Laparoscopic Ovarian Cautery for Polycystic Ovarian Syndrome

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Approximately 15% of all couples suffer from infertility, and in 10% of cases, anovulation or oligoovulation is a factor. One of the most common clinical syndromes in which anovulation occurs, often presenting as infertility, is the polycystic ovary syndrome (PCOS).

When this condition was described by Stein and Leventhal in 1935,[1] it was recognized that ovulatory cycles could often be established following a procedure known as ovarian wedge resection (OWR). This procedure involved a laparotomy and resection of a portion of the enlarged ovaries with subsequent reconstruction. Although successful in restoring ovarian cycles in most patients, OWR induced periovarian adhesions, a serious complication of a procedure performed for fertility promotion. With the subsequent introduction of clomiphene citrate and gonadotropin therapy in the early 1960s, this procedure fell into disfavor.

The development of operative laparoscopy has resulted in the re-evaluation of several procedures traditionally performed by laparoscopy. Advocates of laparoscopy claim a decreased likelihood of postoperative adhesions compared with laparotomy.[2,3] In 1984, the concept of surgery to initiate ovulation in women with PCO was rekindled when Gjonnaess described the minimally invasive procedure of laparoscopic ovarian cautery (LOC).[4] Since then, several laparoscopic procedures for surgical ovulation induction in women with PCOS have been described. These include laparoscopic ovarian biopsy at multiple sites, laparoscopic ovarian cautery, laparoscopic laser vaporization with the CO_2 or KTP laser, as well as laparoscopic laser coagulation or wedge resection using the Nd:YAG laser. The term "laparoscopic ovarian drilling" has found its way into the literature to describe the majority of these techniques in which either cautery or laser is applied to the surface of the ovary at multiple sites to effect destruction of the cortex and underlying stroma.

This paper will confine itself to the use of laparoscopic ovarian cautery for initiation of ovulation in women with PCOS. Emphasis will be placed on selection of candidates, benefits and complications, as well as alternate therapies. A detailed description of the technique will follow. For a more detailed discussion of other modalities and a review of the literature, the reader is referred to the recent exhaustive review by Donesky and Adashi.[5]

CANDIDATES FOR LAPAROSCOPIC OVARIAN CAUTERY

Women with PCOS usually present to the physician with one or more of three main complaints: (1) irregular cycles, manifesting as amenorrhea and dysfunctional uterine bleeding; (2) signs of androgen excess such as hirsutism or acne; and/or (3) infertility. It is only for the last symptom that LOC should be considered.

Approximately 75% to 85% of women with PCOS will ovulate in response to

clomiphene citrate (CC). Clomiphene citrate is therefore always the first therapy to try. However, if the patient fails to ovulate with a maximal dose of CC, or fails to conceive despite regular ovulatory cycles with CC, and other infertility factors are absent, then two options should be discussed with the patient. These are ovulation induction with parenteral gonadotropin therapy and LOC.

An understanding of the risks and benefits of these two therapies is essential when counseling the woman with PCOS who fails CC therapy.

Gonadotropin Therapy

Gonadotropin therapy is expensive ($500 to $2,000 per cycle [$CAN]). For patients without an insurance plan that covers these medications, this cost is often prohibitive. Treatment with gonadotropins requires the patient to be close to a tertiary center for the necessary ultrasound and blood monitoring required. Gonadotropin therapy must be given parenterally, although recent purification methods allow subcutaneous administration. There is a significant risk of multiple pregnancy (20% to 25%) as well as ovarian hyperstimulation syndrome (1% to 10%). Both of these complications are increased in women with PCO.

With gonadotropin therapy, the chance of conception is limited to the cycle of treatment. If the patient does not ovulate or conceive in a given cycle, subsequent attempts at ovulation and conception require re-treatment. Ovulation rates with the use of gonadotropins have been reported to range between 76% to 95%.[6] However, when hyperandrogenic, eustrogenic women (typical PCOS hormonal profile) are evaluated as opposed to all anovulatory women, cumulative conception rates over 6 to 12 cycles have been reported to be as low as 30% to 50%.[7,8]

Laparoscopic Ovarian Cautery

Because of the expense and time commitment involved in monitoring with the use of gonadotropins, many physicians recommend diagnostic laparoscopy prior to initiating therapy. Ovarian cautery can be performed at this time with minimal increase in operative time or morbidity. Eighty to 90% of patients will ovulate following LOC for PCOS. Cumulative conception rates of 55% to 65% over 6 to 12 months can be expected.[5] Several studies have suggested that in patients who fail to ovulate, or become oligoovulatory following LOC, many will have been made sensitive to anti-estrogen therapy, and up to 95% will ovulate if these “failures” are

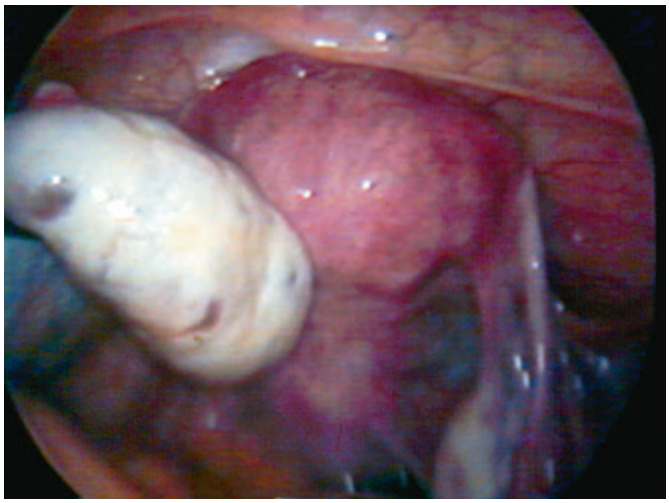

Figure 1. Enlarged, polycystic ovary.

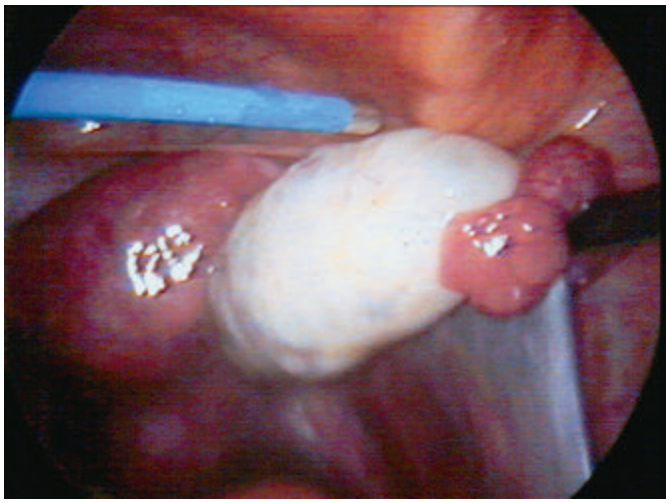

Figure 2. Right ovary being stabilized against right pelvic side wall prior to cautery.

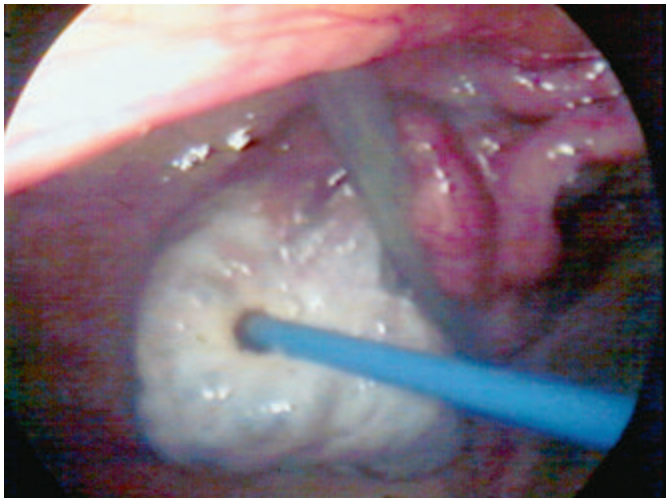

Figure 3. Left ovary stabilized against left pelvic side wall during cautery.

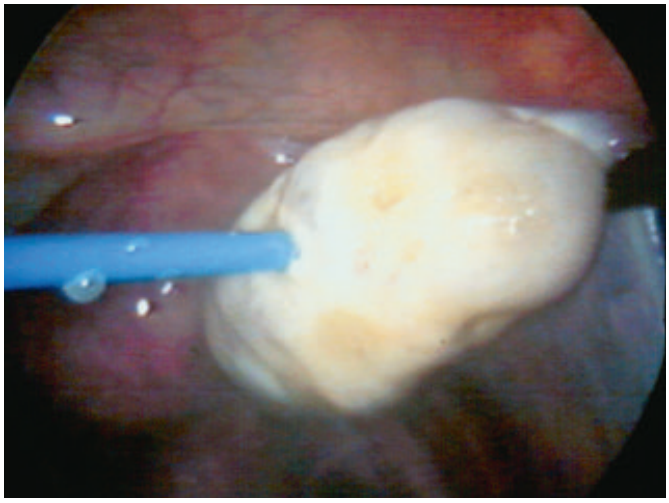

Figure 4. Ovarian cautery. Note probe is applied perpendicular to ovarian surface.

treated with clomiphene citrate following LOC.

Laparoscopic ovarian cautery is a surgical procedure utilizing energy intra-abdominally (in the form of monopolar cautery). The patient must be made aware of the risks of general anesthesia as well as the potential complications of operative laparoscopy. The potential for adhesion formation following any surgical procedure must be raised and will be discussed in more detail.

As with OWR, the response is not necessarily permanent. Therefore, LOC should be reserved for women actively trying to conceive. If the patient responds (regular ovulatory cycles ensue), conception occurs as a result of spontaneous ovulation. Monitoring is not required. The risk of multiple pregnancy is not increased, and there is no risk of hyperstimulation.

Studies suggest that spontaneous abortion rates are less if the conception occurs following LOC than if it follows medical induction of ovulation, in which case abortion rates approach 25% to 50%.[9,10,11]

Adhesions Following Laparoscopic Ovarian Cautery

The main drawback of ovarian wedge resection, which leads to its abandonment, is the formation of postoperative adhesions. This complication then introduces a mechanical factor contributing to infertility.

Although conventional wisdom and animal data would predict that laparoscopy would result in less adhesion formation,[2,3] it is known that avoiding laparotomy does not guarantee adhesion-free healing. Several studies that have assessed this unwanted complication often have suffered from inadequate and random evaluation.

Sporadic re-evaluation of ovaries following ovarian cautery or laser vaporization, often at the time of Caesarean section, has not revealed significant adhesions, and the high conception rate would suggest that postoperative adhesion formation is not a significant problem.[4,12] However, three studies in which second-look laparoscopy was performed following laparoscopic ovarian cautery or laser vaporization demonstrated adhesion formation, sometimes severe, in the majority of patients, following both techniques.[13,14,15]

The significance of minimal adhesions to fertility is unknown. Gurgan et

Figure 5. Ovarian cautery.

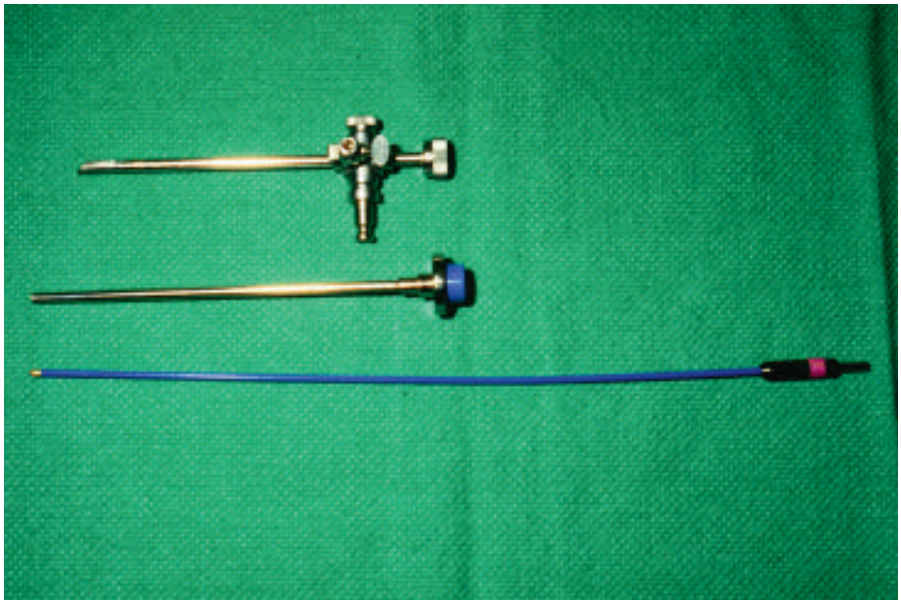

Figure 6. Ovarian cautery instruments, from above: 5-mm trocar, reducer, cone-tipped insulated cautery probe.

Figure 7. Polycystic ovary, post-cautery.

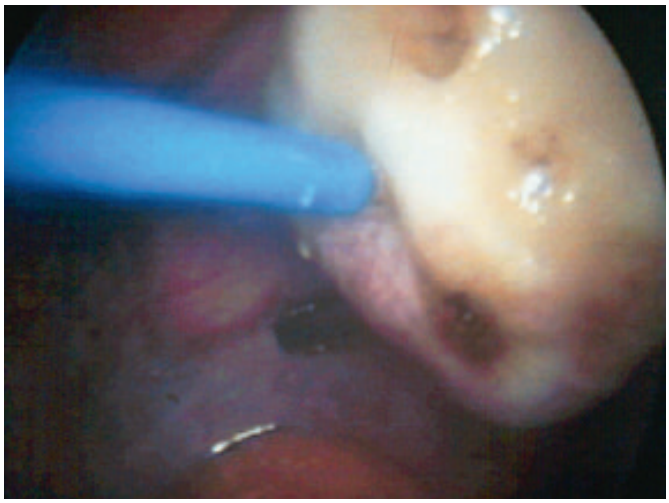

Figure 8. Polycystic ovary, post-cautery.

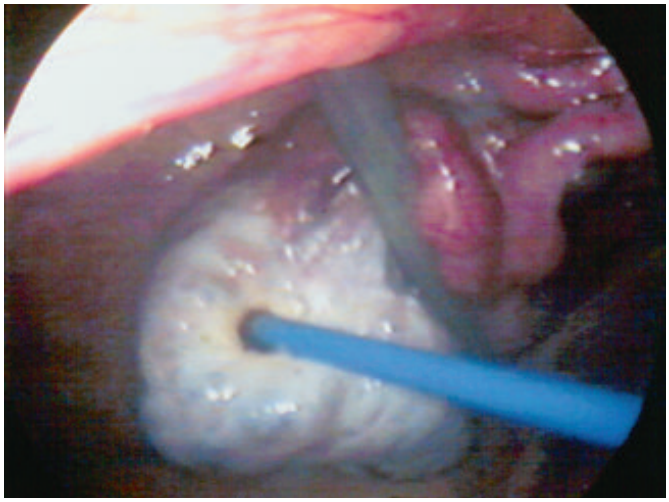

Figure 9. Cautery of inferior ovarian surface.

Figure 10. Irrigation of ovary post-cautery.

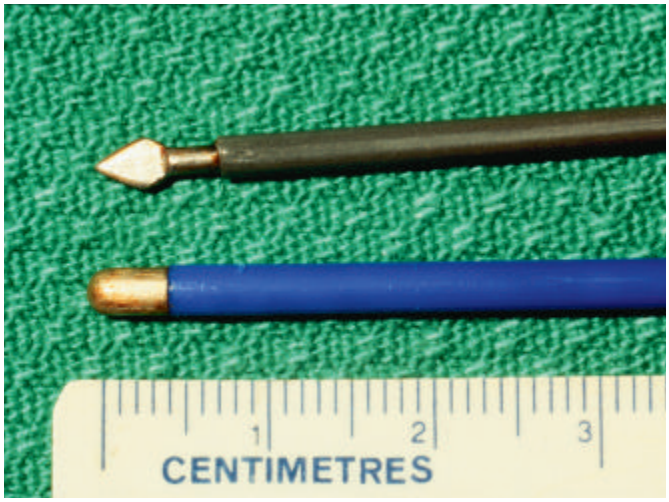

Figure 11. Cautery probes; from above, prototype probe, standard probe.

Figure 12. Corpus luteum is shown at three to four weeks postoperatively.

al.[16] performed a prospective, randomized, controlled study in which pregnancy rates were compared between 19 patients who underwent second-look laparoscopy and lysis of adhesions when present (13 of 19) and 20 patients who did not undergo second-look laparoscopy. No significant difference in pregnancy rates was observed. Furthermore, in evaluating the efficacy of Interceed (Johnson and Johnson, Inc., Arlington, Tex.) to prevent adhesions following ovarian cautery, we performed second-look laparoscopy in seven patients and found that pregnancy rate did not correlate with adhesion score.[15]

Therefore, although further studies are required, it appears that postoperative adhesions following laparoscopic ovarian cautery are fairly frequent. Unless they are severe, however, in which tubo-ovarian relationship is affected, it seems that as long as ovulatory cycles ensue and continue, the chance for pregnancy remains very good.

PERFORMING LAPAROSCOPIC OVARIAN CAUTERY

The patient must be grounded and catheterized. A uterine manipulator is placed to improve exposure of the ovaries during surgery. The procedure is performed using a three- or four-puncture technique, as described below.

A pneumoperitoneum is created through a Veress needle with carbon dioxide gas and the laparoscope is inserted through a subumbilical incision. In order to involve assistants during the procedure, it is preferable to work with a video camera. This requires using a 10- to 11-mm laparoscope in order to ensure adequate illumination.

The patient is placed in deep Trendelenburg position, to displace bowel into the upper abdomen, and the pelvis is inspected. The typical enlarged smooth, sclerocystic appearance of chronically anovulatory ovaries is seen (Fig. 1). Full diagnostic laparoscopy should be performed, including tubal dye insufflation, to document tubal patency and uncover any other factors that might contribute to infertility. A 5-mm sheath is placed in each lower quadrant for introduction of graspers, cautery, and a suction/irrigator. Care must be taken to avoid injuring the superficial and deep inferior epigastric vessels when placing these trocars, by dimming the room lights and transilluminating the abdominal wall with the laparoscope light. The course of the vessels can then be confirmed by inspecting the abdominal wall directly, as well as the peritoneal surface intra-abdominally through the laparoscope.

Puncture into the peritoneal cavity should then be performed under direct vision, taking care to enter either medial, or, as the author prefers, lateral to the inferior epigastric vessels. Good exposure is crucial. If it is difficult to keep bowel out of the pelvis with Trendelenburg positioning alone, as often occurs in these patients (many of whom are obese), a third suprapubic trocar or pararectal mid-abdominal trocar and sheath can be placed. An atraumatic instrument can then be used to hold the bowel in the upper abdomen.

Ovarian cautery is then performed in the following manner. An atraumatic grasper is introduced through the suprapubic or lower quadrant incision ipsilateral to the ovary being cauterized, and the ovarian ligament is gently grasped. As it is crucial to stabilize the ovary while applying cautery, the ovarian ligament can be gently twisted. Care must be taken not to use excessive traction on the ovarian ligament, as this can shear the ovarian vessels. If the ovary is very mobile, the uterus should be retroverted and used as a backstop while tethering the ovary in the anterior cul-de-sac. Alternatively, the ovary can be stabilized by using a probe to push the ovary against the lateral pelvic side wall (Figs. 2, 3). If this method is used, care must be taken to ensure that the cautery instrument does not pass through the ovary when energy is applied, as vital structures along the lateral pelvic side wall may be damaged. When performing ovarian cautery, the instrument must be applied perpendicular to the ovarian surface to avoid slippage off the ovary and inadvertent burn injury to other organs (Figs. 4, 5). The cautery instrument is therefore best introduced through the lower quadrant sheath opposite the ovary being cauterized. The ovary must be carefully held away from bowel and other vital structures since sparking and arcing may occur with monopolar cautery. As it is necessary to penetrate the cortex of the ovary, an instrument with a sharp tip is preferable to one with a rounded or dull tip. We have adapted a 3-mm hysteroscopic monopolar cautery instrument for use in this procedure (Fig. 6). This instrument must therefore be introduced through a 5-mm to 3-mm reducer so as to prevent loss of the pneumoperitoneum, which would compromise visualization. This instrument is circular and insulated to within approximately 3 mm of the tip. The conductive tip is cone-shaped, ending in a point. Monopolar current is used in order to apply adequate energy to penetrate through the cortex of the ovary to the underlying stroma. The Valleylab 40S-20 electrosurgical unit (Valleylab Inc, Richmond Hill, Ontario) is used at "blend 1" setting with both cut and cautery modes set at 35 to 40 W. The output with this machine at these settings is 35 to 40 ± 5 W. Using these settings, the monopolar instrument is applied with moderate pressure, perpendicular to the surface of the ovary for approximately 10 seconds at each point. The instrument penetrates the cortex to the underlying stroma and the operator can both see and "feel" when this has occurred. As underlying immature follicles are cauterized, an egress of fluid and/or steam may be seen. A minimum of 10 holes, approximately 3 to 4 mm in diameter and 4 to 5 mm deep, are burned at random, regular points, approximately 1 cm apart, over the entire surface of the ovary (Figs. 7, 8). With particularly large ovaries, more points are cauterized. Avoid cauterizing near the hilum of the ovary because it could disrupt the ovarian blood supply. In order to access the undersurface of the ovary, the ovary can be flipped up and held against the lateral pelvic wall in order to stabilize it (Fig. 9). Following treatment of each ovary, the cautery tool can be replaced with a suction-irrigator. Irrigation (Ringers Lactate with 1000 u/L heparin) is then used to cool the ovary and confirm hemostasis (Fig. 10). The same procedure is then repeated on the other ovary.

We are currently evaluating a new cautery tool that is still in the prototype phase. This instrument is sharp and flat, and insulated fully down to the cautery tip so that the cortex is pierced mechanically and cautery is then performed under the ovarian surface (Fig. 11). The amount of char left on the ovarian surface is thus decreased. It is hypothesized that this tool will lead to fewer postoperative adhesions.

Following bilateral ovarian cautery, leave 100 to 200 cc of irrigant in the pelvis.

At a short interval second-look procedure (performed for research purposes only at three to four weeks), identification of a corpus luteum, demonstrating recent ovulation, is desirable (Fig. 12).

MINIMIZING COMPLICATIONS

Although the patient must be fully informed of the potential risks of the operative procedure, attention to the following points will minimize complications:

- Ensure the bladder is empty.
- Introduce all secondary trocars under direct vision.
- Ensure adequate exposure. The ovary must be immobilized before applying energy. If the ovary cannot be stabilized remote from other vital structures such as bowel, ureter, and major blood vessels, the procedure should be abandoned.
- When not using the cautery instrument, the electrical cord should be detached to avoid accidental firing.

In summary, LOC should be reserved for infertile women with PCOS who have failed first line therapy with CC and are actively attempting conception. In the appropriate patient, following a discussion of treatment options, response rates, and potential complications of this therapy, LOC should be considered for ovulation induction in these women. STI

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