Right postoperative pleural effusion and pulmonary embolism following laparoscopic gynecological surgery: A rare case report and PRISMA-driven systematic review

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Abstract: The incidence of postlaparoscopic pleural effusion and pulmonary embolism were rare. However, it might be life-threatening. Therefore, confirming the risk factor and management is important. We present a 53-year-old woman with ovarian endometriosis arranged for laparoscopic surgery. However, desaturation was noted on postoperation day 1. Chest radiograph and chest computed tomography showed pleural effusion and pulmonary embolism. Pleural pigtail insertion was performed and anti-coagulant medication, albumin, and lasix were given. The patient's recovery was uneventful. Several factors have been advanced to explain including the prolonged duration of the operation. Management options include supplemental oxygen therapy, and pig-tail catheter insertion. Mechanical prophylaxis (sequential compression devices and graduated compression stockings) is sufficient for venous thromboembolism prevention.

Keywords: Gynecology; Laparoscopic surgery; Pleural effusion; Venous thromboembolism

1. INTRODUCTION

Pleural effusion and pulmonary embolism after laparoscopic surgery are rare. However, it might be a cause of postoperative mortality. Confirming the risk factor and etiology of postlaparoscopic pleural effusion and pulmonary embolism and determining appropriate management are important.

2. CASE REPORT

A 53-year-old menopausal woman was admitted to our hospital for bilateral ovarian cysts found during health checkup. Her gynecologic history was gravida 3, para 2, and artificial abortion 1. A transvaginal ultrasonographic examination revealed a left ovarian cyst about 36 mm, and left hydrosalpinx was suspected. It also revealed a right ovarian cyst about 36 mm, and right ovarian endometriosis was suspected. After discussion with the patient, laparoscopic bilateral salpingo-oophorectomy was scheduled. Preoperative chest x-ray film showed a significant costophrenic angle without pleural effusion (Fig. 1A). Bilateral lung markings were clear. During the operation, severe adhesion between the omentum and the anterior abdominal wall and adhesion between the bilateral adnexa and the colon were noted. Left hydrosalpinx with endometriosis, 4 cm, and left ovarian chocolate cyst, 3 cm, with a solid part was found. Right hydrosalpinx with endometriosis, 4 cm, was also noted (Fig. 2A, B). Laparoscopic adhesion lysis and bilateral salpingo-oophorectomy were carefully performed. An adhesion-reduction agent, Adept (4% icodextrin) 1500 mL, was used at the end of the surgical procedure. We washed the abdominal cavity with 750 mL of Adept, and the remaining amount was instilled into the abdominal cavity. A Jackson-Pratt drain was inserted. However, desaturation and tachypnea were noted on postoperative day 1. Auscultation showed decreased breath sound on the right side. Chest x-ray film showed right massive pleural effusion and lung atelectasis (Fig. 1B). Blood gas analysis revealed hypoxia, and laboratory data showed elevated D-dimer (15.12 μg/mL). Pulmonary embolism was highly suspected. Chest computed tomography (CT) findings of filling defect in the left segmental pulmonary arteries (Fig. 3A) and suspicious in the small branches of the right segmental pulmonary arteries (Fig. 3B) with main truck sparing were compatible with pulmonary embolism. It also showed air bubbles in the left lateral upper abdominal wall (Fig. 3C) and minimal free air in the anterior upper peritoneal cavity (Fig. 3D); hence, pneumoperitoneum was suspected. Right pleural pigtail insertion was performed and an anticoagulant medication, rivaroxaban 30 mg/day, was given. Albumin and Lasix were also given for 3 days. The total amount of pleural pigtail insertion was 1165 mL. Chest

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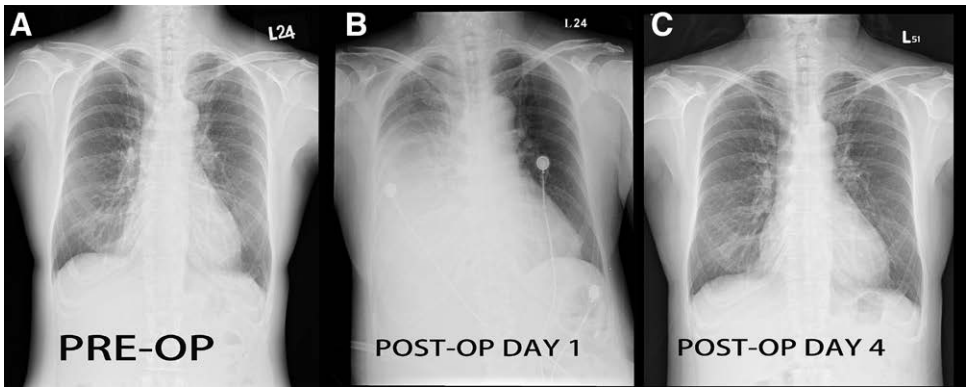

Fig. 1 Chest radiograph. A, Preoperative chest x-ray film showed significant costophrenic angle without pleural effusion. B, On postoperation day 1, it showed right massive pleural effusion and lung atelectasis. C, On postoperation day 4, it showed in the absence of right pleural effusion and significant costophrenic angle.

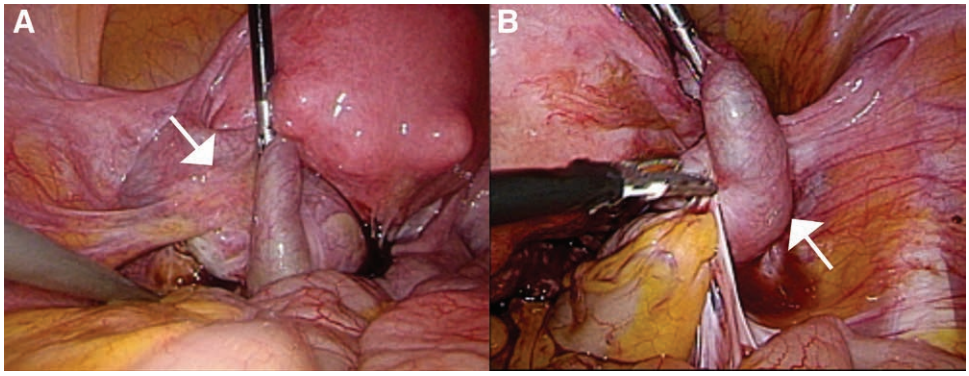

Fig. 2 Laparoscopic stock image. A, Left hydrosalpinx with endometriosis, 4 cm and left ovarian chocolate cyst, 3 cm with solid part was found. B, Right hydrosalpinx with endometriosis, 4 cm was also noted.

radiograph on postoperative day 4 revealed the absence of right pleural effusion, and oxygenation was improved (Fig. 1C). The patient's recovery was uneventful, and the drain was removed on postoperative day 5.

A total of seven articles as illustrated in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram (Fig. 4) and 12 patients are included, and detailed information is summarized in Table.

3. DISCUSSION

The incidence of postoperative pulmonary complication after laparoscopic hysterectomy is as low as 0.9%; however, pleural effusion and pulmonary embolism might be fatal and are associated with significant mortality. We report published cases of postlaparoscopic pleural effusion and present a rare and recent case of postlaparoscopic pleural effusion and pulmonary embolism at our institution.

Laparoscopic surgery was performed for benign diseases in 10 cases[1–5] and for malignant diseases (serous adenocarcinoma and endometrial carcinoma) in two cases.[6,7] Preoperative evaluation including chest radiograph and electrocardiography of all cases showed no evidence of abnormality. Only four cases[1,4] presented with intraperitoneal pressure of 15 mmHg during operation, and remaining cases were not applicable. The duration of operation ranged from 30 to 270 minutes. Three cases[1] showed that Adept (4% icodextrin), ranging from 750 to 1500 mL, was left in the peritoneal cavity. In four cases, 1 to 6 L of normal saline was used for peritoneal lavage.[1,3,4,7] All 12 cases showed symptoms such as dyspnea, desaturation, or right thoracic pain after operation, with the time of onset ranging from immediate to postoperative day 7. In one unusual case,[5] the reason for the hydrothorax and ascites was bilateral ureter injury.

Chest radiograph and chest CT were used for diagnosis in nine[1,3–7] and four cases,[2] respectively. Chest tube insertion[1,3,6,7] or thoracentesis[1,2] was performed in nine cases. The amount of chest tube drainage ranged from 750 to 1500 mL. Postoperative pleural effusion in one unusual case[1] resolved spontaneously, and one case[4] was under conservative management, as advised by the pulmonologist.

Mechanism of postoperative pleural effusion was related to type of operation (eg, heart, liver, pancreas, and lung). The common factor could be atelectasis that the loss of volume of the atelectatic lung results in more negative pleural pressure and reabsorption of pleural fluid.[8] The other common factor was related to the presence of abdominal fluid. It might lead to the development of pleural effusion by one of the two mechanisms.[9] The fluid may flow from the abdominal cavity to the pleural cavity directly through pores in the diaphragm; or the purulent peritoneal exudate may irritate the diaphragm, resulting in an exudative pleural effusion.

Several factors have been advanced to explain postlaparoscopic pleural effusion, including the prolonged duration of the operation, the high amount of fluid in the abdominal cavity, the Trendelenburg position, and increased intraperitoneal pressure.[1,3] Congenital or iatrogenic defects of the diaphragm with

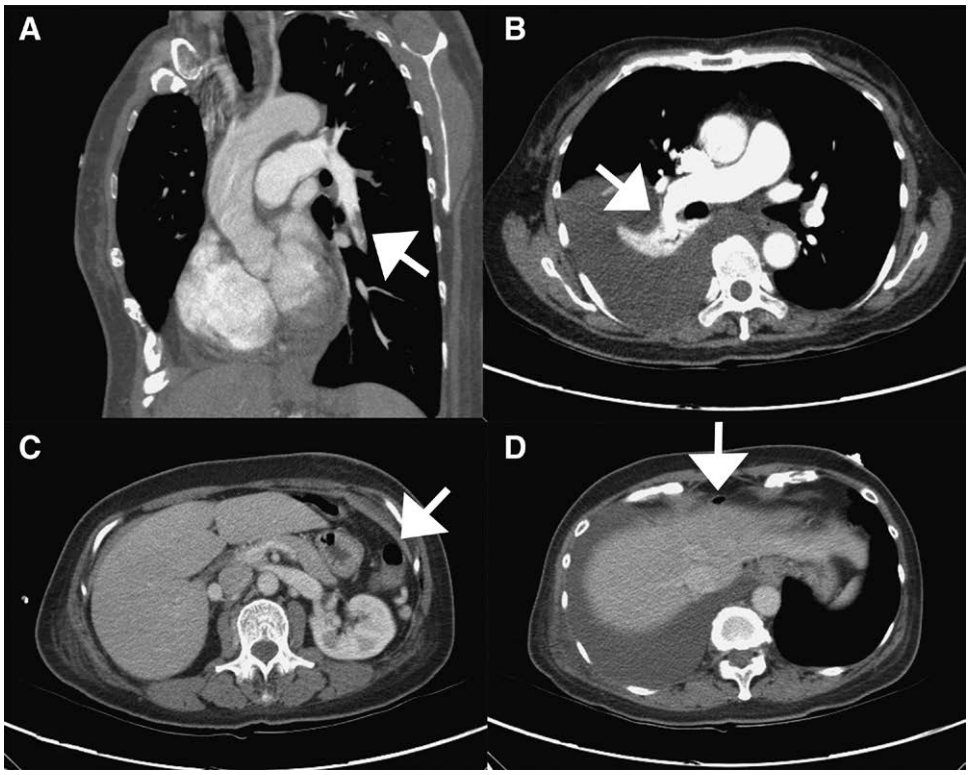

Fig. 3 Chest computed tomography (CT). A, It showed filling defect in left segmental pulmonary arteries. B, Filling defect was also suspicious in small branches of right segmental pulmonary arteries with main truck sparing. It was compatible with pulmonary embolism. C, Air bubbles in left lateral upper abdominal wall was noted. D, Minimal free air in anterior upper peritoneal cavity and pneumoperitoneum was suspected.

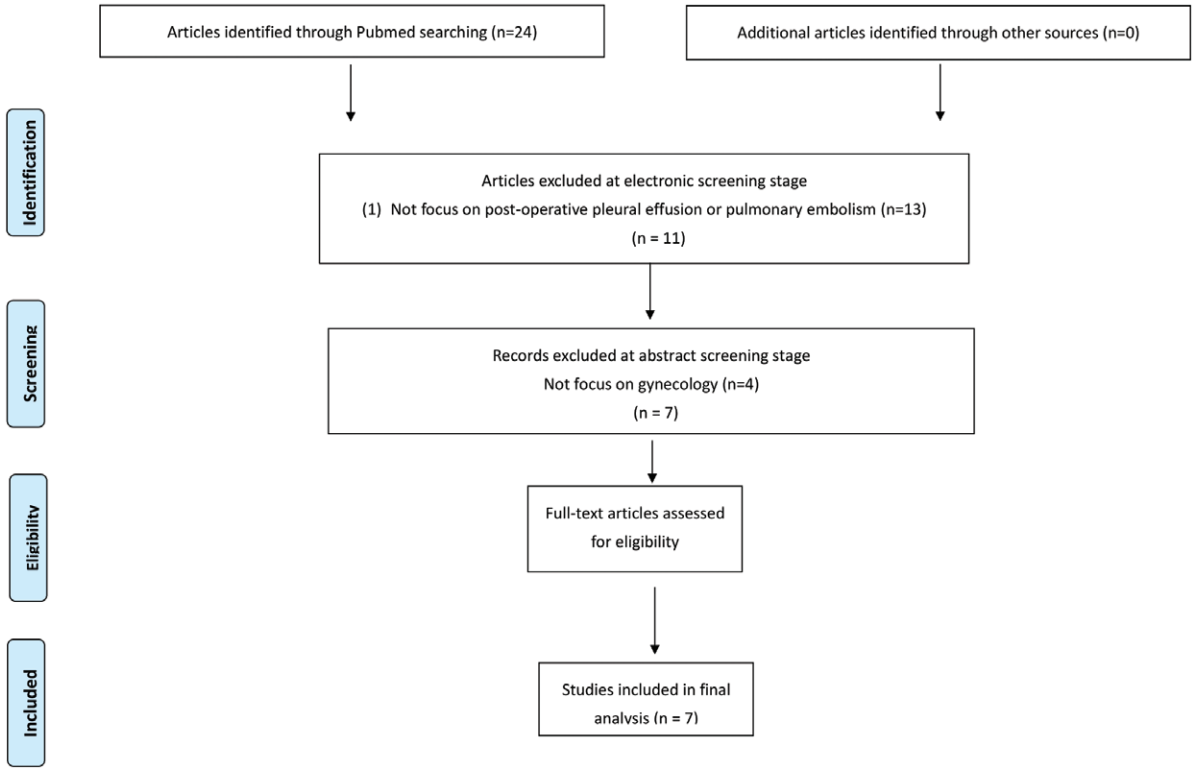

Fig. 4 PRISMA flow diagram. PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

Table

Summary of published case of postoperative pleural effusion following laparoscopic surgery

Author	Year of publication	Age, gender	Surgery	Intraperitoneal pressure	Operation time	Irrigation fluid balance (in/out)	Symptoms onset after operation	Image findings	Management
Ronghe et al[1]	2009	38, female	Laparoscopic adhesion lysis and laser treatment of endometriosis	15 mmHg	N/A	4.5 L/3 L	Right side diminished breath sounds at the end of surgery	Chest x-ray film showed white out of right side	Chest tube was inserted and the amount of pleural effusion was 1000 mL
		38, female	Laparoscopic adhesion lysis and laser treatment of endometriosis	15 mmHg	80 min	N/A but 1.5 L of ADEPT was left in the peritoneal cavity	Difficulty in breathing and right shoulder pain on the night of operation	Chest x-ray film showed left-sided basal effusion	Needle aspiration of pleural fluid was done
		44, female	Laparoscopic adhesion lysis and laser treatment of endometriosis	N/A	30 min	N/A but 1.5 L of ADEPT was left in the peritoneal cavity	Desaturation on the next morning of operation	Chest x-ray film showed right side pleural effusion	Pleural effusion was resolved spontaneously
Kim et al[2]	2013	58, female	Laparoscopic surgery for ovary serous adenocarcinoma	N/A	N/A	N/A	Desaturation after 40 min of operation	Chest x-ray film showed right side hemi-thorax	Chest tube was inserted and the amount of pleural effusion was 1500 mL
Peycru et al[3]	2010	21, male	Laparoscopic appendectomy	N/A	N/A	N/A	Right thoracic pain on postoperative day 4	Chest CT showed right pleural effusion	Pleural percutaneous puncture was done
		42, female	Laparoscopic appendectomy	N/A	N/A	N/A	Right thoracic pain on postoperative day 7	Chest CT showed right pleural effusion	Pleural percutaneous puncture was done
		67, female	Laparoscopic appendectomy	N/A	N/A	N/A	Right loin pain on postoperative day 7	Chest CT showed right pleural effusion	Pleural percutaneous puncture was done
Kanno et al[4]	2001	38, female	Laparoscopic myomectomy	N/A	4.5 h	6 L/5.3 L	Desaturation after 10 min of extubation	Chest x-ray film showed massive right side pleural effusion	Chest tube was inserted and the amount of pleural effusion was 850 mL
Paul et al[5]	2017	51, female	Laparoscopic bilateral salpingo-oophorectomy	15 mmHg	110 min	1 L/0.5 L	Desaturation after 10 min of extubation	Chest x-ray film showed right hydro-pneumothorax and mild left displacement of the mediastinum.	Pulmonologist advised O_2 at 1 to 2 L/min through the nasal cannula for 10 h
Ameer et al[6]	2013	30, female	Laparoscopic coagulation of endometrial implants with bilateral ureteric injury	N/A	N/A	N/A	Abdominal distention and dyspnea were noted on postoperative day 3	Sonogram showed moderate ascites, and chest x-ray film showed massive right pleural effusion; Retrograde bulbo-uretero gram showed contrast leak from both ureters	Bilateral Double J stent was inserted and exploratory laparotomy was done
Sato et al[7]	2013	61, female	Robotic-assisted staging surgery	N/A	207 min	3 L/N/A	Immediate postoperative brief atrial fibrillation was noted	Chest x-ray film showed large right pleural effusion	Chest tube was inserted and the amount of pleural effusion was 750 mL
Present case	2018	53, female	Laparoscopic bilateral salpingo-oophorectomy	15 mmHg	1 h and 40 min	N/A but 750 mL of ADEPT was left in the peritoneal cavity	Desaturation and tachypnea were noted on postoperative day 1	Chest x-ray film showed right massive pleural effusion and Chest CT showed pulmonary embolism	Pigtail catheter was inserted and the amount of pleural effusion was 1165 mL

possible channels of communication between the peritoneal and pleural cavities, which might be regarded as porous diaphragm syndrome, allow fluids to reach the pleural space and are noted as possible causes. Kim et al[6] present the case that pseudo-Meigs syndrome might be associated with benign ovarian tumor and postoperative right hydrothorax.

Venous thromboembolism (VTE) is a major cause of mortality following operation. The significant risk factors for postoperative VTE are obesity, malignancy, a history of VTE, length of surgery >1 hour, and increasing age. According to 9th edition of the American College Chest Physicians (ACCP) guideline, optimal thrombo-prophylaxis in nonorthopedic surgical patients will consider the risks of VTE and bleeding complications.[10] The society of gynecologic surgeons' systematic review group also developed clinical practice guidelines for VTE prophylaxis in women undergoing gynecologic surgery.[11] However, VTE prophylaxis for laparoscopic gynecologic surgery is still unclear.

Barber et al[12] retrospectively analyzed a total of 44 167 patients who underwent hysterectomy for benign conditions, with the following operative methods: open, 12 733 patients (28.8%); laparoscopic, 22 559 patients (51.1%); and vaginal, 8875 patients (20.1%). The total of VTE among all patients who underwent hysterectomy was 154 cases. Seventy-three cases (0.2%) were under minimal invasive surgery, and 81 cases (0.6%) were under open surgery. Minimally invasive surgery had a significantly lower rate of postoperative VTE than open surgery ($p < 0.001$). Barber et al[12] also defined the risk factors of postoperative VTE, including high body mass index, African American race, diabetes, dependent preoperative functional status, longer total operative time, and longer days from operation to discharge. According to this study, the beginning of thrombus formation cannot be determined, and there were no sufficient data on whether prophylaxis was helpful to these women.

According to Mahdi et al,[13] the incidence of VTE within 30 days was low (0.7%) in patients who underwent minimal invasive surgery for gynecologic cancer. They also defined the risk factor of postoperative VTE, including disseminated cancer. However, no difference was found in the risk of VTE based on operative time, need for lymphadenectomy, age, and body mass index. The risk factors associated with VTE in patients undergoing surgery is difficult to determine. Mahdi et al[13] also showed that the 30-day mortality was significantly higher in patients who had VTE within 30 days. However, they did not show evidence to support pharmacologic thromboprophylaxis in patients undergoing minimal invasive surgery for gynecologic cancer. Freeman et al[14] reported in the cohort study that the VTE rate following minimally invasive surgery among women with endometrial cancer was 0.35%, with a pulmonary embolism rate of 0.2%. There were no mortalities due to VTE in this study. Mechanical (sequential compression devices and graduated compression stockings) and pharmacologic prophylaxes have been reported to reduce perioperative VTE after cancer surgery. This study showed that the VTE rate was not different among those who received pharmacologic prophylaxis compared with those who underwent mechanical prophylaxis (0.23% [2/865] vs 0.55% [3/548], respectively, $p = 0.38$). Mechanical prophylaxis is sufficient for women undergoing minimal invasive surgery.

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