Laparoscopic management of endometriosis

Diaa M. El-Mowafi, MD
Professor, Obstetrics and Gynecology Department
Benha Faculty of Medicine, Egypt
Educator & Researcher, Wayne State University, Detroit, MI USA
Fellow, Geneva University, Switzerland
Consultant & Head of Obstetrics and Gynecology Department,
King Khalid General Hospital, Hafr El-Batin, Saudi Arabia
E.mail dmowafi@yahoo.com

How to cite this article:
El Mowafi DM. Laparoscopic management of endometriosis. *Geneva Foundation for Medical Education and Research*. 16 Nov. 2006.

Available from:
http://www.gfmer.ch/Presentations_En/Pdf/Laparoscopic_management_endometriosis_Mowafi_2006.pdf

Endometriosis is a significant health problem for women of reproductive age. Defined as the presence of endometrial-like glands and stroma in any extrauterine site. It is a disease that has fascinated gynecologists for more than a century.

Incidence

Endometriosis occurs in 7-10% of women in the general population and up to 50% of premenopausal women (1), with a prevalence of 38% (range, 20-50%) (2,3,4) in infertile women, and in 71-87% of women with chronic pelvic pain (5,6,7). Contrary to much speculation, there are no data to support the view that the incidence of endometriosis is increasing, although improved recognition of endometriosis lesions (8) may have led to an increase in the rate of detection. There also appears to be no particular racial predisposition to endometriosis.

A familial association of endometriosis has been documented (9), and patients with an affected first-degree relative have nearly a 10-fold increased risk of developing endometriosis.

Etiology

Although the pathogenesis of endometriosis remains unclear, leading theories include retrograde menstruation, hematogenous or lymphatic transport, and coelomic metaplasia. It has been suggested that virtually all women are potentially vulnerable to the development of the lesions of endometriosis, but appropriate immunocompetency in most eradicates such lesions in a timely fashion, preventing clinical sequelae (10). Menstrual flow that produces a greater volume of retrograde menstruation may increase the risk of developing endometriosis. Cervical or vaginal atresia with outflow obstruction also is linked with the development of endometriosis (11). Early menarche, regular cycles (especially without intervening pregnancy-induced amenorrhea), and a longer and heavier than normal flow are associated with this disease (12). Because endometriosis is an estrogen-dependent disease, factors that reduce estrogen levels, such as exercise-induced menstrual disorders, decreased body-fat content, and tobacco smoking, are associated with reduced risk of developing endometriosis (12). The commonest sites for endometrial implantation within the pelvis are the ovaries, broad and round ligaments, Fallopian tubes, cervix, vagina and pouch of Douglas. The gastrointestinal tract may be involved in about 12% of cases and the urinary tract is affected in about 1%.

Clinical Manifestations

The clinical manifestations of endometriosis are variable and unpredictable in both presentation and course. Dysmenorrhea, chronic pelvic pain, dyspareunia, uterosacral ligament nodularity, and adnexal mass (either symptomatic or asymptomatic) are among the well-recognized manifestations (13,14,15,16). A significant number of women with endometriosis remain asymptomatic.

The association between endometriosis and infertility remains the subject of considerable debate.

Pelvic pain that is typical of endometriosis is characteristically described as secondary dysmenorrhea (with pain frequently commencing prior to the onset of menses), deep dyspareunia (exaggerated during menses), or sacral backache with menses. Endometriosis that involves specific organs may result in pain or physiologic dysfunction of those organs, such as perimenstrual tenesmus or diarrhea in cases of bowel involvement or dysuria and hematuria in cases of bladder involvement.

The pain associated with endometriosis has little relationship to the type or location of the lesions that are visible at laparoscopy (17).

Diagnosis

Direct visualization confirmed by histologic examination, especially of lesions with nonclassical appearance (18, 19, 20), remains the standard for diagnosing endometriosis. The presence of two or more of the following histologic features is used as the threshold criteria for the diagnosis by a pathologist (21):

- Endometrial epithelium
- Endometrial glands
- Endometrial stroma
- Hemosiderin-laden macrophages

Visual inspection as the sole means for making the diagnosis of endometriosis requires an experienced surgeon who is familiar with the protean appearances of endometriosis. Experience is associated with increased diagnostic accuracy (8, 18, 19), but the correlation between visual inspection and histologic confirmation of the presence of endometriosis in biopsy specimens is imperfect (19).
Although laparoscopy remains the investigation of choice in the diagnosis of endometriosis, imaging does play a significant role in its management.

Currently available laboratory tests lack the necessary sensitivity and specificity to serve as reliable screening tests for endometriosis, although there is growing evidence that carcinoembryonic antigen CA125 may help to evaluate selected populations at risk, to follow the course of the disease and to monitor response to treatment (22).

Imaging Studies

Ultrasound

High resolution images may be obtained via the transvaginal approach using a 7.5 mHz probe. Sensitivity in the detection of focal endometrial implants is poor. However, the detection of endometriomas using ultrasound is excellent, with reports of 83% sensitivity and 98% specificity. Diagnostic accuracy may be enhanced by Doppler flow studies where blood flow in endometriomas is usually pericystic with a resistive index above 0.45(23).

There is a broad range of ultrasound appearances of endometriomas. Diffuse, low level internal echoes occur in 95% of endometriomas. Hyperechoic wall foci and multilocularity also point towards an endometrioma (24).

CT

Endometriomas may appear solid, cystic, or mixed solid and cystic, resulting in an overlap in the appearances with an abscess, ovarian cyst or even a malignant lesion. Owing to the poor specificity and high radiation dose, use of CT in the evaluation of pelvic endometriosis has been replaced by MRI.

MRI

Identification of endometriomas by MRI relies on detection of pigmented haemorrhagic lesions. Signal characteristics vary according to the age of haemorrhage. (a) Typically, lesions appear hyperintense on T_1 weighted spin echo (T1WSE) images and hypointense (shading) on T_2 weighted turbo spin echo (T2WTSE) images owing to the presence of deoxyhaemoglobin and methaemoglobin. (b) Acute haemorrhage occasionally appears hypointense on T1WSE and T2WTSE sequences. (c) Old haemorrhage occasionally appears hyperintense on T1WSE and T2WTSE images (23).

Endometrial implants are often small and express signal intensity similar to that of normal endometrium on both T1WSE and T2WTSE images (24). Depending on hormonal influences, they exhibit varying degrees of haemorrhage.

Endometriosis and Infertility

Treatment options for endometriosis-associated infertility include medical therapy, surgical intervention, and assisted reproduction. For endometriosis-associated infertility, medical therapy seems to have no value alone. Surgical therapy is beneficial for all stages of diseases, as well as assisted reproduction. The suggestion for the treatment of early-stage endometriosis is surgery and/or superovulation with intrauterine insemination as first-line treatments. For more advanced disease, with tubal damage, surgery or in vitro fertilization are options. For the most advanced cases, in vitro fertilization preceded by 3 months of medical treatment of the endometriosis is advised (25).

The goal of conservative surgery is to remove all apparent endometriosis from the abdomen and pelvis and restore normal anatomical relations. Actually, no proved difference in efficacy between the open and endoscopic surgery for endometriosis (26). However, the cost is lower, and the recovery time shorter with laparoscopy, even in women with advanced endometriosis.

A variety of instruments have been used in the treatment of endometriosis, ranging from scissors and monopolar cautery to multiple types of lasers and ultrasonic scalpels. There is no evidence that any of these instruments is superior to others in terms of efficacy in removing implants of endometriosis or lower frequency of complications.

Another pertinent issue involves the method of destruction of implants. Options include excision, vaporization, and the combination of fulguration and desiccation. These techniques have not been compared with one another in randomized trials, despite the fact that each approach has vocal proponents. In one retrospective study comparing the fertility rates in 101 women with early-stage disease treated by the excision of implants or by electrocoagulation, there was no difference between the two treatments (27).

Laparoscopy versus Laparotomy

The era of operative laparoscopy started in the 1980s and expanded to involve most of the previous traditional pelvic surgery. The advantages of endoscopic surgery are claimed to be reduction of hospital stay, postoperative pain, length of abdominal incision, and expense. One of the claims is the reduction of subsequent postoperative adhesion formation. This view is supported in theory by the concepts of lack of retractors and packs usage at laparoscopy, maintaining a closed abdomen with presumed reduction in peritoneal drying, less likelihood of introduction of foreign bodies, decreased possibility of blind dissection of adhesions during abdominal exploration and less tissue damage at the abdominal wall incision(s) compared to that of laparotomy. Luciano and co-worker (28) have demonstrated no intra-abdominal adhesions in rabbits with the lesions created laparoscopically, whereas those lesions created at laparotomy were consistently followed by adhesion formation. Furthermore, the investigators then assigned those animals with adhesions to adhesiolysis at laparotomy or laparoscopy and demonstrated greater reduction in adhesion reformation following laparoscopic adhesiolysis. In their study, Nezhat and co-worker(29) reported no de novo adhesion formation at non-operated sites at a second look laparoscopy done 4-8 months after laser laparoscopy for the treatment of endometriosis associated infertility in 157 patients. An overall 60-79% reduction in adhesions in patients undergoing adhesiolysis was observed. Diamond and co-workers (30) described in a multicenter study a high (97%) incidence of adhesion reformation seen at early (90 days) second-look laparoscopy following laparoscopic adhesiolysis. Moreover, adhesion reformation occurred regardless of the consistency or vascularity of the initial adhesion. This incidence is consistent with that previously reported following adhesiolysis at laparotomy, therefore they concluded that adhesion reformation would not be able to be eliminated by utilization of endoscopic surgery per se. Their report also pointed to a 12% of patients who developed de novo adhesions.
At this time, it seems that there is no clear and convincing evidence that laparoscopic adhesiolysis in humans is superior to microsurgical lysis of adhesions at laparotomy in terms of adhesion reformation or subsequent pregnancy.

Open surgery

This is the usual method of approaching the more severe degrees of endometriosis, particularly where endometriomas are large and there is more extensive scarring involving the bowel and bladder.

Hysterectomy is an end-stage treatment for women who have completed their family and where endometriosis is severe. It is usual to suggest removal of the ovaries, particularly in a woman who is over the age of 40 or where the disease is particularly

severe. Hormone replacement therapy will protect the bones and avoid the menopausal symptoms.

Laparoscopic management of endometriosis

Laparoscopic appearance of endometriosis

Even by the eyes of experienced laparoscopist who has treated hundreds of endometriosis patients can miss 7% or underdiagnose 50% of lesions (31). The gross appearance of endometriosis is a result of several factors, including the relative proportion of glands and stroma, amount of scarring, intralesional bleeding and quantity of haemosiderin. While the relative contribution of the above factors results in a continuum of visual appearances, the most commonly described types of endometriosis include scarred white lesions, strawberry-like reddish lesions, red flame-like lesions, reddish polyps, clear vesicular lesions, adhesions, peritoneal defects, yellow-brown patches and black puckered lesions. Histologically, lesions were confirmed in 90% of typical dark black lesions, 81% of white opacified, 75% of red-flame-like, 67% of glandular lesions, 50% of subovarian adhesions 48% of intraovarian cysts, 47% of yellow-brown patches, 45% of circular peritoneal defects, 33% of hemosiderin lesions, and 13-15% of normal peritoneum (32).

The laparoscopic management of endometriosis usually includes: lysis of pelvic adhesions, dissection of ovaries from cul-de-sac or pelvic sidewall, tubes freed and chromopertubated, fulguration of endometrial implants, resection of endometriomas, and uterosacral nerve ablation or presacral nerve resection for chronic pelvic pain.

Lysis of Pelvic Adhesions

The bowel and omentum carefully dissected from the parietal and visceral peritoneum. The large vessels are occluded using laparoscopic clips, electrosurgyl, or laser. A 5 mm atraumatic grasping forceps is used to grasp either bowel or omentum, and then attempt blunt dissection and aquadissection. KTP laser may be used to vaporize thicker bands. If bleeding cannot be controlled with KTP laser, endoloop sutures or clips can be placed.

Resection of Ovarian Endometriosis

Endometrial implants or endometriomas less than 2 cm in diameter are coagulated, laser ablated or excised using scissors or biopsy forceps. For successful eradication, all visible lesions and scars must be excised from the ovarian surface. Endometriomas more than 2 cm diameter must be resected thoroughly to prevent recurrence. Draining the endometrioma or partial resection of its wall is inadequate because the endometrial tissue lining the cyst is likely to remain functional and can cause the symptoms to recur (33). However, photocoagulation of the cyst wall has been equally therapeutic and occasionally less difficult (34, 35, 36). For endometriomas over 2 cm in diameter, the cyst is punctured with the 5-mm trocar and aspirated with the suction probe. Using high pressure irrigation, at 500-800 mmHg, the cyst is irrigated, causing it to expand, and aspirated several times (37). Following the repeated expansion and shrinkage with irrigation and suction, the cyst wall should separate from the surrounding ovarian stroma. If it doesn't, 5-20 ml of lactated Ringer's is injected between the stroma and cyst wall (37). The cyst wall is removed by grasping its base with laparoscopic forceps and peeling it from the

ovarian stroma. If unsuccessful, the wall is separated from the ovarian cortex with forceps at the puncture site. A cleavage plane is created by pulling the two forceps apart and by cutting between the structures with laser or needle electrode (Figure 1). The blood vessels supplying the endometrioma are usually small enough to be cut and coagulated simultaneously.

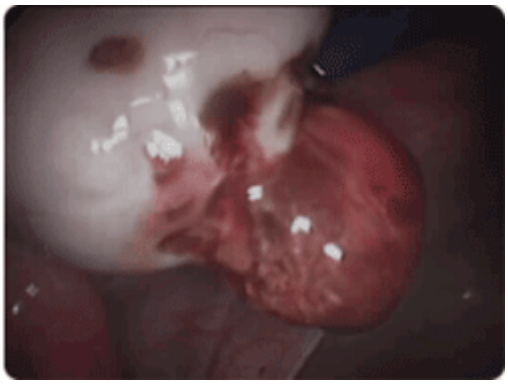

Fig.1. Removal of chocolate cyst from the ovary

Cyst wall closure is not necessary according to animal experiments (38) and clinical experience (39). For large defects that result from resecting endometriomas larger than 5 cm, the edges of the ovarian cortex are approximated with a single suture placed within the ovarian stroma. The knot is tied inside the ovary, so that no part of the suture penetrates the ovarian cortex or exposed to the ovarian surface so as to minimize adhesion formation. Fibrin sealant has been described to atraumatically approximate the edges of large ovarian defects, without adhesion formation (40).

In rare cases of unilateral ovarian affection, a unilateral salpingo-oophrectomy for the diseased ovary will decrease the recurrence rate and improve the fertility potential by limiting ovulation to the healthy ovary (41).

The number of oocytes and embryos obtained was not significantly decreased by laparoscopic cystectomy, suggesting that in experienced hands this procedure may be a valuable surgical tool for the treatment of large ovarian endometriomas. However, great care must be taken to avoid ovarian damage (42).

Genitourinary Endometriosis

Involvement of the ureter in endometriosis was reported in 1% to 11% of patients (43). Endometriosis of the urinary tract tends to be superficial but can be invasive and cause complete ureteral obstruction. Superficial implants over the ureter are generally treated by hydrodissection. Twenty to thirty ml of lactated Ringer's is injected subperitoneally on the lateral pelvic wall to elevate the peritoneum and back it with a bed of fluid. The CO2 laser is used to create a 0.5 cm opening on this elevation. The opening in the peritoneum is made anteriorly and laterally, close to corresponding round ligament. The hydrodissection probe is inserted into the opening and around 100 ml of lactated Ringer's is injected under 300 mm Hg pressure into the retroperitoneal space along the course of the ureter. After creating the water bed, CO2 laser is used to vaporize or excise the lesion with a circumference of 1-2 cm.

Laparoscopic ureteroureterostomy was first performed for ureteral obstruction due to endometriosis by Nezhat and colleagues in 1990 (44). Under cystoscopic guidance ureteral catheter is passed through the ureterovesical junction up to the level at which the CO2 laser is used to open the ureter. Indigocarmine is injected intravenous to insure patency of the proximal ureter. The distal ureter was transected over the catheter, and the obstructed portion was removed. The ureteral catheter was introduced into the proximal ureter and advanced into the renal pelvis (Fig. 2, 3). Finally the edges of the ureter were reapproximated with four interrupted 4/0 polydioxanone sutures (PDS).

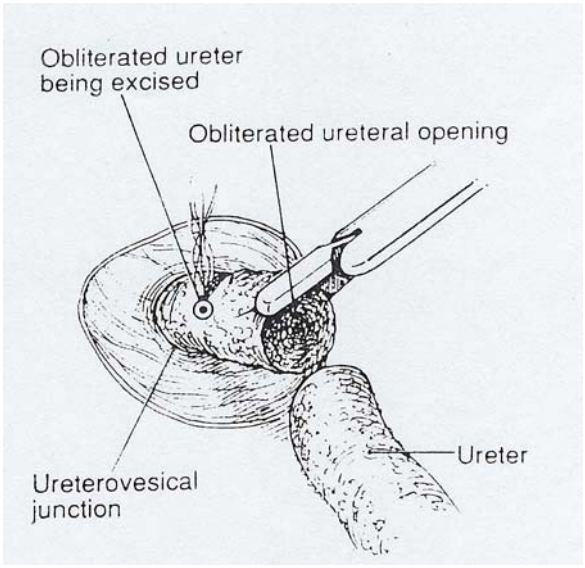

Fig. 2. Excision of obliterated ureter

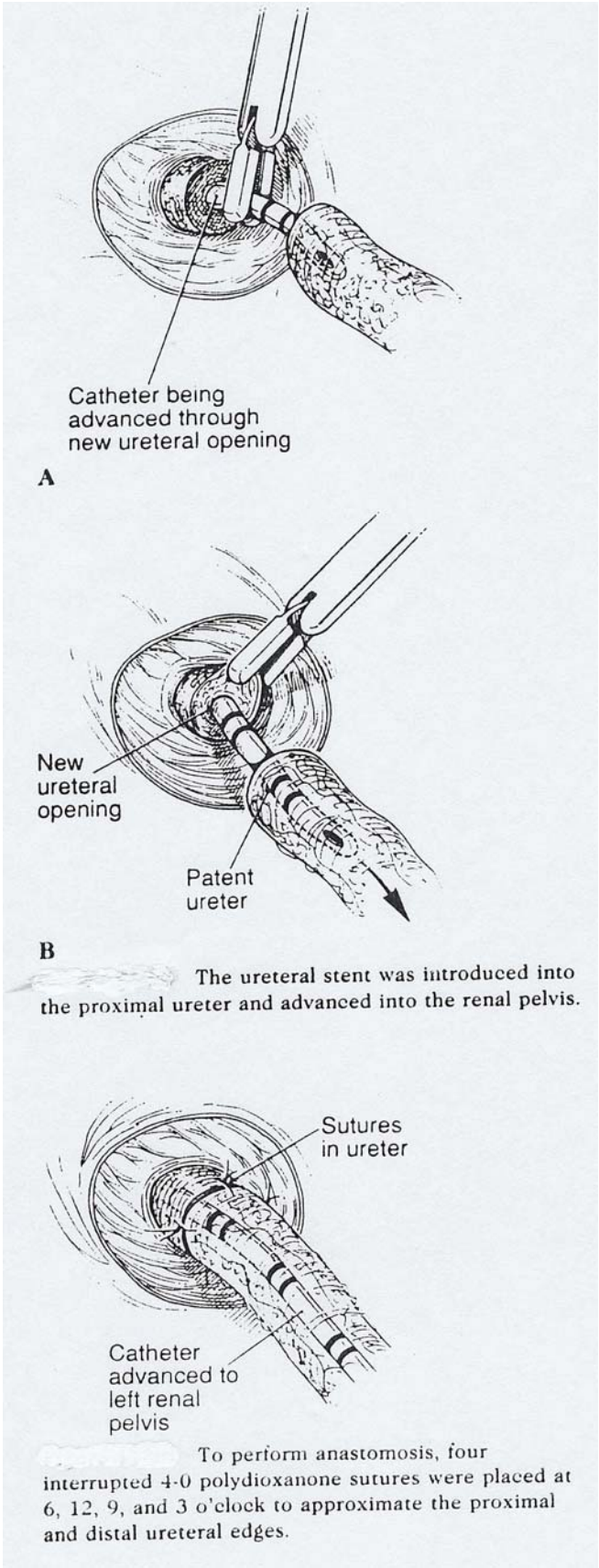

Fig. 3. Applying ureteral catheter and reanastomosis of the ureter

Bladder endometriosis lesions are vaporized after hydrodissection if they are superficial. The lesion is circumcised with the laser and fluid is infused into the resulting defect. The lesion is grasped with forceps and dissected with the laser. Traction allows the small blood vessels supplying the surrounding tissue to be coagulated as the lesion is resected (Fig. 4). Frequent irrigation is necessary remove char, ascertain the depth of vaporization, and ensure that the lesion does not involve the mascularis and the mucosa.

Endometriosis extending to the muscularis but without mucosal involvement can be treated laparoscopically and any residual or deeper lesions may be treated successfully with postoperative hormonal therapy (45). When endometriosis involves full bladder wall thickness, the lesion is excised and the bladder reconstructed. Simultaneous cystoscopy is performed and bilateral ureteral catheters are inserted. CO2 gas distends the bladder cavity, allowing excellent observation of its interior (Fig. 4). After again identifying the ureters and examining the bladder mucosa, the bladder is closed in with several interrupted 4-0 polydioxanone through-and-through sutures using extracorporal or intracorporeal knots.

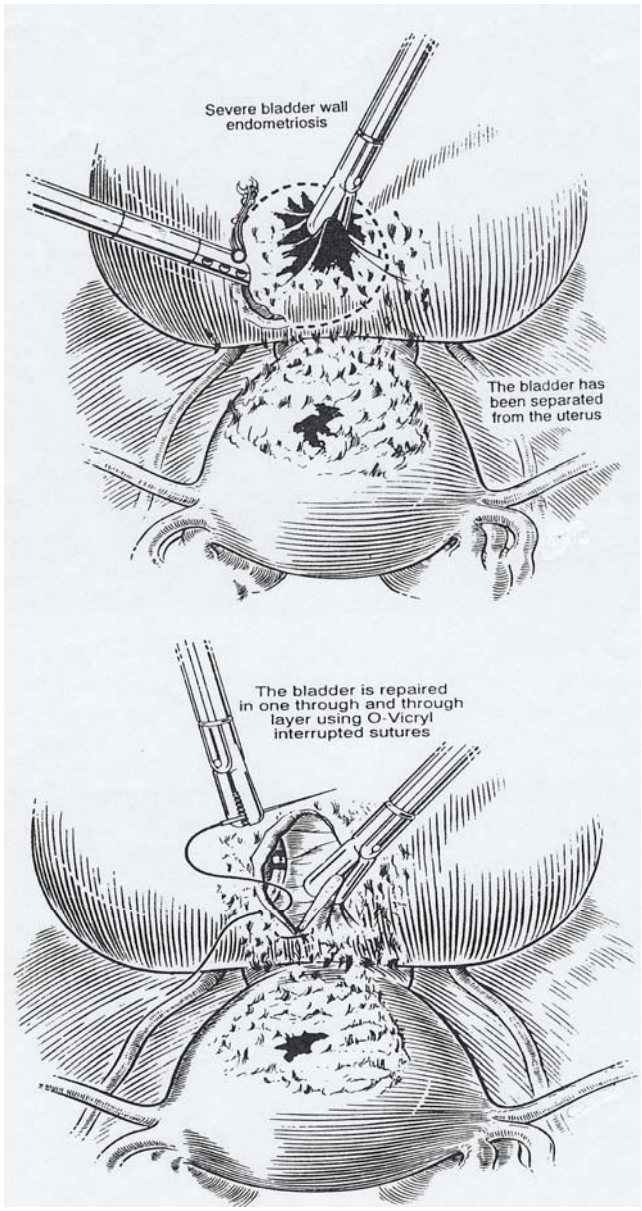

Fig. 4. Excision of endometriosis and repair of the bladder

Gastrointestinal Endometriosis

The gastrointestinal tract is involved in 3% to 37% of cases with endometriosis (46, 47). This incidence can be increase to 50% if patients with serosal and subserosal lesions are included (41).In cases of severe disease of the bowel wall, resection may be necessary. Preoperative mechanical and antibiotic bowel preparation is necessary. Three 5-mm suprapubic trocars are placed, one in the midline and the others in the right and left iliac fossa, for the insertion of grasping forceps, endoloop suture applicators, a suction irrigation probe, and a bipolar electrocoagulator. The technique includes laparoscopic mobilization of the lower colon, transanal prolapse, resection and anastomosis.

When the lesion involves only the anterior rectal wall near the anal verge, the rectovaginal septum is delineated by simultaneous vaginal and rectal examinations performed by an assistant. The rectum is mobilized along the rectovaginal septum

anteriorly to within 2 cm of the anus, using the CO2 laser and hydrodissection. Mobilization continues along the left and right pararectal spaces by electrodessication and dividing branches of the hemorrhoidal artery, and partially posteriorly, as well. The lesion is excised using electrosurgery and rectal closure is confirmed by insufflating the rectum while the cul-de-sac is filled with lactated Ringer's.

In circumferentional lesions, the entire rectum is mobilized, presacral space is entered. The rectum is transected proximal to the lesion, the rectal stump, containing the endometrial lesion, is prolapsed through the anal canal and transected using linear stapler. The rectal stump is replaced again into the pelvis and end to end anastomosis is done using the stapler. A proctoscope is used to examine the anastomosis for structural integrity and bleeding.

Diaphragmatic Endometriosis

Patients with diaphragmatic endometriosis may present with pleuritic, shoulder and upper abdominal pain occurring with menses. Laparoscopy is an excellent tool for diagnosis and treatment of endometriosis as, which is difficult to reach through laparotomy. The danger still there regarding the possible of injury to the diaphragm, phrenic nerve, lungs or heart. So, the other alternatives for management should be discussed with the patient.

In addition to the 10-mm umbilical port site for laparoscopy, three additional trocars are placed in the upper quadrant (right or left according to implant location), similar to the sites for the laparoscopic cholecystectomy. Two grasping forceps are used to push the liver from the operative field. Lesions are removed using hydrodissection and vaporization or excision. If a diaphragmatic defect is formed, it is repaired with 4-0 PDS or staples.

Uterosacral Ligament

Uterosacral ligament can be resected for its involvement with endometriosis or transected for control of pain by laparoscopic uterine nerve ablation (LUNA). To resect the uterosacral ligament, incise the peritoneum lateral and parallel to it. This incision over the adjacent broad ligament results in spontaneous retraction of the peritoneum with the resultant visualization of the retroperitoneal structures. The ureter and uterine vessels can now be dissected bluntly laterally to ensure that they are not near the uterosacral ligament. The insertion of the uterosacral ligament into the posterior cervix is divided with unipolar coagulation current or with bipolar coagulation followed by scissors transection. For more safety, a chemical laparoscopic presacral neurolysis was described by Soysal and colleagues (48). A 10 mm umbilical port is used for the standard insufflation and video endoscopy. Two additional 5 mm subumbilical standard ports are created for diagnostic and therapeutic purposes. The peritoneum overlying the promontory is grasped and elevated by a grasper and from the other port, 5 ml of saline was injected retroperitoneally by the laparoscopic needle used for ovarian cyst puncture. This elevates the peritoneum and endopelvic fascia from the promontory. Furthermore this space avoids inadvertent injection of phenol to vessels and backflow of phenol to the peritoneal space. Then 10 ml phenol (10% in Urografin, radiographic contrast medium; Schering AG, Germany) is injected slowly to the deeper part of the

artificially created retroperitoneal space from another point of entry. Before withdrawing the needle an additional 2 ml of saline was given to avoid intraperitoneal spillage of phenol during the withdrawal of the needle. Afterwards a thorough pelvic lavage was done. The presacral neurolysis itself is a 2 min operation.

Postoperative Hormonal Therapy

Combined surgery and medical therapy represents the best treatment for endometriosis according to various authors (49, 50, 51, 52, 53). Theoretically, postoperative medical treatment may eradicate any foci of endometriosis remaining after surgery and this improves the results of the procedure. It may also stop the implantation and growth of endometriotic tissue disseminated at surgery and prevents recurrence. In spite of that, Bianchi et al, (1999) reported that a 3 month course of danazol after laparoscopic surgery for stage III/IV endometriosis does not markedly improve the short-term reproductive prognosis or pelvic pain (54). Also, the study of Busacca et al, (2001) did not support the routine post-operative use of a 3 month course of GnRH analogue in women with symptomatic endometriosis stage III–IV. However, larger series and longer follow-ups are required to identify less important effects of treatment, in particular on the objective disease recurrence rate. Moreover, these data could not rule out that post-surgical GnRH analogue or other oestrogen-lowering medical therapies may be of value in selected patients, particularly those in whom disease has not been completely extirpated (55).

References

1. Wheeler JM. Epidemiology of endometriosis-associated infertility. J Reprod Med 1989;34:41-46
2. Rawson JM. Prevalence of endometriosis in asymptomatic women. J Reprod Med 1991;36:513-515
3. Strathy JH, Molgaard CA, Coulam CB, Melton LJ 3d. Endometriosis and infertility: a laparoscopic study of endometriosis among fertile and infertile women. Fertil Steril 1982;38:667-672
4. Verkauf BS. Incidence, symptoms, and signs of en-dometriosis in fertile and infertile women. J Fla Med Assoc 1987;74:671-675
5. Carter JE. Combined hysteroscopic and laparoscopic findings in patients with chronic pelvic pain. J Am Assoc Gynecol Laparosc 1994;2:43-47
6. Koninckx PR, Meuleman C, Demeyere S, Lesaffre E, Cornillie FJ. Suggestive evidence that pelvic endometriosis is a progressive disease, whereas deeply infiltrating endometriosis is associated with pelvic pain. Fertil Steril 1991;55:759-765
7. Ling FW. Randomized controlled trial of depot leuprolide in patients with chronic pelvic pain and clinically suspected endometriosis. Pelvic Pain Study Group. Obstet Gynecol 1999;93:51-58
8. Ripps BA, Martin DC. Endometriosis and chronic pelvic pain. Obstet Gynecol Clin North Am 1993;20:709-717
9. Cramer DW. Epidemiology of endometriosis. In: Wilson EA, ed. Endometriosis. New York: Alan R. Liss Inc, 1987:5-22
10. Vigano P, Vercellini P, Di Blasio AM, Colombo A, Candiani GB, Vignali M. Deficient antiendometrium lymphocyte-mediated cytotoxicity in patients with endo-metriosis. Fertil Steril 1991;56:894-899

11. Keltz MD, Berger SB, Comite F, Olive DL. Duplicated cervix and vagina associated with infertility, endometriosis, and chronic pelvic pain. Obstet Gynecol 1994;84: 701-703
12. Cramer DW, Wilson E, Stillman RJ, Berger MJ, Belisle S, Schiff I, et al. The relation of endometriosis to menstrual characteristics, smoking and exercise. JAMA 1986;255: 1904-1908
13. Adamson GD. Diagnosis and clinical presentation of endometriosis. Am J Obstet Gynecol 1990;162:568-569
14. The American Fertility Society: Management of endometriosis in the presence of pelvic pain. Fertil Steril 1993; 60:952-955
15. Luciano AA, Pitkin RM. Endometriosis: approaches to diagnosis and treatment. Surg Annu 1984;16:297-312
16. Muse K. Clinical manifestations and classification of endometriosis. Clin Obstet Gynecol 1988;31:813-822
17. Demco L. Mapping the source and character of pain due to endometriosis by patient-assisted laparoscopy. J Am Assoc Gynecol Laparosc 1998;5:241-245
18. Martin DC, Hubert GD, Vander Zwaag R, el-Zeky FA. Laparoscopic appearances of peritoneal endometriosis. Fertil Steril 1989;51:63-67
19. Stripling MC, Martin DC, Chatman DL, Zwaag RV, Poston WM. Subtle appearance of pelvic endometriosis. Fertil Steril 1988;49:427-431
20. Jansen RP, Russell P. Non-pigmented endometriosis: clinical, laparoscopic, and pathologic definition. Am J Obstet Gynecol 1986;155:1154-1159
21. Pittaway DE. CA-125 in women with endometriosis. Obstet Gynecol Clin North Am 1989;16:237-252
22. Duleba AJ. Diagnosis of endometriosis. Obstet Gynecol Clin North Am 1997;24:331–46
23. Patel MD, Feldstein VA, Chen DC, Lipson SD, Filly RA. Endometriomas: diagnostic performance of US. Radiology 1999; 210:739–45.
24. Arrive L, Hricak H, Martin MC. Pelvic endometriosis: MR imaging. Radiology 1989; 171:687–92.
25. Olive DL, Lindheim SR, Pritts EA. Endometriosis and infertility: What do we do for each stage? Current Women's Health Reports 2003,3:389-94.
26. Crosignani PG, Vercellini P, Biffignandi F: Laparoscopy versus laparotomy in conservative surgical treatment for severe endometriosis. Fertil Steril 1996, 66:706-711.
27. Tulandi T, al-Took S: Reproductive outcome after treatment of mild endometriosis with laparoscopic excision and electrocoagulation. Fertil Steril 1998, 69:229-231.
28. Luciano A, Maier DB, Kock EL, et al: A comparative study of postoperative adhesions; laser surgery by laparoscopy versus laparotomy in the rabbit model. Obstet Gynecol 1989; 74:220.
29. Nezhat CR, Nezhat FR, Metzger DA, Luciano AA: Adhesion reformation after reproductive surgery by videolaseroscopy. Fertil Steril 1990; 53:1008.
30. Diamond MP, Daniell JF, Johns DA et al.: Postoperative adhesion development after operative laparoscopy: evaluation at early second-look procedures. Fertil Steril 1991; 55:700.
31. Martin DC, Hubert GD, Vander Zwaag R, El-Zeky FA: Laparoscopic appearance of peritoneal endometriosis. Fertil Steril 1989 5163-67.

32. Laparoscopic treatment of endometriosis. In: Operative Gynecologic laparoscopy, principles and techniques. Nezhat et al., MacGraw-Hill, Inc. New York, 1995, P 121-147.
33. Hasson HM: Laparoscopic management of ovarian cysts. J Reprod Med 1991; 56:349-52.
34. Keye WR, Hansen LW, Astin M: Argon laser therapy of endometriosis: a review of 92 consecutive patients. Fertil Steril 1987; 47:208-14.
35. Brosens I, Puttemansi P: Double optic laparoscopy. Ballieres Clin Obtet Gynecol 1989; 3:595-8.
36. Fayez JA, Collazo LM: Comparison between laparotomy and operative laparoscopy in the treatment of moderate and severe endometriosis. Int J Fertil 1990; 35; 272-76.
37. Nezhat F, Nezhat C, Allan CJ, Metzger DA, Sears DL: A clinical and histologic classification of endometriomas: implications for a mechanism of pathogenesis. J Reprod Med 1992; 37; 771-76.
38. Marana R, Luciano AA, Muzii L: Reproductive outcome after ovarian surgery: suturing versus nonsuturing of the ovarian cortex. J Gynecol Surg 1991; 7:155-9.
39. Nezhat C, Nezhat F: Postoperative adhesion formation after ovarian cystectomy with and without ovarian reconstruction. Abstract O-012, 47th annual meeting of American Fertility Association, Orlando, FL, 1991.
40. Donnez J, Nisolle M: Laparoscopic management of large ovarian endometrial cyst: use of fibrin sealant. Surgery 1991; 7:163-8.
41. Nezhat CR, Nezhat FR, Luciano AA, Siegler AM, Metzger DA, Nezhat CH: Laparoscopic treatment of endometriosis. In: Operative Gynecoogic laparoscopy, Principles and techniques. McGraw-Hill, Inc. New York, 1995 p 121-147.
42. Canis M, Pouly J L, Tamburro S, G. Mage G, Wattiez A, Bruhat M A: Ovarian response during IVF–embryo transfer cycles after laparoscopic ovarian cystectomy for endometriotic cysts of >3 cm in diameter. Hum Reprod, 2001;16 (12), 2583-86,
43. Stanley EK, Utz DC, Dockerty MB: Clinical significant endometriosis of the urinary tract. Surg Gynecl Obstet 1965; 120: 491-6.
44. Nezhat C, Nezhat F, Green B: Laparoscopic treatment of obstructed ureter due to endometriosis by resection and ureteroureterostomy: a case report. J Urol 1992; 148:659-63.
45. Busacca M, Somigliana E, Bianchi S, De Marinis S, Calia C, Candiani M, Vignali M: Post-operative GnRH analogue treatment after conservative surgery for symptomatic endometriosis stage III–IV: a randomized controlled trial Human Reprod 2001; 16 (11) 2399-402,
46. Jenkinson EL, Brown WH: Endometriosis: a study of 117 cases with special reference to constricting lesions of the rectum and sigmoid colon. JAMA 1943; 122:349-52.
47. Samper ER, Sagle GW, Hand AM: Colonic endometriosis, its clinical spectrum. South Med J 1984; 77:912-18.
48. Soysal ME, Soysal S, Gurses E, Ozer S: Laparoscopic presacral neurolysis for endometriosis-related pelvic pain. Human Reproduction 2003; 18(3): 588-92.

49. Buttram VC Jr: Use of danazol in conservative surgery. J Reprod Med 1999; **35**, 82–4.
50. Thomas, E.J.: Combining medical and surgical treatment for endometriosis: the best of both worlds? Br J Obstet Gynaecol 1992; 99 (suppl. 7), 5–8.
51. Malinak, L.R.: Surgical treatment and adjunct therapy of endometriosis. Int J Gynaeco. Obstet 1993; 40 (suppl.), S43–S47.
52. Muzii, L, Marana R, Caruana P, Mancuso S: The impact of preoperative gonadotropin-releasing hormone agonist treatment on laparoscopic excision of ovarian endometriotic cysts. Ferti. Steril 1996; 65, 1235–1237.
53. Rana N, Thomas S, Rotman C, Dmowski W P: Decrease in the size of ovarian endometriomas during ovarian suppression in stage IV endometriosis. Role of preoperative medical treatment. J Reprod Med 1996; 41, 384–392.
54. Bianchi S, Busacca M, Agnoli B, Candiani M, Calia C, Vignali M: Effects of 3 month therapy with danazol after laparoscopic surgery for stage III/IV endometriosis: a randomized study. Hum Reprod 1999; 14(5), 1335-7.
55. Busacca M, Somigliana E, Bianchi S, De Marinis S, Calia C, Candiani M, Vignali M: Post-operative GnRH analogue treatment after conservative surgery for symptomatic endometriosis stage III–IV: a randomized controlled trial. Hum Reprod 2001; 16 (11), 2399-402.