CASE REPORT

Porous diaphragm syndrome: haemothorax secondary to haemoperitoneum following laparoscopic hysterectomy

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SUMMARY

The porous diaphragm syndrome is associated with the presence of diaphragmatic fenestrations creating peritoneopleural communications. Such defects may occur in conditions associated with a rise on intra-abdominal pressure including laparoscopic surgery. Thoracic complications of laparoscopic surgery may occur as a result. A 48-year-old woman underwent a total laparoscopic hysterectomy for heavy menstrual bleeding. The postoperative period was complicated by haemoperitoneum resulting in haemothorax secondary to porous diaphragm syndrome. Surgeons and anaesthetists should be aware of the possibility of serious thoracic complications related to laparoscopic surgery.

BACKGROUND

Though rare, severe and potentially life-threatening thoracic complications of laparoscopic surgery may occur. Very few cases of such complications have been reported. In presenting this case we hope to raise the awareness of the potential for such complications and the mechanism involved.

CASE PRESENTATION

A 48-year-old nulliparous woman presented with a history of heavy menstrual bleeding. Transvaginal ultrasound revealed the presence of an enlarged multifibroid uterus, left endometrioma and multiple adhesions. The patient's medical history included a diagnosis of borderline sleep apnoea and a sternal fracture in 1999. No other significant medical or surgical history was identified. Following discussion, the patient opted to proceed with total laparoscopic hysterectomy and bilateral salpingo-oophorectomy. Preoperative haemoglobin was 123 g/L and platelet count was $325 \times 10^9/L$. Intraoperative findings were of a 16-weeks size, multifibroid uterus, multiple dense adhesions and a 3 cm left endometrioma. Total laparoscopic hysterectomy was completed without intraoperative complication and haemostasis was confirmed at the end of the procedure. A four port configuration was used for the procedure. A 10 mm umbilical port was inserted under direct vision and a survey of the abdomen undertaken to exclude any visceral injury. Three 5 mm ports were then inserted under vision. A 5 mm port was inserted in each iliac fossa, lateral to the rectus abdominis muscle approximately 2 cm above and 2 cm medial to the anterior superior iliac spines. A further 5 mm port was inserted approximately 8 cm above and parallel

to the left iliac fossa. The ports were inserted under vision and no inadvertent trauma occurred. Cystoscopy confirmed the presence of ureteric jets bilaterally. Given the complexity of the surgery, a Yeates abdominal drain was left in situ, as is our routine practice. Morphine patient controlled analgesia was provided postoperatively and low-molecular-weight heparin given for thromboprophylaxis.

The patient remained well in the immediate postoperative period and all observations were within normal limits. Early on the first postoperative day 90 mL of haemoserous fluid had collected in the Yeates drain, this was then removed. Observations remained within normal limits. Postoperative haemoglobin was 97 g/L and urine output was satisfactory at ≥ 40 mL/h. The patient remained stable throughout the second postoperative day though complained of anorexia, nausea and migraine and was reluctant to mobilise. Oxygen saturations were 95% on room air. On the third postoperative day the patient complained of shortness of breath on exertion. Oxygen saturations were 85% on room air. A repeat full blood count revealed a fall in haemoglobin to 75 g/L. A clotting profile was normal (PT 13 s, INR 1.1, APTT 28 s, Fib 3.6 g/L). On clinical examination, the right side of the chest was dull to percussion with reduced air entry, a

Figure 1 Chest X-ray. Day 3 postoperation.

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To cite: May J, Ades A.
BMJ Case Rep Published
online: [please include Day
Month Year] doi:10.1136/
bcr-2013-201088

Figure 2 CT of the abdomen/pelvis. Day 3 postoperation.

new clinical finding. A chest X-ray (figure 1) and CT of the abdomen/pelvis (figure 2 and video 1) showed a large right-sided pleural effusion and a moderately large amount of intermediate density material in the pelvis and abdomen consistent with recent haemorrhage centred in the uterine surgical bed.

TREATMENT

Two units of packed red cells were transfused, following which the haemoglobin increased to 93 g/L. Thoracocentesis was performed under ultrasound guidance using a Yueh catheter system and 1050 mL of heavily blood-stained fluid drained. Cytology of the pleural fluid reported heavily blood-stained fluid with mesothelial cells and macrophages. No malignant cells were identified. Following aspiration the patient was asymptomatic with oxygen saturations of 98% of room air. A postaspiration film showed a significant persistent effusion estimated at 800 mL (figure 3). No further fall in haemoglobin was noted and the pelvic haematoma was managed conservatively. Owing to the persistent effusion an opinion was requested from the thoracic team, with particular regard to the need for surgical intervention. A further chest X-ray was requested and performed on the sixth postoperative day (figure 4). This revealed no sign of the residual pleural fluid. It was the opinion of the thoracic team that, since the effusion had resolved and the patient was now asymptomatic no surgical intervention was required presently and conservative management with

Video 1 CT abdomen/pelvis. Day 3 post op.

Figure 3 Chest X-ray. Postaspiration.

respiratory follow-up should be arranged. The patient was subsequently discharged home.

OUTCOME AND FOLLOW-UP

At follow-up 2 weeks postoperatively the patient was asymptomatic and no residual effusion was evident (figure 5). No further follow-up was arranged by the respiratory physicians at this time. Eight weeks postoperatively the patient remained well. Pelvic ultrasound scan demonstrated ongoing resolution of the pelvic haematoma which had significantly reduced in size.

DISCUSSION

The porous diaphragm syndrome¹ is associated with the presence of diaphragmatic fenestrations creating peritoneopleural communications. This has most commonly been reported in association with liver cirrhosis and peritoneal dialysis^{2 3} resulting in right-sided pleural effusion, that is, hepatic hydrothorax. Transdiaphragmatic flow has been demonstrated using intraperitoneal injection of radionuclide.⁴ Huang *et al*⁵ divided diaphragmatic pores into four morphological types, based on thoroscopic findings in patients with hepatic hydrothorax:

1. No obvious defect;
2. Blebs lying in the diaphragm;

Figure 4 Chest X-ray. Day 6 postoperation.

Figure 5 Chest X-ray. Two weeks postoperation.

3. Broken defects (fenestrations) in the diaphragm;
4. Multiple gaps in the diaphragm.

The diaphragm consists of a central tendinous portion and peripheral muscular area. Microscopic examination of the defects, which occur mainly in the tendinous portion, reveals discontinuities in the collagen bundles. Such defects may be congenital or acquired.¹ LeVeen *et al*⁶ postulated that such events arise as a result of small defects in the diaphragm covered by pleura or peritoneum that rupture in association with a rise in intra-abdominal pressure allowing communications to form between the pleural and peritoneal cavities. The creation of an artificial pneumoperitoneum during laparoscopic surgery may then result in the creation of such defects. In the case of endometriosis affecting the diaphragm, defects might arise due to cyclical necrosis of the endometriotic implants.

The predominance of right-sided effusions may be explained by the anatomical differences of the right and left upper quadrant. The liver, given its proximity to the diaphragm, may act as a piston, raising the local intraperitoneal pressure and forcing substances through either pre-existing or acquired diaphragmatic defects.⁷

Though very rare, thoracic complications of laparoscopy have been described including hydrothorax⁸ and pneumothorax.⁹ We believe this to be the first report of haemothorax secondary to haemoperitoneum following gynaecological laparoscopic surgery. Haemothorax has previously been described following abdominal surgery.^{10–11} Vaughan *et al* reported a case of haemothorax secondary to uterine haemorrhage following caesarean section. Thoracotomy and laparotomy were performed revealing a small number of diaphragmatic fenestrations and massive haemoperitoneum resulting in haemothorax.¹¹

Haemothorax has also been described in association with torsion of an ovarian tumour, with fine diaphragmatic fenestrations confirmed at thoracotomy¹² as well as secondary to diaphragmatic endometriosis.¹³ Laparoscopic inspection of the diaphragm at the time of surgery did not reveal signs of endometriosis. Given the timing of events and the finding of haemoperitoneum on postoperative imaging we believe the gradual accumulation of blood from the abdominal cavity via

peritoneopleural communications to be the more likely cause of the haemothorax. Furthermore, the subsequent dramatic resolution of the residual pleural effusion occurred at the time of a significant increase in patient mobility. This change in posture may then have resulted in drainage of the remaining fluid through diaphragmatic fenestrations into the peritoneal cavity.

With the increasing use of laparoscopic surgery we believe that surgeons should be aware of potential thoracic complications including haemothorax and consider the possibility of intra-abdominal bleeding in patients presenting with an apparently spontaneous haemothorax.

Learning points

- ▶ Although rare, operative laparoscopy is associated with potentially serious thoracic complications.
- ▶ In gynaecological surgery such complications are likely to arise as a result of congenital peritoneopleural communications exposed by raised intra-abdominal pressure rather diaphragmatic trauma.
- ▶ The possibility of intra-abdominal haemorrhage should be considered in patients presenting with an apparently spontaneous haemothorax following laparoscopic surgery.

Contributors JM drafted the article. AA revised the article for intellectual content and gave final approval for submission.

Competing interests None.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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