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Endometriosis of the Diaphragm: Four Cases Treated with a Combination of Laparoscopy and Thoracoscopy

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ABSTRACT **Study Objective:** We aim to describe the clinical characteristics and the principles of combined laparoscopic and thoracoscopic management of women with diaphragmatic endometriosis at our institution.
Design: Case series (Canadian Task Force Classification II2).
Setting: Tertiary care referral center.
Patients: Four women with diaphragmatic endometriosis.
Interventions: Laparoscopy and thoracoscopy.
Measurements: We retrospectively reviewed the charts of 4 consecutive women with diaphragmatic endometriosis who underwent laparoscopy and thoracoscopy from June 2008 through September 2008.
Main Results: Four patients underwent a combination of laparoscopy for treatment of abdominopelvic endometriosis and thoracoscopy for treatment of diaphragmatic endometriosis. All patients had a history of chest pain. Three had a history of pelvic pain. Two had a history of catamenial hemothorax or pneumothorax. Two had been previously diagnosed with endometriosis, and three had a history of hormonal pharmacotherapy. All underwent laparoscopy and thoracoscopy without complications. All had uneventful recoveries. At nine-month follow-up, all patients were free of chest pain, and one patient had recurring pelvic pain.
Conclusions: To the best of our knowledge, this constitutes the only reported series of patients with endometriosis who underwent a procedure systematically combining both laparoscopy and thoracoscopy for treatment of abdominopelvic and thoracic disease. It confirms that combined laparoscopic and thoracoscopic diagnosis and management of diaphragmatic endometriosis is reasonable. The inferior aspect of the diaphragm should be evaluated in all patients undergoing laparoscopy for endometriosis. Concomitant thoracoscopy should be considered for all patients with history of catamenial hemopneumothorax, cyclic chest or shoulder pain, or cyclic dyspnea. The aim of treatment should be to remove endometriotic lesions, to provide symptomatic relief, and to avoid recurrence. The use of these minimally invasive techniques may reduce the need for laparotomy or thoracotomy in affected patients. Journal of Minimally Invasive Gynecology (2009) 16, 573–80 © 2009 AAGL. All rights reserved.

Keywords: Laparoscopy; Thoracoscopy; Diaphragmatic endometriosis; Catamenial pneumothorax; Catamenial hemothorax; VATS; Shoulder pain; Videolaparoscopy; Chest pain; Dysmenorrhea; Thoracic endometriosis; Pelvic pain; Video-assisted thoracoscopy

Endometriosis is a common condition affecting predominantly women of reproductive age. It is found in 47 to 65 percent of women under 20 years of age with chronic pelvic pain or dyspareunia, and in only 2 to 4 percent of postmenopausal women requiring laparoscopy. The actual prevalence of endometriosis in all women is therefore difficult to determine, however, it can be estimated at 10 percent [1]. It is defined by the presence of endometrial glands and stroma outside the endometrial cavity. When it occurs in the pelvis, disease can involve the surface of the uterus, as well as the fallopian tubes, ovaries, and pelvic peritoneum. Extrapelvic disease can be found in other areas of the body, including the vagina, vulva, cervix, perineum, inguinal canal, urinary system, gastrointestinal tract, extremities, skin, central nervous system,

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and pulmonary structures [2]. No epidemiologically well-defined studies exist [2], but estimates have been made that extrapelvic disease exists in up to 12% of women with endometriosis [3]. Any estimate, however, depends on the population studied, methods used to make the diagnosis, and on the expertise of the investigators.

Endometriotic involvement of the diaphragm, even in patients affected by extrapelvic disease, is rare. Endometriosis of the diaphragm as a distinct entity was first described by Brews in 1954 [4]. It is most often asymptomatic [5]. When symptoms occur, they commonly consist of chest pain, right upper quadrant pain, and chronic shoulder pain [6,7]. These symptoms may or may not occur in relation to menstruation. Involvement of the right side of the diaphragm occurs significantly more frequently than does involvement of the left or both sides[5,8] and may be reflected in the laterality of symptoms.

Endometriosis of the diaphragm can also present with what is called *thoracic endometriosis syndrome,* an entity that includes catamenial pneumothorax, catamenial hemothorax, catamenial hemoptysis, or intrathoracic endometriotic nodules [9]. This may occur in association with diaphragmatic endometriosis or independent of it [9].

Previous investigators have reported successful treatment with a variety of surgical techniques and combinations that have included laparoscopy [5,10,11], laparotomy [8,12-14], thoracotomy [15-19], and thoracoscopy [20,21]. To the best of our knowledge, the combination of laparoscopy and thoracoscopy in a combined procedure represents a novel systematic approach to diaphragmatic endometriosis. We report our results from a series of patients who underwent treatment of diaphragmatic endometriosis via a combination of videolaparoscopy and video-assisted thoracoscopic surgery at our tertiary referral center.

Materials and Methods

This study is a retrospective case series of 4 women with diaphragmatic endometriosis who underwent laparoscopic and thoracoscopic treatment at Center for Special Minimally Invasive Surgery in Palo Alto, California, from June 2008 through September 2008. Patients were identified through a retrospective chart review of patients undergoing surgery from November 2006 through November 2008.

Chart review was conducted manually (i.e., without the use of prior patient databases). Diagnosis of diaphragmatic endometriosis was based on characteristic lesions, observed during laparoscopy or thoracoscopy, and on histopathologic confirmation in pathology reports on resected tissues.

Patient characteristics were acquired through a systematic review of patient charts. Age, body mass index, gravidity, parity, symptoms, signs, use of hormonal therapies, and previous surgeries for endometriosis were recorded. Findings from physical examinations and radiologic studies were also noted, although preoperative imaging was not routinely done. Information regarding patient symptoms were collected from physician notes in all cases.

Operative reports were reviewed for the surgical procedures. Presence of endometriotic lesions, stage of endometriosis (according to the revised American Society for Reproductive Medicine classification [22]), and intraoperative complications (if any) were recorded. Follow-up notes were reviewed to determine disease recurrence. Approval from the hospital Institutional Review Board was obtained for all chart review activities. No funding or project support was received from any source.

All procedures were performed with patients under general endotracheal anesthesia with use of a double-lumen endotracheal tube for single-lung ventilation. In 3 of the 4 cases, the primary approach was laparoscopy. In 1 case, laparoscopy was performed after thoracoscopy because of surgeon availability. For the laparoscopic portion of the case, patients were placed in the dorsal lithotomy position. A Foley catheter and HUMI (Harris-Kronner Uterine Manipulator Injector; Cooper Surgical, Inc., Trumbull, CT) were placed. Establishment of pneumoperitoneum was performed with the Lap Cap (Aragon, Palo Alto, CA) [23] and was followed by introduction of the primary 10-mm laparoscopic trocar through an umbilical incision. In patients with a history of any abdominal surgery, the mapping technique [24] was used before the introduction of the primary trocar. Patients were then placed in the steep Trendelenburg position. Under visualization with the operative laparoscope, 3 additional 5-mm laparoscopic trocars were inserted: 1 suprapubically and 2 lateral to the epigastric arteries in the left and right lower abdominal quadrants.

Particular attention was paid to the examination of the diaphragm in addition to the routine abdominopelvic exploration completed during the initial phase of laparoscopy. For better visualization of the diaphragm, patients were repositioned in the steep reverse Trendelenburg position for this portion of the procedure. In 1 case, a 5-mm trocar was inserted in the right subchondral space. An atraumatic grasping forceps, liver retractor, or suction irrigation probe was used to push the liver down and away from the operative field to provide better visualization of the posterior surface of the diaphragm.

The final decision for the type of laparoscopic procedure undertaken was made according to the intraoperative findings. Where diaphragmatic lesions appeared superficial, they were vaporized or excised with a combination of hydrodissection, carbon dioxide (CO_2) laser, and bipolar electrocoagulation.

After completion of the laparoscopic portion of the case (with appropriate closure of port sites and skin incisions where indicated), the patients were placed in the left lateral decubitus position to commence the thoracoscopic portion of the case. At this time, the right chest was prepped and draped in the usual sterile fashion. After deflation of the lung on the operative (right) side, a 10-mm thoracoscopic trocar was introduced in the mid axillary line. The 10-mm laparoscope was then introduced through the port for thoracoscopic use. Two additional 5-mm thoracoscopic trocars were introduced under direct visualization; 1 posteriorly and 1 in the anterior axillary line. Exploration of the right thoracic cavity was performed. The pericardium and the superior vena cava were noted.

The innervation points of the diaphragm by the phrenic nerves were clearly identified and protected.

The CO_2 laser was used to vaporize endometriosis lesions. The suction irrigator was routinely placed in 1 of the 5-mm ports to evacuate smoke and water vapor. In 1 case, diaphragmatic defects were repaired with nonabsorbable suture and metal clips. In another case, a portion of the lower lobe of the right lung was resected with an endoscopic stapler. In all cases, after copious irrigation and suction, a chest tube was placed under direct visualization and attached to water seal. The chest tube was removed on the first or second postoperative day after recovery from iatrogenic pneumothorax. No postoperative chest imaging or pulmonary function testing was routinely performed thereafter.

Results

Four patients underwent a combination of laparoscopy for treatment of abdominopelvic endometriosis and thoracoscopy for treatment of diaphragmatic endometriosis. Their characteristics are presented in Table 1.

All patients had a history of chest pain. Three had a history of pelvic pain. Two had a history of catamenial hemothorax or pneumothorax. Two had been previously diagnosed with endometriosis. Three had a history of hormonal pharmacotherapy. These preoperative findings are presented in Table 2.

All patients were diagnosed with severe endometriosis of the pelvis (stage III-IV). All patients had endometriotic lesions of the pelvic peritoneum, both ovaries, and urinary tract (including the peritoneum over 1 or both ureters or the bladder). Only 1 patient had endometriosis of the bowel. All patients had uneventful recoveries without complications and were discharged on the first or second postoperative day.

Case Reports

Case 1

A 41-year-old woman, gravida 2, para 2, presented with a history of chronic pelvic pain and 1 episode of catamenial pneumothorax requiring hospital admission, percutaneous thoracostomy, and management with a Heimlich (flutter) valve for evacuation. She subsequently had at least 6 episodes of right-sided chest pain associated with exercise and physical exertion. These were consistent with pneumothorax but were unconfirmed because the patient did not seek treatment at the time. Three years before, the patient had also had a right pleural effusion during a cycle of in vitro fertilization, which had been attributed to ovarian hyperstimulation. She had no known history of endometriosis, no prior surgeries, and no known medical comorbidities. At the time of presentation, she was taking combined oral contraceptive pills for birth control.

On presentation, her pelvic examination revealed a 1-cm myoma on the anterior uterine wall. Pelvic sonography revealed a 1.4-cm subserosal myoma but was otherwise unremarkable. Her computed tomography (CT) scan 4 months before the surgery had revealed some nonspecific signs of thoracic endometriosis, which included nodular density along the right hemidiaphragm (Fig. 1), a small intraparenchymal nodule in the right midlung, and small areas of plaquelike pleural thickening posteriorly bilaterally. There was a 5-mm noncalcified nodule peripherally in the right lung, as well as a 1.4- × 0.7-cm density around the right hemidiaphragm.

During laparoscopy, extensive endometriosis involving the ovaries, rectum, rectosigmoid colon, and the serosa of both ureters was noted. There was evidence of complete posterior cul-de-sac obliteration. The uterus was enlarged and globular in appearance. Exploration of the upper abdominal cavity revealed endometriosis on the surface of the right hemidiaphragm. Both superficial and deep lesions were noted both anteriorly and posteriorly. There was a 3-cm diaphragmatic defect anteriorly connecting the chest to the abdomen. This was consistent with a diaphragmatic hernia. The left hemidiaphragm appeared to be normal. The endometriotic lesions over the diaphragm were vaporized with a combination of hydrodissection and the use of the carbon dioxide (CO_2) laser. The pelvic endometriosis was treated as well in a manner previously described [24,25].

During the thoracoscopic portion of the procedure, exploration of the right thoracic cavity revealed endometriosis on the pleural side of the diaphragm. Eventration through a diaphragmatic defect was also noted. First, with bipolar energy, the areas of endometriosis on the diaphragm were systematically fulgurated. Then, the diaphragmatic defect was repaired using metal clips and Ethibond (Johnson & Johnson, Piscataway, NJ) nonabsorbable sutures. Mechanical pleurodesis was subsequently accomplished by placing a Bovie scratcher within the thoracic cavity, causing abrasion on the pleural spaces. The chest cavity was thoroughly irrigated, and a chest tube was placed. Recovery was uneventful. At 9-month follow-up, she had no recurrence of pneumothorax and no pain.

Table 1
Characteristics of the study population

Characteristics	
Age (y)	34.5 [31-41]
BMI	21.3 [19.3-23.0]
Nulliparous	25%
Prior diagnosis of endometriosis	50%

BMI = Body mass index.
Data are presented as median [min-max] or No. (%).

Table 2
Preoperative findings

	Case 1	Case 2	Case 3	Case 4
Pelvic pain	Yes	Yes	Yes	No
Chest/shoulder pain	Yes	Yes	Yes	Yes
Catamenial hemothorax/pneumothorax	Yes	No	No	Yes
History of endometriosis	No	Yes	Yes	No
Hormonal pharmacotherapy	OCP	OCP	Leuprolide	No

OCP = Oral contraceptive pill.

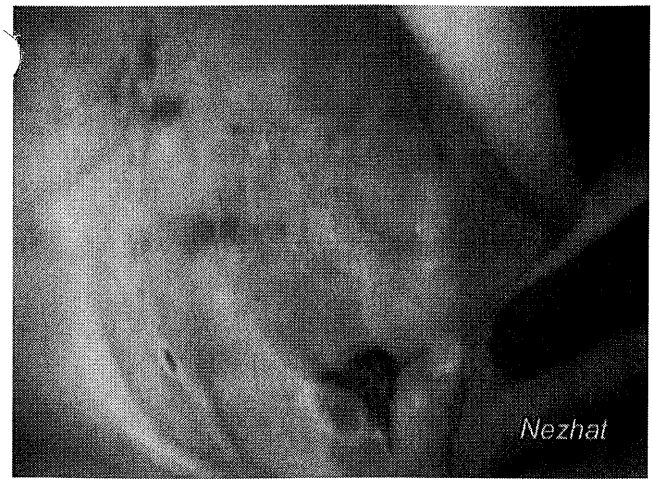


Fig. 1. Case 1. Lesion of endometriosis on inferior surface of right hemidiaphragm.

Case 2

A 31-year-old nulliparous woman presented with a history of chronic pelvic pain, as well as catamenial chest, back, and shoulder pain. She had a history of extensive endometriosis for which she had undergone laparoscopy 5 times and was taking combination oral contraceptive pills. Diaphragmatic endometriosis had been diagnosed during a prior laparoscopy. The patient had no known history of catamenial pneumothorax or hemothorax and no known medical comorbidities. She did admit to intermittent long-term tobacco use. Pelvic examination and ultrasonography during her initial consultation revealed a 3.8-mm right ovarian cyst but was otherwise unremarkable.

Laparoscopy revealed extensive endometriosis involving the ovaries, fallopian tubes, rectovaginal septum, and the serosa of both ureters. There were scattered endometriotic lesions around the rectosigmoid colon causing a slight narrowing of the colon approximately 25 cm from the dentate line. Exploration of the upper abdominal cavity revealed several small endometriotic lesions of the right hemidiaphragm and some filmy adhesions from the right side of the diaphragm to the posterior surface of the liver. The endometriotic lesions were vaporized with a combination of hydrodissection and a CO_2 laser. The perihepatic adhesions were divided, and, after complete treatment of extensive pelvic endometriosis [24,25], the laparoscopic portion of the procedure was terminated.

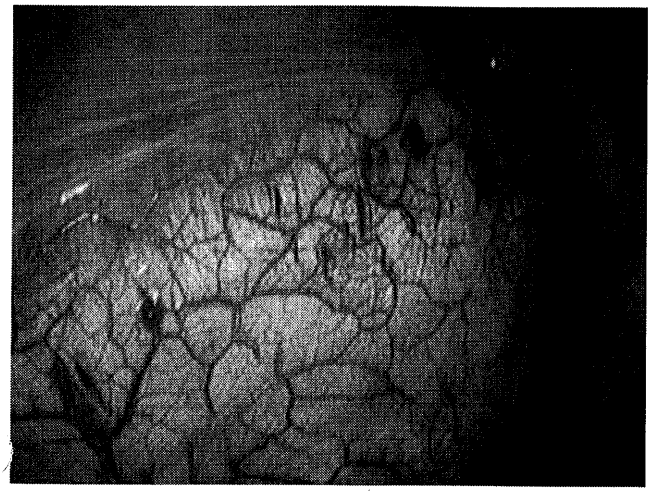


Fig. 2. Case 4. Diaphragmatic fenestrations and endometrial implants—right pleural surface.

Endoscopic exploration of the right thoracic cavity revealed areas of clustered endometriosis involving the dome of the diaphragm posteriorly at the junction of the tendinous and muscular portions. These areas of endometriosis were fulgurated with the CO_2 laser. The chest cavity was thoroughly irrigated, and a chest tube was placed. Recovery was uneventful. The patient reported no more chest pain at her nine-month follow-up.

Case 3

A 31-year-old nulliparous woman presented with a history of chronic pelvic pain, as well as catamenial chest and shoulder pain. The patient had history of extensive pelvic endometriosis for which she had undergone total abdominal hysterectomy 2 years before. Endometriosis of the diaphragm was diagnosed 1 year later at the time of laparoscopic appendectomy and cholecystectomy. Prior therapy for endometriosis had also included leuprolide acetate, which was discontinued because of patient intolerance to side-effects. The patient had no known history of catamenial pneumothorax or hemothorax and no known medical comorbidities. The results of her pelvic examination and ultrasound scan were unremarkable. Her preoperative chest CT showed a small nodule within the right midlung zone.

Laparoscopy revealed evidence of superficial endometriosis involving the dome of the bladder and the serosa of the right ureter with deeper involvement of the left ureter. Endometriosis was also noted to involve the rectovaginal septum and both pelvic side walls. Both fallopian tubes and ovaries were densely adherent to the surface of the ureters and the rectum. The rectosigmoid colon was adherent to the vaginal cuff. There were smaller lesions consistent with endometriosis scattered throughout the pelvis.

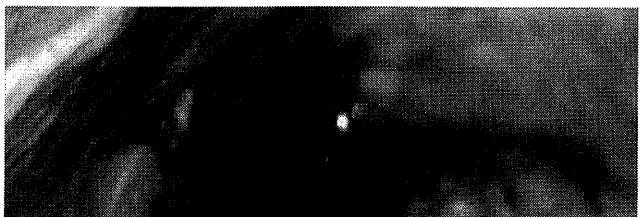
Exploration of the upper abdomen revealed severe endometriosis of the right hemidiaphragm, with approximately 20 to 30 individual lesions of varying depth. An additional 5-mm laparoscopic trocar was inserted into the subxiphoid area to aid in exposure of the posterior portion of the diaphragm. The lesions on the diaphragm were then fulgurated with the CO_2 laser. Excision of a portion of the diaphragm was considered because of the extent of the disease but was thought to be inadvisable because such a procedure would have left a large defect. Further treatment was deferred to the thoracoscopic portion of the case. Attention was turned to the pelvis where complete treatment of severe endometriosis [24,25] necessitated extensive ureterolysis and placement of a left ureteral stent.

Fig. 3. Case 4. Apex of right lung in grasper.

Exploration of the right thoracic cavity indicated areas of endometriosis involving the dome of the diaphragm in several clusters. These were treated with a combination of CO_2 laser fulguration and application of bipolar energy. Care was taken to protect the phrenic nerve, the putative location of which was identified in close proximity to a cluster of endometriosis lesions. The chest cavity was thoroughly irrigated, and a chest tube was placed. Recovery was uneventful. At her nine-month follow-up, the patient reported minimal to no chest pain; however, she rated her pelvic pain as 7 out of 10.

Case 4

A 37-year-old woman, gravida 1, para 1, presented with a history of chronic chest pain and 1 episode of catamenial hemopneumothorax 10 days before surgery. This had been treated with percutaneous tube thoracostomy on the right side. The patient had no known history of endometriosis or hormonal pharmacotherapy but did admit a history of infertility and 1 (successful) cycle of in vitro fertilization. She had no known medical comorbidities. The results of her pelvic examination and ultrasound scan were unremarkable.



Laparoscopy revealed endometriosis of the anterior and posterior cul-de-sac, both ovaries, and both pelvic sidewalls. The uterus was noted to be globular in appearance. Exploration of the upper abdominal cavity revealed 3 areas of endometriosis on the right hemidiaphragm (Fig. 2). These lesions were vaporized with a combination of hydrodissection and the CO_2 laser. All areas of pelvic endometriosis were thoroughly treated [24,25], and the laparoscopic portion of the procedure was terminated.

Exploration of the right thoracic cavity showed some remaining serosanguinous fluid that was suctioned and removed. Areas appearing consistent with endometriosis were noted to involve the apex of the right lung (Fig. 3) and the dome of the right hemidiaphragm. These were treated with CO_2 laser fulguration. Adhesions from the lung to the pleura over the chest wall were divided.

The apex of the right lung was further inspected because it was surrounded by blood and older clots (Fig. 4). This area was thought to be implicated in the recent episode of hemothorax. The apex of the lung was then resected with the Endo-GIA stapler (Covidien, Mansfield, MA) (Fig. 5). Pathologic examination of the lung specimen later revealed organizing hemorrhagic and fibrous pleuritis but was negative for endometriosis. The chest cavity was thoroughly irrigated, and a chest tube was placed. Recovery was uneventful. The patient has had no recurrences of chest pain or hemothorax at 9 months of follow-up.

Discussion

The estimated prevalence of endometriosis in a given population ranges between 10% to greater than 50% depending on the group of women studied [26,27]. The peritoneal cavity, especially the pelvis, contains the sites most frequently involved, but endometriosis of virtually all body compartments has been reported [1]. The occurrence decreases as centrifugal distance from the uterus increases [28]. Interestingly, endometriosis involving the heart and spleen have not been reported [2,29].

Because endometriosis is a disease characterized by the proliferation of estrogen-dependent tissue, it is prevalent in the reproductive years, with a peak incidence found between ages 30 and 45 [30]. The median age at diagnosis is some

Fig. 5. Case 4. Resection of apex of right lung with endoscopic stapler.

endometriosis are symptom free [5], the diagnosis should be considered in any female patient of reproductive age who complains of chest pain, right upper quadrant pain, or chronic shoulder pain [6,7], especially when occurring in relation to menses or without other explanatory clinical findings [31]. These referred pain symptoms may be the result of hormonal activation of endometrial tissue located on the diaphragm, stimulating sensation in the distribution of the C5 nerve root. The intensity of the symptoms seems to be correlated with the location, depth of infiltration, and the tendency of some of these lesions to involve neural structures [32].

Diaphragmatic endometriosis may arise independently or in association with thoracic endometriosis [9]. Catamenial pneumothorax, or recurrent pneumothorax associated with menses, is the most common presentation of thoracic endometriosis and is considered pathognomonic [33]. Catamenial pneumothorax, which is responsible for up to one third of pneumothoraxes in women [34,35], can occur in isolation or in concert with other conditions included in the spectrum of thoracic endometriosis syndrome. These include catamenial hemothorax, catamenial hemoptysis, and intrathoracic endometriotic nodules [9]. Interestingly, confirmatory histologic findings at the time of surgery for thoracic endometriosis are rare [36].

Diaphragmatic endometriosis presents several diagnostic problems resulting from similarities in clinical symptoms to other disorders, both benign and malignant. In our case series, all patients had symptoms. Three of them presented with chest pain, 2 had catamenial pneumothorax, 1 had right upper quadrant pain, and 1 right shoulder pain. Reasonable differential diagnoses for patients presenting with atypical chest symptoms may have included various cardiovascular, hematologic, fibromuscular, gastrointestinal, and even psychiatric conditions. Operative findings, including perihepatic adhesions in the context of pelvic disease, may also have been confused with Fitz-Hugh and Curtis syndrome [37].

CT or magnetic resonance imaging may play a role in the establishment of a diagnosis. The tomographic appearance of endometriosis in the pelvis and other sides has been described [38-41], but these are variable and nonspecific. Lesions of thoracic endometriosis may appear as small cystic defects of condensations on chest radiograph or CT scan [2]. It has been suggested that CT scanning during menstruation may increase the sensitivity of detection [2]. Magnetic resonance imaging may be better suited to diagnosing and defining the extent of endometriosis [30], but additional studies are needed. Chest imaging may also be entirely negative [2] or of little utility [8].

Treatment of suspected thoracic or diaphragmatic endometriosis may be undertaken on the basis of an appropriate history alone and the patient observed for appropriate response. Specifically, intractable right upper quadrant and chest pain or hemopneumothorax are indications for diagnostic thoracoscopy in conjunction with laparoscopy. Attempts at various hormonal pharmacotherapies (i.e., danazol, oral contraceptives) have been reported and are an attractive option for those desiring to avoid thoracic surgery. But recurrence rates after discontinuation of medication approximate 50% [42]. Suppressive hormonal medications that allow for menstruation to occur are generally ineffective, even in patients who have had hysterectomy and bilateral salpingo-oophorectomy [43]. Long-term use of GnRH agonists is associated with serious health risks. However, short-term therapy with GnRH agonists such as leuprolide acetate may be of utility in patients for whom surgery cannot be scheduled within their current cycle or in postoperative patients in whom maturation of adhesions is desired before challenging pleurodesis [43].

Chemical pleurodesis, pleurectomy, or segmental resection may be necessary for treatment of hemopneumothorax or pneumothorax and in patients with pulmonary parenchymal disease [2]. Indeed, pleurodesis is the treatment of choice for most patients with recurrent hemothorax or pneumothorax. However, the use of thoracoscopy confers several advantages. It allows resection of apical blebs and parenchymal implants on the lung, ablation, or resection of diaphragmatic implants, as well as excision or closure of diaphragmatic fenestrations without the longer hospital stay and greater postoperative pain associated with thoracotomy.

Concerns regarding the adequacy of minimally invasive techniques in diagnosing and treating diaphragmatic endometriosis have been raised by other investigators [8]. Laparoscopy with umbilical port placement allows visualization of the anterior portion of the right hemidiaphragm, as well as almost the entire left hemidiaphragm. The right lobe of the liver, however, obscures the posterior portion of the diaphragm on that side. Unfortunately, the area that is obscured includes the junction between the diaphragm and the posterior edge of the liver, a common site of significant and invasive disease. It has been suggested that the surgeon may search via laparoscopy for "sentinel lesions" on the anterior right hemidiaphragm, which, if present, would argue for examination of the posterior portion of the diaphragm (via laparotomy, an additional port placement in the right subchondrium, or the use of

a flexible laparoscope [44]). However, this practice may miss most clinically significant lesions, especially if these "sentinel" lesions are mistaken to represent most of the disease burden in the upper abdomen [8].

We believe that through the systematic combination of laparoscopy and thoracoscopy, an approach that has not been previously reported, these shortcomings have been overcome. In a series of 8 patients treated with a combination of laparoscopy and laparotomy in 2002, investigators reported that lesions associated with symptomatic endometriosis were characterized by involvement of the full thickness of the diaphragm and that discoloration could be seen on the pleural surface in 100% of cases [8]. In that case, the use of thoracoscopy in combination with laparoscopy would prevent underdiagnosis of posterior diaphragmatic lesions through the use of "sentinel lesions." Diaphragmatic endometriosis lesions could then be fulgurated or excised thoracoscopically wherever clinically indicated without the need for laparotomy. Thoracoscopic treatment would also allow treatment of diaphragmatic fenestrations, as well as concomitant pleural and parenchymal lung disease as described above.

The true prevalence of asymptomatic diaphragmatic endometriosis is unknown because most surgeons performing laparoscopy through an umbilical port would consider it excessive to place all patients in reverse Trendelenburg position and consider additional port placement to examine the posterior diaphragm. Although it has been established that the treatment of asymptomatic disease by laparotomy and diaphragmatic resection cannot be justified, treatment of superficial asymptomatic disease can be safely accomplished laparoscopically [5,8,10]. The addition of thoracoscopy in selected patients would offer more thorough evaluation and treatment without necessitating laparotomy or thoracotomy.

Conclusion

Endometriosis remains a challenge for clinicians and patients alike. The difficulties include variations in symptoms, pathophysiology, and a poor understanding of the progression of the disease. Therefore focus falls squarely on developing effective treatment options. It is our belief that, when chest pain, shoulder pain, hemothorax or pneumothorax or hemoptysis occur in women of reproductive age, a diagnosis of diaphragmatic or thoracic endometriosis must be considered. If surgery is indicated, thorough laparoscopic evaluation and treatment of the inferior surface of both the right and left hemidiaphragms can be accompanied by thoracoscopic evaluation and treatment of the diaphragm on the symptomatic side. Treatment of any suspicious lesions can then be conducted with excellent outcomes and without the need for laparotomy.

The techniques used in our series demonstrate the feasibility of a minimally invasive approach and underscore the importance of concomitant surgical treatment of coexisting pelvic disease. These procedures are best accomplished via a multidisciplinary approach in a tertiary endometriosis treatment center.

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