Ovarian endometrioma: postoperative adhesions following bipolar coagulation and suture

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Objective: To compare bipolar coagulation and suturing of the ovary in terms of postoperative ovarian adhesions after laparoscopic ovarian cystectomy for endometriosis.
Design: Prospective, randomized, controlled study.
Setting: Department of Obstetrics and Gynecology, University of Naples "Federico II."
Patient(s): Thirty-two women with a single endometriotic cyst were randomly divided into two groups of 16 women each (groups A and B).
Intervention(s): All patients underwent laparoscopic ovarian cystectomy for endometriosis. In group A, hemostasis was performed by closure of the ovary with an intraovarian suture. In group B, complete hemostasis was achieved only with bipolar coagulation on the internal face of the ovary.
Main Outcome Measure(s): Rate and extension of postsurgical ovarian adhesions at 60–90 days follow-up.
Result(s): At follow-up, a significantly lower rate of postsurgical ovarian adhesions was observed in group A than in group B (30.8% vs. 57.1%). The extension of ovarian adhesions was significanlty higher in group B than in group A.
Conclusion(s): The use of sutures on ovaries treated for endometrioma is associated with a lower rate of postoperative ovarian adhesion formation compared with bipolar coagulation. (Fertil Steril® 2008;89:796–9. ©2008 by American Society for Reproductive Medicine.)

Key Words: Endometriosis, laparoscopy, ovarian cyst, adhesion, prevention

Endometriosis is characterized by ectopic endometrial tissue with the formation of adhesions (1). The major consequences of adhesions are infertility, pelvic or abdominal chronic pain, and intestinal obstruction (2). Laparoscopic excision with stripping of the cyst wall is considered an adequate treatment for endometriotic ovarian cysts (1, 3–7). Unfortunately, pelvic surgery for endometriosis has been associated with high rates of adhesion formation and reformation (5, 8). After laparoscopic endometriosis surgery, odds of adhesion formation range from 80% to 100% (5, 8, 9). The high incidence of adhesion formation after surgery for endometriosis underscores the importance of optimizing surgical technique and the possible role of antiadhesion drugs to potentially reduce adhesion formation.

Several methods, as well as physical barriers interposed between adjacent injured surfaces, have been used to prevent pelvic adhesions both after laparoscopy and laparotomy. An oxidized regenerated cellulose absorbable barrier (10), a hydrophilic polyethylene glycol–based adhesion barrier (11), an autocrosslinked hyaluronic acid gel (12–14), and a 4% icodextrin solution (15) have recently been used with inconclusive results.

Current surgical technique has been shown as insufficient for adhesion prevention (16). Moreover, the influence of bipolar coagulation, widely used in surgical hemostasis and ablation of endometriotic implants, has rarely been studied on adhesion formation (17).

The aim of this prospective, randomized, controlled study was to compare bipolar coagulation and suturing of the ovary treated for endometrioma in terms of postoperative ovarian adhesions.

MATERIALS AND METHODS

From April 2004 to July 2005, 32 infertile women, each with a single endometriotic cyst, referred to the Department of Obstetrics and Gynaecology of the University of Naples "Federico II," were included in this randomized trial. The study was approved by the Institutional Review Board, and written informed consent was obtained from each patient.

Inclusion criteria were age between 18 and 45 years; history of infertility >2 years, no male factor of infertility; single endometriotic cysts >3 cm or <7 cm on preoperative ultrasound screen; no earlier surgery for endometriotic cysts

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or additional surgical procedure planned to be performed during the laparoscopic procedure; good general health, including an American Society of Anaesthesiologists score of 2 or less; no current pregnancy, including ectopic pregnancy; serum glutamic-oxaloacetic transaminase, serum glutamate pyruvate transaminase, and/or bilirubin <20% above the upper range of normal and considered clinically significant; azothemia and creatinine <30% above the upper range of normal and considered clinically significant; no concurrent use of systemic corticosteroids, antineoplastic agents, and/or radiation; and no active pelvic or abdominal infection.

The enrolled patients were preoperatively randomized and allocated to one of the two groups according to a computer-generated random list of 16 women each (groups A and B). Both groups underwent laparoscopy for endometriosis.

Laparascopy was performed by use of a 10-mm scope (Karl Storz, Tuttlingen, Germany) with two or three ancillary ports. After careful exploration of the pelvic organs and upper abdomen, patients with clinical evidence of cancer, pregnancy including ectopic pregnancy, rectovaginal endometriosis, endometriosis American Society for Reproductive Medicine (ASRM) (18) stage III or IV, or endometriotic cyst not stripped were excluded. Light adhesions on the contralateral adnexa and/or small subserousal uterine myomas observed at first surgery were not considered as exclusion criteria and were treated after second-look evaluation. Tubal chromopertubation was performed in all patients after second-look evaluation.

In all cases, endometrioma was treated moving the ovary from the ovarian fossa. The two groups had the same degree of adhesiolysis during the first surgery. Ovarian capsula was completely removed using two atraumatic forceps. In group A, hemostasis was performed by closure of the ovary with an intraovarian absorbable monofilament suture (2-0 PDSII; Ethicon, Somerville, NJ). The suture was performed with intraovarian knots and was not detectable on the surface of ovary. Before closure of the ovary, light coagulation with bipolar forceps was obtained only if necessary. Light coagulation has been used exclusively inside the ovarian parenchyma. After ovarian closure, no coagulated tissue was detectable outside. In group B, complete hemostasis was achieved with a 40-W current applied using bipolar forceps (Karl Storz) on the internal face of the ovary without coagulation of external surface and ovary was left open.

At the end of surgical procedure, all patients received application of 4% icodextrin solution (Adept; Shire, London, UK). The maximum volume of solution used for intraoperative irrigation was 1000 mL and, at the end of laparoscopic procedure, 1000 mL had been left in peritoneal cavity.

Postsurgical adhesions were evaluated 60–90 days after laparoscopy. The surgeon performing second-look laparoscopy for the evaluation of adhesion extension was blinded to the treatment. A subject was defined as adhesion free if there were no ovarian adhesions. At second-look adhesions, extension of treated adnexa were evaluated according to ASRM adhesion score system and were compared with adhesions present at first laparoscopy.

Statistical significance of between-group comparisons was assessed by χ^2 test for proportions. The Student *t* test for unpaired data was used for comparison between groups when appropriate. Operative time was compared using the Wilcoxon rank-sum test. In all analyses, statistical significance was assessed at the 5% level.

RESULTS

Patients included in the study had a mean age of 27.5 ± 1.9 years (mean ± SD), a weight of 58.6 ± 6.3 kg, and an endometrioma diameter of 5.1 ± 0.5 cm. There were no significant differences between the two groups for age, weight, diameter of endometrioma, and its localization.

Five patients, 3 from group A and 2 from group B, dropped out of the study because they did not meet intraoperative inclusion criteria (2 patient) or refused laparoscopic second look (3 patients).

At follow-up, a significantly ($P<.001$) lower rate of postsurgical ovarian adhesions was observed in group A (4 out of 13 patients) than in group B (8 out of 14 women) (30.8% vs. 57.1%, respectively; Table 1). The extension of adhesions at first laparoscopy, evaluated according to the ASRM adhesion score system, was not significanlty different between the two groups (8.3 ± 1.9 in group A vs. 7.9 ± 2.2 in group B). At second look, the adhesion score was significantly higher in group B than in group A ($P<.001$; Table 2). The mean adhesion score was significantly lower between first and after laparoscopic cystectomy in group A ($P<.05$), whereas it was significantly higher after laparoscopic cystectomy in group B ($P<.01$). We did not observe significant differences between cystectomies performed on left and right ovaries ($P=.08$). We did not observe any correlation between the diameter of endometrioma and the extension of adhesive disease.

The operating time was not different between group A and group B. First laparoscopy operative time was higher, but not

TABLE 1

Rate of postsurgical adhesions between groups treated with ovarian suture (group A) and bipolar coagulation (group B).

	Group A, 13 patients	Group B, 14 patients
Postoperative adhesion formation	4 (30.8%)[a]	8 (57.1%)[a]
No postoperative adhesion formation	10 (69.2%)	7 (42.9%)

[a] Postoperative adhesion formation, group A vs. group B: $P<.001$.

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TABLE 2

Extension of ovarian adhesions, evaluated according to the ASRM adhesion score system, in groups treated with ovarian suture (group A) or with bipolar coagulation (group B), before surgery and at second look.

	Score of pelvic adhesion, mean ± SD	
	Before surgery	Second look
Group A	8.3 ± 1.9[a,c]	5.4 ± 2.1[b,c]
Group B	7.9 ± 2.2[a,d]	10.3 ± 2.9[b,d]

[a] Before surgery, group A vs. group B: not significant.
[b] Second look, group A vs. group B: $P<.001$.
[c] Group A, before surgery vs. second look: $P<.05$.
[d] Group B, before surgery vs. second look: $P<.01$.

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significantly, in patients who developed postoperative adhesion compared with adhesions-free patients at the second-look laparoscopy (Table 3).

The time of ovarian hemostasis was not significantly different between the two groups, but it was higher in group B than in group A (Table 4).

No major complications were reported between the first and the second laparoscopy, with the exception of one episode of postoperative fever.

DISCUSSION

Laparoscopic excision with stripping of the cyst wall usually involves the use of bipolar current to obtain good hemostasis of the exposed ovarian parenchyma. Removal of the cyst by stripping and bipolar coagulation is swift, well accepted, and safe (1, 3–7). However, there aren't enough data to evaluate the side effects of this surgical procedure.

TABLE 4

Time of ovarian hemostasis procedure in group A and group B.

Suture time (group A)	6.2 ± 2.1 min[a]
Bipolar time (group B)	6.9 ± 3.4 min[a]

[a] Suture time vs. bipolar time: not significant.

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Bipolar high-frequency coagulation causes large zones of destruction, judging by macroscopic, microscopic, and ultrastructural cellular alterations (19). In particular, the incidence of adhesion after bipolar coagulation has rarely been studied. Our data show an adverse influence of bipolar current use on postoperative adhesions formation. A significantly lower rate of postsurgical adhesions was observed when the ovary was only sutured (28.6% of patients in group A) compared with use of bipolar coagulation (53.3% of patients in group B). Moreover, the extension of pelvic adhesions, classified according to the ASRM adhesion score system, was significanlty higher when bipolar coagulation was applied (group B). A recent study on an animal model (17) confirms the hypothesis that bipolar current use induces peritoneal adhesion formation independently from type of antiadhesion agent used. In that study, severe peritoneal wounds were induced by peritoneal coagulation during a short laparoscopy using bipolar coagulation. The authors observed that no rats were free of adhesions. Although the use of antiadhesion agents was effective in postoperative adhesion prevention (10–13, 15), our data show the influence of surgical technique and hemostasis on postsurgical adhesion development.

In the present study, no significant difference was observed between cystectomies performed on left and right ovaries in terms of postoperative adhesion formation. Moreover, we did not observe any correlation between the diameter of endometrioma and the extent of adhesive disease. These data are in

TABLE 3

First laparoscopy operative time in patients who developed postoperative adhesion in adhesions-free patients at the second-look laparoscopy in each group.

	First laparoscopy operative time	
	Group A (ovarian suture), mean ± SD	Group B (bipolar coagulation), mean ± SD
Postoperative adhesion formation	39.0 ± 8.3 min[a]	41.3 ± 9.6 min[b]
No postoperative adhesion formation	36.2 ± 10.5 min[a]	37.3 ± 7.7 min[b]
Total	37.1 ± 9.6 min[c]	39.5 ± 8.8 min[c]

[a] Group A, postoperative adhesion formation vs. no postoperative adhesion formation: not significant.
[b] Group B, postoperative adhesion formation vs. no postoperative adhesion formation: not significant.
[c] Group A vs.group B: not significant.

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agreement with those reported by other authors (20). First laparoscopy operative time was higher, although not significantly, in patients who developed postoperative adhesion compared with adhesions-free patients, therefore first laparoscopy operative time did not influence postoperative adhesions formation. Operative time was higher, although not significantly, in group B than in group A. However, it is important to note the great variability of standard deviation in each group. Sometimes a complete hemostasis with use of bipolar coagulation alone required more time than apposition of an intraovarian suture. In fact, we observed that hemostasis performed by closure of the ovary with an intraovarian suture required less time than the use of bipolar coagulation. Hemostasis technique influences, but not significantly, operative time, which was lower in group A.

Bipolar electrocoagulation of the ovarian parenchyma also adversely affects ovarian function. A recent study (21) compared the functional ovarian damage associated with the use of bipolar coagulation versus ovarian suture after laparoscopic excision of ovarian endometriomas in patients with a single ovary. The authors observed significantly more patients with elevated FSH levels on day 3 of the cycle among women who received bipolar coagulation of the cystic bed. Another study confirmed the adverse effects of bipolar electrocoagulation on ovarian function, observing that a treated ovary developed a mean of 0.3 follicle per cycle as opposed to 1 follicle per cycle of untreated controlateral ovary (22).

Prospective comparative studies including more patients should be conducted to confirm our preliminary results both for adhesion evaluation and for reproductive outcome.

In conclusion, the use of the suture on ovaries treated for endometrioma is a simple, safe, and effective surgical procedure associated with a lower rate of postoperative adhesion formation compared with bipolar coagulation of the ovarian surface.

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