening.

Case presentation: A 71-year-old woman presented with a 1-month history of recurrent bloody stool, and electronic colonoscopy suggested a rectal mass. Laparoscopic radical resection of rectal cancer was performed. Two days later, she developed chest tightness, shortness of breath, and slight pain in the left chest. Emergency chest radiography revealed mild left pneumothorax and pleural effusion. SHP was suspected and a thoracic drain was inserted. However, the patient developed hemorrhagic shock 3 hours after drainage. She underwent emergency video-assisted thoracic surgery (VATS), which revealed left lung tip rupture with bleeding and adhesive band fracture at the top of the left thoracic cavity. The ruptured lung tissue was removed and electrocoagulation at the adhesion band was performed for hemostasis. The patient was discharged on postoperative day 11. At the time of this writing, she had developed no SHP recurrence or any other complications.

Conclusions: This case shows that conservative treatment may have serious consequences in patients with SHP. Thus, chest X-ray examination and VATS should be performed in patients with SHP.

Keywords

Spontaneous hemopneumothorax, laparoscopy, video-assisted thoracic surgery (VATS), case report, chest radiography, thoracic drainage

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Background

Laparoscopic surgery is widely performed because of its many advantages over open surgery, such as lower mortality and morbidity, less postoperative pain, less invasiveness, and improved postoperative recovery.[1] Despite these benefits, laparoscopic surgery may also be associated with complications such as pneumothorax, pneumomediastinum, and subcutaneous emphysema.[2] Laparoscopic radical resection of rectal cancer can provide an optimal field of view using insufflation of carbon dioxide into the peritoneal cavity. It is widely used for the surgical treatment of gastrointestinal tumors. Although the incidence rates of pneumomediastinum and pneumothorax in laparoscopic surgery are only 0.02% and 0.03%, respectively,[2] these are potentially serious and life-threatening conditions that require prompt diagnosis and therapeutic intervention.

Spontaneous hemopneumothorax (SHP) is rare and has an incidence rate of 0.5% to 12% in patients with spontaneous pneumothorax (SP) according to a recent systematic review.[3] SHP is defined as the accumulation of >400 mL of blood in the pleural cavity in association with pneumothorax without any preceding trauma.[3] SHP often progresses to fatal hemorrhagic shock and requires rapid recognition and treatment.[4] We herein present a case of SHP following laparoscopic radical resection of rectal cancer.

Case presentation

A 71-year-old woman presented to The First People's Hospital of Changzhou with a >1-month history of bloody stool. She demonstrated normal consciousness and arrived at the hospital on foot. Her vital signs were stable (blood pressure, 120/80 mmHg; heart rate, 80 bpm; and SpO_2, 98%). Electronic colonoscopy suggested a rectal mass in the anal canal line within 2 cm of the anus, occupying about one-quarter of the circumference. Pathological biopsy suggested adenocarcinoma. Laparoscopic radical resection of rectal cancer was planned. The patient stated that she had no other medical conditions except for a history of cholecystectomy 10 years previously. Laboratory test results showed positive fecal occult blood, tumor marker CA72-4 level of 7.79 U/mL (reference, <7 U/mL), and carcinoembryonic antigen level of 6.51 ng/mL (reference, <5 ng/mL). The patient's hemoglobin level was 110.0 g/L (reference, 115.0–150.0 g/L) and red blood cell count was 3.79×10^{12}/L (reference, $3.80–5.10 \times 10^{12}$/L). The results of both chest X-ray and electrocardiogram examinations were normal.

On the second day after surgery, the patient experienced chest tightness, shortness of breath, and slight pain in the left side of her chest. Her blood pressure decreased from 125/89 to 103/75 mmHg, SpO_2 decreased to 90%, and heart rate was 90 bpm. The patient was agitated. Chest auscultation revealed weakened breath sounds on the left and normal breath sounds on the right. Arterial blood gas analysis was performed immediately. The results showed a PCO_2 of 75 mmHg and PO_2 of 65 mmHg. The patient's hemoglobin level was 97.0 g/L and red blood cell count was 3.12×10^{12}/L. Oxygen was provided to the patient through a facemask; although she was able to breathe spontaneously without pain, she experienced some pain in the left side of her chest. Her SpO_2 gradually increased to 95% to 96%.

Emergency chest X-ray (Figure 1(a)) and computed tomography (Figure 1(b)) demonstrated left pleural effusion and left pneumothorax. A chest tube was immediately placed in the left hemithorax. A total of 550 mL of blood and air were discharged from the chest tube. Because the patient's chest tightness, shortness of breath, and

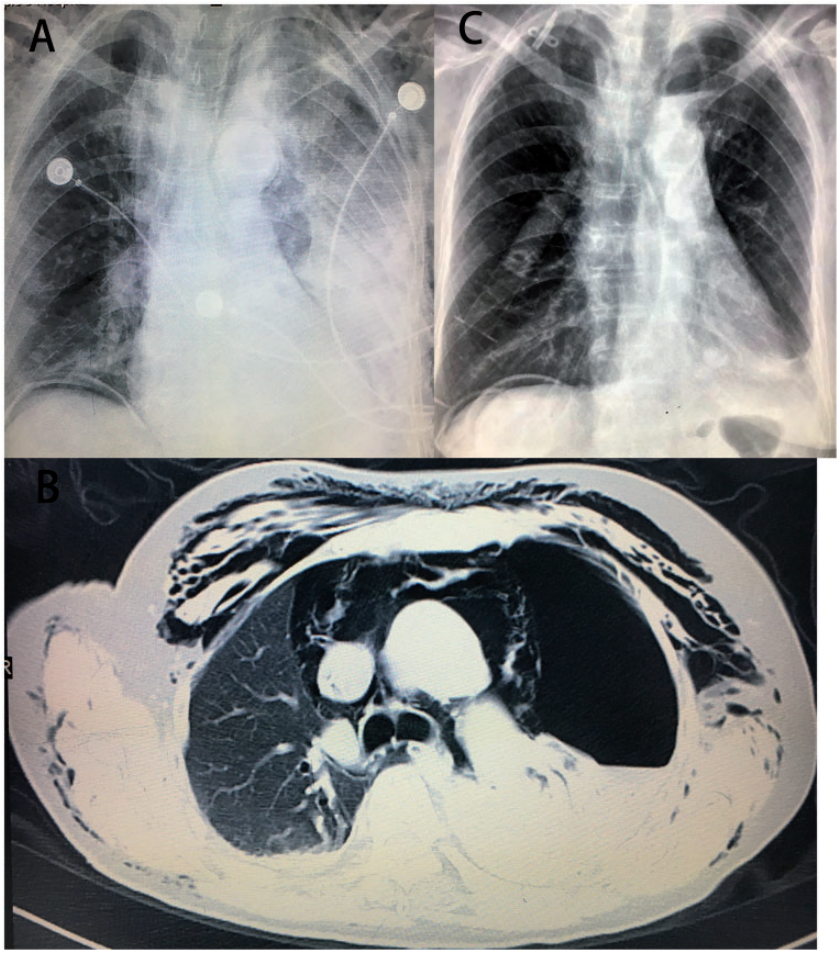

Figure 1. Imaging findings. (a) Chest radiograph revealed left pneumothorax and pleural fluid. (b) Chest computed tomography revealed left pneumothorax and pleural fluid. (c) Chest radiograph on the third postoperative day.

other symptoms were improved and vital signs were relatively stable, conservative treatment was continued with fluid infusion and chest drainage.

The chest tube discharged 850 mL of blood and air 3 hours after the initiation of conservative treatment. However, the patient developed shortness of breath and signs of shock (blood pressure, 89/60 mmHg; heart rate, 110 bpm). In addition, a chest radiograph suggested an increase in the amount of left pleural effusion. Her red blood cell count decreased to 2.95×10^{12}/L and hemoglobin level decreased to 87 g/L.

The patient's vital signs were stable after blood transfusion and fluid resuscitation. She then underwent emergency video-assisted thoracic surgery (VATS) to control the progression of her condition. We found that the chest tube was blocked by blood clots. A large number of blood clots and a large amount of blood were found and removed after the chest tube was pulled out (Figure 2(a)). After evacuation of the

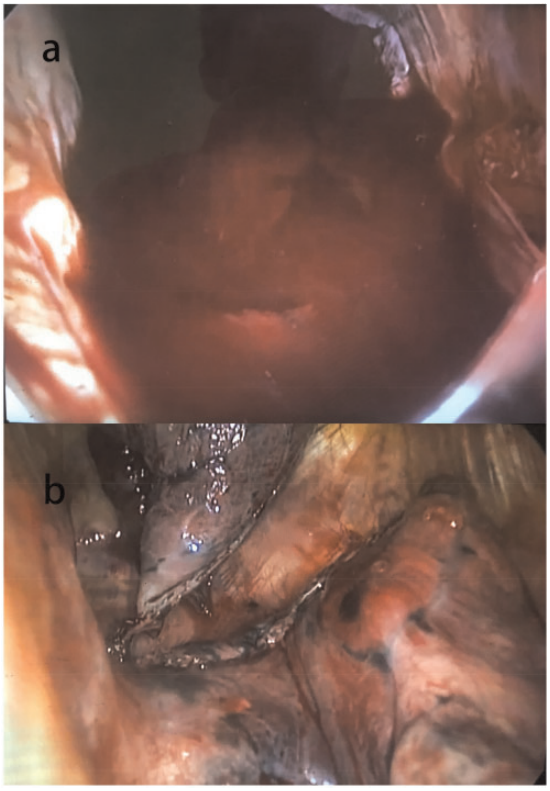

Figure 2. Operative findings. (a) Large amount of coagulation in the thoracic cavity. (b) Ruptured lung tissue was removed and electrocoagulation was performed at the adhesion band to stop the bleeding.

blood clots and blood, we discovered left lung tip rupture with bleeding and adhesive band fracture at the top of the left thoracic cavity. The ruptured lung tissue was removed and electrocoagulation was performed at the adhesion band to stop the bleeding. Hemostasis was easily achieved by clipping (Figure 2(b)). After the operation, the patient received fluid resuscitation and anti-infection treatments. The chest drainage tube was removed on the third postoperative day. Repeated chest X-ray examination revealed good lung recruitment (Figure 1(c)). The patient's blood hemoglobin level increased to 99 g/L, and her red blood cell count increased to 3.55×10^{12}/L. The postoperative course was uneventful, and the patient was discharged on the 11th postoperative day. Follow-up was carried out by telephone calls. At the time of this writing, the patient had developed no recurrence of SHP or any other complications. Histopathology of the excised specimens was consistent with bullae with emphysematous changes and hemorrhage. No malignancy was present.

The Ethics Committee of the Third Affiliated Hospital of Soochow University approved this study. Written informed consent was obtained from the patient.

Discussion

Laparoscopy is a safe and effective surgical procedure with a reported mortality rate of 3 to 8 incidents per 100,000 patients.[5]

Chapron et al.[5] reported a total complication rate of 4.64 incidents per 1000 laparoscopies. Pneumothorax is an extremely rare complication caused by gas insufflation and has a reported incidence of 0.03%. Pneumomediastinum has a reported incidence of 0.02%, while clinically significant subcutaneous emphysema has a reported incidence of 0.43% to 2.34%.[6,7] The actual incidence of these complications may be substantially higher because many of these complications may not be recognized. No studies have shown that hemopneumothorax is a complication of laparoscopic surgery. In addition, the patient described in the present report was not traumatized during hospitalization. Thus, we suspected that she had SHP.

SHP is defined by Ohmori et al.[8] as SP with >400 mL of blood in the pleural cavity. SHP is a rare condition, and bleeding is observed in 0.5% to 12% of patients with SP.[9] SHP is usually seen in adolescents older than 15 years of age and is more common in male patients. The reason for the relative infrequency of SHP in female patients remains unclear. SHP is a rare condition that affects approximately 1% to 12% of patients with SP. The symptoms of SHP are very similar to the symptoms of SP, especially in the early stage. However, unlike simple SP, SHP has a more fulminant clinical course because it is often associated with hypovolemic shock. Clinically, if a patient with pneumothorax suddenly develops unexplained shock symptoms, SHP should be considered and treated as a life-threatening emergency. Unfortunately, because emergency physicians often encounter SP, SHP is likely to be ignored. In addition, some patients with SHP may have occult signs of shock, and their condition may not be identifiable until massive life-threatening hemorrhage occurs.[10] The patient's age, medical history, clinical signs, hemoglobin level, and radiological assessment may be very useful diagnostic tools for SHP.

Pathophysiologically, SHP involves an accumulation of air and blood in the pleural cavity with no chronic lung diseases or provoking factors, such as diagnostic intervention, trauma, thoracic surgery, or other obvious causes. Hsu et al.[3] proposed three mechanisms of bleeding in cases of SHP: (1) bleeding of the visceral pleura from rupture of vascularized bullae or lung parenchyma, (2) hemorrhage resulting from a torn adhesion between the parietal and visceral pleurae, and (3) bleeding resulting from a torn congenital aberrant vessel following pneumothorax-induced lung collapse.

Patients with SHP have almost no underlying lung diseases. Subpleural bullae can be found in 81% to 90% of patients using surgical exploration or computed tomography.[11] Factors that may be associated with the occurrence of pleural porosity, blebs, and bullae include connective tissue disorders, distal bronchial tree anomalies, distal airway inflammation, malnutrition, and local ischemia. Increased pleural porosity secondary to inflammation is reportedly another mechanism for the occurrence of SHP.[11–13]

The incidence of hypovolemic shock is 30% to 46% in patients with SHP.[3,10] Timely and appropriate interventions can help to avoid or reduce life-threatening complications, especially after a delay in diagnosis. Therefore, patients with SHP may require aggressive surgical treatment, especially for the definitive diagnosis and appropriate treatment of patients with hemodynamic instability, as well as for prevention of related complications. When SHP becomes life-threatening because of massive bleeding, it has been recommended to insert a chest drainage tube as soon as possible to drain the accumulated blood and air and thus allow the lung to re-expand, thereby preventing hemostasis by compressing the bleeding vessels. However, this procedure does not have a high success rate. It has been reported that timely surgical intervention, especially

VATS, can significantly reduce morbidity and mortality, transfusion requirements, and the length of hospital stay. In contrast, conservative treatment may result in hypovolemic shock secondary to massive hemorrhage with a mortality rate of up to 33%.[14] However, research has shown that it is difficult to determine the source of bleeding in patients with SHP, especially during the initial VATS procedure.[15] This may be because the collapsed lung loses its local filling ability, and blood from even small vessels can freely flow into the chest cavity, resulting in a large amount of blood loss and hemorrhagic shock. The most important indicator of SHP is the presence of ipsilateral pleural effusion accompanied by a high air–fluid level displayed on a chest radiograph.[10] Symptoms of pneumothorax after any type of laparoscopic surgery, especially with a massive air–fluid level displayed on a chest X-ray, should be considered to indicate SHP.

There are several options for surgical treatment of SHP, including VATS, thoracotomy, and tube thoracostomy. Thoracotomy should be performed if the patient has an indication for this procedure, such as continuous bleeding (100 mL/h), hypovolemic shock, persistent air leaks, pachypleuritis, impaired lung expansion, or recurrent pneumothorax.[3] Conservative management with tube thoracostomy alone is suggested if the patient is hemodynamically stable and has none of the above surgical indications. Inafuku et al.[1] reported that early performance of VATS in patients with SHP will be of more benefit than conservative treatment, resulting in a shorter hospital stay, shorter drainage period, less postoperative pain, less bleeding, and less frequent requirement for transfusion. There are also other advantages to using VATS for the treatment of SHP. These include identification of the bleeding source and rapid control of the bleeding, easier blood clot removal, resection of blebs or bullae, and placement of chest tubes with minimal trauma under direct vision.[16] VATS has now become the most important treatment for SHP, especially for patients with massive blood clots and active hemorrhage in the thoracic cavity.[17] From a diagnostic and therapeutic point of view, VATS seems to be a better choice than thoracotomy.[15] Therefore, VATS rather than conservative chest drainage should be considered immediately after diagnosis of SHP.

Tearing of aberrant vessels between the parietal pleura and adhesion bulla due to pneumothorax collapse is the most important cause of bleeding in patients with SHP.[18,19] Such aberrant vessels often lack a muscle layer. In addition, negative pressure in the pleural cavity causes continuous bleeding.[19] Although other sources of bleeding have been reported, such as lung parenchyma, torn parietal pleura, or ruptured vascularized bullae,[3,18,20] the source of bleeding cannot be determined in 29.6% to 35.0% of cases.[19] During surgery in the present case, rupture of the left lung tip was accompanied by bleeding, which is consistent with the first bleeding mechanism described by Hsu et al.[3] (i.e., bleeding of the visceral pleura from rupture of vascularized bullae or lung parenchyma). At the same time, the adhesive band at the top of the left thoracic cavity was broken, which is consistent with the second bleeding mechanism described by Hsu et al.[3] (i.e., hemorrhage resulting from a torn adhesion between the parietal and visceral pleurae). The ruptured lung tissue was removed and electrocoagulation was performed at the adhesion band to stop the bleeding. Hemostasis was easily achieved by clipping. Histopathology of the excised specimens was consistent with bullae with emphysematous changes and hemorrhage. No malignancy was present.

Conclusions

SHP is a rare but potentially life-threatening disease. SHP should be considered in patients with spontaneous chest pain and dyspnea,

radiographic findings of pneumothorax, and pleural fluid or signs of shock. If SHP is diagnosed, early aggressive VATS may be considered as an initial treatment procedure. Compared with conservative treatment, early VATS can significantly reduce morbidity and mortality, transfusion requirements, and the length of hospital stay.

Declaration of conflicting interest

The authors declare that there is no conflict of interest.

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