Nov. 2000

The role of laparoscopy in managing infertility

The author details the use of laparoscopy as both a diagnostic and a treatment tool when managing patients who present with infertility due to such conditions as endometriosis, ovarian disorders, tubal damage, and uterine myomas.

BY CEANA NEZHAT, MD

Laparoscopy is an indispensable tool for determining the cause of infertility, as it can provide a good indication of the overall condition of the patient's abdominopelvic cavity. Among the pathologies Ob/Gyns frequently identify during diagnostic laparoscopy are pelvic endometriosis, which may have invaded extrapelvic organs (*Figure 1*), leiomyoma, adhesions, polycystic ovaries, and neoplasms (*Figure 2*). Laparoscopy also makes it possible to evaluate the fimbriae for occlusion or other pathology and to carry out chromopertubation when indicated.

Recent studies have found that even treatment of minimal to mild endometriosis can increase fertility rates.

• • •

In addition to its role as a diagnostic tool, the modality can increase a woman's chances of becoming pregnant, as well as improve her overall well-being—as long as appropriate treatment is performed at the time of laparoscopy. For example, the simultaneous evaluation and ablation or resection of endometriosis creates a more favorable environment for tubal and ovarian function, fertilization, and implantation, and minimizes the risk that the disease will spread to other structures such as the bladder, bowel, or ureter (*Figure 3*). Thus, the number of surgeries is reduced and, with it, the development of related adhesions. Nonetheless, laparoscopy should be reserved for the later stages of the diagnostic process—after ovulatory status has been assessed and a semen analysis and hysterosalpingography have been performed.

The causes of infertility

Infertility may be caused by conditions involving the uterus, fallopian tubes, or ovaries, or in 2 or more of these structures at the same time. It also may be linked to infection. The main etiologies, as well as the role of laparoscopy in evaluating and treating each particular condition, are discussed below.

By utilizing the multipuncture operative laparoscopy technique, the majority of female reproductive diseases can be diagnosed and treated successfully. After administering general endotracheal anesthesia, the physician places the patient in Allen stir-

Dr. Nezhat is associate clinical professor of OBG at Stanford University School of Medicine, in Stanford, Calif. He also is clinical professor of OBG at Mercer University School of Medicine in Macon, Ga, and director of the Center for Special Pelvic Surgery in Atlanta.

rups, which enables the assistant to perform a vaginal examination. The bladder is then catheterized. After introducing a 10-mm operative videolaparoscope infraumbilically, the surgeon inserts one to three 5-mm accessory cannulas suprapubically, depending on the severity of the case. The physician then inspects the intraperitoneal cavity to detect any pelvic abnormalities and to assess whether treatment is required, which, depending on the experience of the surgeon and the patient's condition, could be performed at the same time.

Endometriosis. One of the most common causes of female infertility is endometriosis; 30% to 60% of patients with infertility are diagnosed with the disease.[1] It has been suggested that endometriosis can hinder tubal and ovarian function, fertilization, and implantation due to abnormal peritoneal fluid, the adverse effects of prostaglandins and other toxic substances from endometriotic lesions, or immune system disturbances.[2]

Some researchers believe that women with mild endometriosis are no less likely to become pregnant than those without the disease, and that only patients with moderate to severe endometriosis have lower fertility rates than healthy women. However, recent studies have found that even treatment of minimal to mild endometriosis can increase fertility rates.[3,4] For example, in a randomized study of 341 women with minimal to mild endometriosis, the subjects underwent either diagnostic laparoscopy or operative laparoscopy with resection or ablation of visible endometriosis. All patients were followed for 36 weeks after the laparoscopy. Those who became pregnant were followed through the first 20 weeks of gestation. Of the 172 patients who underwent resection or ablation of endometriosis, 50 conceived and remained pregnant for more than 20 weeks compared to 29 women in the diagnostic laparoscopy group.[4]

This finding is comparable to that of a previous study in which researchers reported improved fertility in women with endometriosis who were treated by operative laparoscopy (*Table 1*). They determined that the overall success rate, i.e., the number of term pregnancies, in patients who underwent excision of their endometriosis at the time of laparoscopy was more than 60% for all stages of the disease.[5] This is significantly higher than the IVF success rate (27.2% per cycle, 31.3% per transfer).[6]

Key points

- Ablation or resection of endometriosis at laparoscopy, for all stages of the disease, yields an overall success rate (number of term pregnancies) of 60% compared to that of 27% for IVF.
- Laparoscopic excision of endometriomas is associated with a lower recurrence rate, a higher level of pain relief, and a higher pregnancy rate than both drainage-coagulation and fenestration.
- If the myomas are numerous, large, and deeply intramural, necessitating uterine reconstruction, laparoscopically assisted myomectomy is indicated.

Ovarian disorders. Ovarian cysts, polycystic ovaries, and endometriosis involving the adnexa can interfere with ovulation. Once cysts are identified during laparoscopy, they should be treated according to their type and size. When fertility is at issue, dermoid cysts are of particular concern. If their contents spill into the pelvic cavity, the result can be granulomatous peritonitis, which can cause adhesions and infertility. The use of retrieval bags to enclose such cysts prior to removal decreases the risk of spillage and reduces operative time.[7]

The surgical induction of ovulation through laparoscopic puncture is an option for women with polycystic ovary syndrome (PCOS). When compared with bilateral ovarian wedge resection at laparotomy, laparoscopic puncture requires less time, is more cost effective, and is associated with fewer adhesions. Gjonnaess concluded that ovulation occurred more frequently if 10 or more punctures, rather than only 6, were made in the ovary.[8-10] In 1998, Gjonnaess also reported that of those patients who had undergone laparoscopic puncture, two-thirds continued to ovulate 18 to 20 years after the procedure. The initial and long-term ovulation rates were higher in women

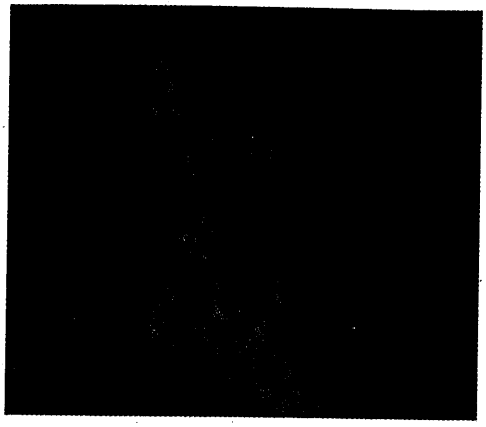

Figure 1: *Endometriosis can invade extrapelvic organs such as the diaphragm.*

Figure 2: *Lesions, e.g., low-malignant-potential tumors, also can cause infertility.*

Figure 3: *Treatment of endometriosis at laparoscopy may prevent the spread of the disease to other structures such as the ureter.*

Figure 4: *Ovarian endometriomas, which occur secondary to ovarian endometriosis, affect 50% to 70% of women with the disease.*

of normal weight than in overweight women (those with a body mass index (BMI) greater than 25 kg/m^2).[8] Despite its effectiveness, laparoscopic puncture should be used with caution, as aggressive surgical treatment can destroy the ovary.[8,11]

Another condition affecting ovarian function is the formation of endometriomas (*Figure 4*). This pathology is secondary to ovarian endometriosis and occurs in 50% to 70% of women with the disease.[12] These masses often are bilateral and may adhere to the pelvic sidewalls, the posterior uterus, or the bowel.[13] In a randomized trial, cystectomy was found to be superior to drainage-coagulation in terms of pain relief, pregnancy rate, and recurrence.[14] Similarly, Saleh et al reported that laparoscopic excision of endometriomas is associated with a lower reoperation rate than is fenestration; while the recurrence rate after fenestration is independent of the age of the patient, it is higher in those with larger cysts.[15]

In cystectomy, the risk of endometrioma recurrence is significantly decreased compared to nonexcisional techniques. However, the method carries a risk of reduced follicular response in natural or clomiphene citrate-stimulated cycles. In a retrospective, controlled study, the mean follicular response was significantly lower in subjects younger than 35 years of age who had undergone cystectomy than it was in women with healthy ovaries and in those who did not undergo cystectomy but who had ovarian stimulation with clomiphene citrate. However, a patient's reduced follicular response after cystectomy can be offset if the physician employs aggressive gonadotropin stimulation.[16]

Tubal function. Another frequent cause of infertility is primary tubal disease, which affects up to 20% of infertile women. The most common etiologies are pelvic inflammatory disease (PID), adhesions from previous pelvic surgery, a ruptured appendix, and endometriosis.[17]

Salpingostomy can be performed easily at the time of laparoscopy, with restoration of patent fallopian tubes in the majority of cases. Success in opening blocked tubes depends on the degree of tubal damage, which, obviously, affects pregnancy rate and other fertility factors.

Research also supports the use of laparoscopic salpingectomy for hydrosalpinges in properly selected patients.[18-20] This condition adversely affects implantation, even in donor oocyte cycles. Cohen and colleagues found that patients with a hydrosalpinx had

continued on page 75

significantly lower implantation rates and higher miscarriage and ectopic pregnancy rates than did women with healthy fallopian tubes.[21] These rates also may reflect the toxicity of the hydrosalpinx fluid. Therefore, laparoscopic proximal tubal occlusion, performed to prevent the passage of hydrosalpinx fluid into the uterine cavity, may improve the developmental environment for embryos without requiring the removal of one or both tubes. However, when salpingectomy is indicated, removing only the severely damaged tube and leaving the other, relatively healthier tube intact may be sufficient to increase pregnancy rates and decrease miscarriage rates. Removing both fallopian tubes and proceeding to in-vitro fertilization (IVF) usually is advisable when both tubes are severely damaged.

Uterine myomas. Fibroids affect 20% to 25% of reproductive-age women.[22,23] Although they are seldom the sole cause of infertility, several studies show a link between fibroids, fetal wastage, and preterm birth.[22] Laparoscopic treatment of fibroids includes laparoscopic myomectomy (LM) and laparoscopically assisted myomectomy (LAM). LM is one of the most difficult laparoscopic procedures to perform, as it requires myoma morcellation and uterine reconstruction with laparoscopic suturing techniques to decrease the risk of uterine rupture during subsequent pregnancies. Therefore, LAM is a safe alternative to LM.

The decision to perform LAM usually is made in the operating room after the diagnostic laparoscopy and treatment of other pelvic abnormalities have been completed. The criteria for LAM are myomas larger than 8 cm; numerous myomas requiring extensive morcellation; and/or deep, large, intramural myomas that necessitate uterine repair in multiple layers and restoration of the myometrial integrity.

To perform LAM, the surgeon injects the myoma at its base with diluted vasopressin to reduce blood loss. He or she then makes a vertical incision in the uterine serosa and extends it to the surface of the tumor until the incision reaches the capsule of the leiomyoma. A corkscrew manipulator is then inserted into the myoma (*Figure 5*). With the trocar and manipulator attached to the myoma, the physician enlarges the midline 5-mm suprapubic puncture to a 4-cm transverse incision and raises the leiomyoma to the incision by using the corkscrew manipulator to elevate the uterus. The fibroid is then grasped, shelled, and morcellated sequentially (*Figure 6*). (When multiple leiomyomas are present, the surgeon should remove as many tumors as possible through 1 uterine incision.) After the myoma has been removed completely, the surgeon repairs the uterine wall defect; the conventional suturing technique, wherein 2 or 3 layers are closed, reduces the potential for uterine

TABLE 1
Pregnancy outcome in endometriosis patients treated laparoscopically

Stage of disease	No. of patients	No. of pregnancies	Success rate (%)	Spontaneous abortions	Abortion rate (%)
Mild	24	18	75.1	4	22.0
Moderate	51	32	62.7	4	12.5
Severe	19	8	42.1	2	25.0
Extensive	8	4	50.0	0	0.0
Total	**102**	**62**	**60.8**	**10**	**9.8**

Source: Nezhat C, Crowgey S, Garrison C. Surgical treatment of endometriosis via laparoscopy. *Fertil Steril.* 1986;45:778-

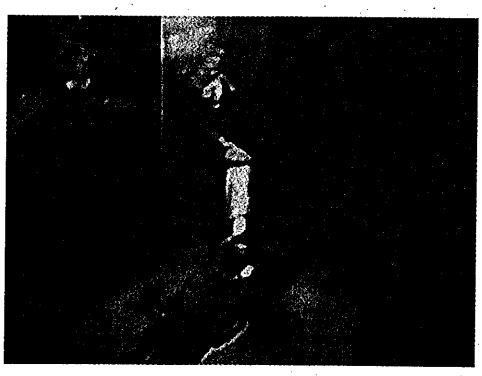

Figure 5: *In LAM, the corkscrew manipulator elevates the uterus to the abdominal incision to facilitate removal of the myoma.*

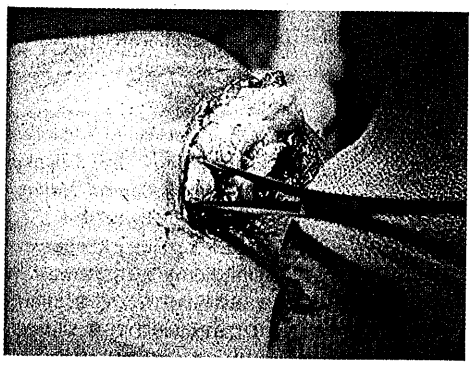

Figure 6: *After the uterus and myoma are elevated, the surgeon then grasps, shells, and morcellates the fibroid sequentially.*

dehiscence, fistulas, and adhesions. After closing the incision, the laparoscope is used to confirm hemostasis. Then, the physician assesses the pelvis again to identify and treat any endometriosis or adhesions that may have been previously obscured by myomas.

Patients should be counseled extensively about the risks associated with both LM and LAM and should be advised that, depending on the size and location of the myomas, future fertility may be compromised.

In summary

While laparoscopy should be included in an Ob/Gyn's armamentarium for assessing and managing infertility, it should be relegated to the later stages of the process. Ovulation assessment, a semen analysis, and hysterosalpingography should be performed prior to laparoscopy when an infertile woman presents for evaluation. However, the failure to perform diagnostic laparoscopy at some point could seriously jeopardize fertility—and the woman's overall health and well-being—when endometriosis, adhesions, or anatomic abnormalities are present.

Additionally, operative laparoscopy can increase a patient's chances of spontaneous conception and improve her response to ovarian stimulation, thus decreasing the need for IVF, risk of multiple gestation, associated maternal and fetal morbidity, and costs. It also can improve IVF outcome.

Laparoscopy, both diagnostic and operative, has its time and place in the management of infertile patients, and its effective use depends on an individual Ob/Gyn's level of comfort and experience. ■

REFERENCES

1. Pauerstein CJ. Clinical presentation and diagnosis in endometriosis. In: Schenken RS, ed. *Contemporary Concepts in Clinical Management.* Philadelphia, Pa: JB Lippincott; 1989:127-144.

2. Nezhat CR, Berger GS, Nezhat FR, et al. *Endometriosis: Advanced Management and Surgical Techniques.* New York: Springer-Verlag; 1995:62.

3. Panidis DK, Matalliotakis IM. Subfertility associated with minimal to mild endometriosis. *J Reprod Med.* 1998;43:1034-1042.

4. Marcoux S, Maheux R, Berube S. Laparoscopic surgery in infertile women with minimal or mild endometriosis. *N Engl J Med.* 1997;337(4):217-222.

5. Nezhat C, Crowgey S, Garrison C. Surgical treatment of endometriosis via laparoscopy. *Fertil Steril.* 1986;45:778-782.

6. Assisted reproductive technology in the United States: 1996 results generated from the American Society for Reproductive Medicine/Society for Assisted Reproductive Technology Registry. *Fertil Steril.* 1999; 71:798-807.

7. Campo S. Laparoscopic conservative excision of ovarian dermoid cysts with and without an endobag. *J Am Assoc Gynecol Laparosc.* 1998;5(2):165-170.

8. Gjonnaess H. Late endocrine effects of ovarian electrocautery in women with polycystic ovary syndrome. *Fertil Steril.* 1998;69(4):697-701.

9. Gjonnaess H, Norman N. Endocrine effects of ovarian electrocautery in patients with polycystic ovarian disease. *Br J Obstet Gynaecol.* 1987;94(8):779-783.

10. Gjonnaess H. Polycystic ovarian syndrome treated by ovarian electrocautery through the laparoscope. *Fertil Steril.* 1984;41(1):20-25.

11. Felemban A, Tan SL, Tulandi T. Laparoscopic treatment of polycystic ovaries with insulated needle cautery: a reappraisal. *Fertil Steril.* 2000;73(2):266-269.

12. Jenkins S, Olive DL, Haney AF. Endometriosis: pathogenic implications of the anatomic distribution. *Obstet Gynecol.* 1986;67:335.

13. Gomel V, Taylor P. *Diagnostic and Operative Gynecologic Laparoscopy.* St. Louis, Mo: Mosby; 1995:136.

14. Beretta P, Franchi M, Ghezzi F, et al. Randomized clinical trial of two laparoscopic treatments of endometriomas: cystectomy versus drainage and coagulation. *Fertil Steril.* 1998;70:1176-1180.

15. Saleh A, Tulandi T. Reoperation after laparoscopic treatment of ovarian endometriomas by excision and fenestration. *Fertil Steril.* 1999;72:322-324.

16. Loh FH, Tan AT, Kumar J, Ng SC. Ovarian response after laparoscopic ovarian cystectomy for endometriotic cysts in 132 monitored cycles. *Fertil Steril.* 1999;72:316-321.

17. Nezhat CR, Nezhat FR, Luciano AA, et al. *Operative Gynecologic Laparoscopy: Principles and Techniques.* New York, NY: McGraw-Hill; 1992:205-213.

18. Mukherjee T, Copperman AB, McCaffrey C, et al. Hydrosalpinx fluid has embryotoxic effects on murine embryogenesis: a case for prophylactic salpingectomy. *Fertil Steril.* 1996;66(5):851-853.

19. Blazar AS, Hogan JW, Seifer DB, et al. The impact of hydrosalpinx on successful pregnancy in tubal factor infertility treated by in vitro fertilization. *Fertil Steril.* 1997;67(3):517-520.

20. Wainer R, Camus E, Camier B, et al. Does hydrosalpinx reduce the pregnancy rate after in vitro fertilization? *Fertil Steril.* 1997;68(6):1022-1026.

21. Cohen M, Lindheim S, Sauer M. Hydrosalpinges adversely affect implantation in donor oocyte cycles. *Human Reprod.* 1999;14(4):1087-1089.

22. Buttram VC Jr, Reiter RC. Uterine leiomyomata: etiology, symptomatology, and management. *Fertil Steril.* 1981;36(4):433-445.

23. Vollenhoven BJ, Lawrence AS, Healy DL. Uterine fibroids: a clinical review. *Br J Obstet Gynaecol.* 1990;97:285.

The author reports no financial relationship with any companies whose products are mentioned in this article.