A comparison of histopathologic findings of ovarian tissue inadvertently excised with endometrioma and other kinds of benign ovarian cyst in patients undergoing laparoscopy versus laparotomy

Saeed Alborzi, M.D., a Leila Foroughinia, M.D., a Perikala Vijayananda Kumar, M.D., b Nasrin Asadi, M.D., a and Soroosh Alborzi, M.D. a

a Division of Infertility and Gynecologic Endoscopy, Department of Obstetrics and Gynecology; and b Department of Pathology, Shiraz University of Medical Sciences, Shiraz, Iran

Objective: To evaluate ovarian tissue inadvertently excised with benign cysts during laparotomy or laparoscopy.

Design: Prospective study.

Setting: Private and university hospitals.

Patient(s): 260 women, 20 to 35 years old, with unilateral benign ovarian cysts.

Intervention(s): One hundred fifty women operated by laparoscopic cystectomy stripping technique, and 110 women operated by laparotomy with the same technique.

Main Outcome Measure(s): Histopathologic findings of ovarian tissue inadvertently excised in endometrioma compared with other kinds of benign cysts in laparoscopy versus laparotomy.

Result(s): In the laparoscopy group, ovarian tissue was present in 65% of endometrioma and in 32% of nonendometriotic cysts. In the laparotomy group, ovarian tissue was seen in 80% of endometrioma and 41% of nonendometriotic cysts.

Conclusion(s): The surgical approach had no statistically significant impact on conservation of ovarian reserves. The nature of the ovarian cyst played a greater role in the quality and quantity of the excised ovarian tissue. (Fertil Steril® 2009;92:2004–7. ©2009 by American Society for Reproductive Medicine.)

Key Words: Endometrioma, nonendometrioma, laparoscopy, laparotomy, cystectomy

Laparoscopy has been used with increasing frequency in the management of ovarian masses in recent years. Although laparoscopic surgery is the approach of choice in women with benign ovarian cysts, laparotomy still has a place in management of this condition (1). Compared with laparotomy, laparoscopy has some benefits such as rapid recovery, shorter hospital stay, less blood loss, and reduced postoperative pain (2–4). Thus, selecting the best surgical approach—laparotomy versus laparoscopy—should be based on the surgical method contractions, the patient’s condition, the surgeon’s experience, and the patient’s preference.

Benign cysts such as endometrioma and dermoids are seen frequently in young, infertile women, so residual ovarian function after surgery is important. To remove endometriotic cysts, most surgeons tend to use the stripping technique because it results in complete removal of the lesion with less recurrence of symptoms and signs (5, 6). In some reports, the stripping technique has been associated with follicular loss, especially in endometrioma (7–9). However, Muzzi et al. (10) reported that the laparoscopic stripping technique could be a tissue-sparing procedure even in with endometriotic cysts. Furthermore, they did not find the normal follicular pattern in any of their cases (10). In our review of literature, only two related articles were found: the first evaluated the presence and nature of ovarian tissue adjacent to the benign cyst wall in the setting of laparoscopy (10), and the second compared ovarian tissue excised with endometriotic cysts during two different laparoscopic techniques, stripping versus circular excision (11, 12).

Our study compared the surgical approaches of laparoscopy versus laparotomy and evaluated the ovarian tissues that were excised with different benign cysts such as endometrioma, dermoid, serous cystadenoma, and mucinous cystadenoma. According to our review of the literature, the number of patients in our study is the largest group ever studied regarding this subject.
MATERIALS AND METHODS
In our prospective study, 260 patients aged 20 to 35 years with sonographically diagnosed benign ovarian cysts underwent cystectomy from 2003 to 2007. All cases had persistent ovarian cysts, 3 to 8 cm in size, that required surgical removal. Patients who had had previous surgical operations on their ovaries and women with functional, hemorrhagic, or malignant cysts were excluded.

In our center, due to the limited number of expert laparoscopists, both laparoscopy and laparotomy have been used for management of benign ovarian cysts. If patients do not insist on laparoscopy or do not like to be held on the long waiting list, laparotomy is performed by a general gynecologist. The first author (S.A.) performed laparoscopy for 150 women; laparotomy was performed for the others. The pathologic specimens were studied by one senior pathologist. This study was approved by the institutional review board of Shiraz University of Medical Sciences. All patients gave informed consent for the operation.

In operative laparoscopy, after general anesthesia a 10-mm trocar was inserted just below the umbilicus and insufflated with carbon dioxide at a pressure of 15 mm Hg. On direct view, two 5-mm trocars were placed through lower abdominal incisions. After an incision was made on antimesenteric surface of the cyst, two atraumatic grasping forceps were used to pull the cyst wall and the normal ovarian parenchyma in opposite directions so that the cyst wall was stripped from the bed of normal ovarian tissue. Any ovarian defect was repaired with continuous baseball intracorporal sutures with 4-0 Vicryl to prevent adhesion formation. Homeostasis was achieved by bipolar coagulation.

The same technique was performed on 110 patients who underwent laparotomy. All cyst walls were sent to a pathologist who was not informed about the clinical or surgical history of the patients. The pathologist evaluated the presence or absence of ovarian tissues adjacent to the cyst walls and graded the morphologic characteristics of the tissues on a semiquantitative scale of 0 to 4: 0, complete absence of follicles; 1, only primordial follicles; 2, primordial and primary follicles; 3, some secondary follicles; and 4, pattern of primary and secondary follicles as in the normal ovary (13).

In our center, due to the limited number of expert laparoscopists, both laparoscopy and laparotomy have been used for management of benign ovarian cysts. If patients do not insist on laparoscopy or do not like to be held on the long waiting list, laparotomy is performed by a general gynecologist. The first author (S.A.) performed laparoscopy for 150 women; laparotomy was performed for the others. The pathologic specimens were studied by one senior pathologist. This study was approved by the institutional review board of Shiraz University of Medical Sciences. All patients gave informed consent for the operation.

In operative laparoscopy, after general anesthesia a 10-mm trocar was inserted just below the umbilicus and insufflated with carbon dioxide at a pressure of 15 mm Hg. On direct view, two 5-mm trocars were placed through lower abdominal incisions. After an incision was made on antimesenteric surface of the cyst, two atraumatic grasping forceps were used to pull the cyst wall and the normal ovarian parenchyma in opposite directions so that the cyst wall was stripped from the bed of normal ovarian tissue. Any ovarian defect was repaired with continuous baseball intracorporal sutures with 4-0 Vicryl to prevent adhesion formation. Homeostasis was achieved by bipolar coagulation.

The same technique was performed on 110 patients who underwent laparotomy. All cyst walls were sent to a pathologist who was not informed about the clinical or surgical history of the patients. The pathologist evaluated the presence or absence of ovarian tissues adjacent to the cyst walls and graded the morphologic characteristics of the tissues on a semiquantitative scale of 0 to 4: 0, complete absence of follicles; 1, only primordial follicles; 2, primordial and primary follicles; 3, some secondary follicles; and 4, pattern of primary and secondary follicles as in the normal ovary (13).

The sample size used (150 vs. 110) was selected to detect with 90% power at the 0.05 alpha level, a difference of 64% in the rate of presence of ovarian tissue inadvertently excised in the laparoscopy group (12), given a reference rate for inadvertently removed ovarian tissue of 50% for the laparotomy group. Statistical analysis was done by using the chi-square test or Fisher’s exact test. \( P < 0.05 \) was considered statistically significant.

RESULTS
Two hundred sixty patients underwent ovarian cystectomy. These patients were divided into two groups. The first group comprised 150 patients operated by laparoscopy, and the second one included 110 patients operated by laparotomy. In all patients, ovarian cystectomy was performed with the stripping technique. No intraoperative or postoperative complications occurred in any of the patients. In the first group, 75 cysts were endometrioma (50%) and 75 (50%) were nonendometriotic cysts from which 36 (24%) were serous cysts, 25 (16.6%) dermoid cysts, and 14 (9.3%) mucinous cysts. In the second group, there were 50 (45%) endometrioma and 60 (55%) nonendometriotic cysts from which 24 (22%) were serous cysts, 22 (20%) dermoid cysts, and 14 (13%) mucinous cyst. No statistically significant differences were seen between these two groups.

In the first group, ovarian tissue was present in 73 cases (48%) (Table 1). In the nonendometriotic cysts, ovarian tissues were present in 9 of 25 dermoid (36%), 13 of 36 serous cystadenoma (36%) and 2 of 14 mucinous cystadenoma (14%).

In second group ovarian tissues were removed in 65 cases (59%) (see Table 1). In nonendometriotic cysts, ovarian tissues were found in 11 of 22 dermoid (50%), 9 of 24 serous cystadenoma (37%), and 5 of 14 mucinous cystadenoma (35%). As reported in Table 1, no statistically significant difference was found between the ovarian tissues excised with ovarian cysts by laparoscopy or laparotomy. As expected, in both groups, ovarian tissue was present more often in endometriotic than in nonendometriotic cyst walls (see Table 1).

The morphologic characteristics of the ovarian tissue inadvertently resected with endometriotic cyst walls was similar in patients operated by laparoscopy or laparotomy (Table 2). In both groups, only primordial follicles were present in most cases (grade 1); no specimens contained secondary follicles or the patterns of a normal ovary (grades 3 and 4). Moreover, in nonendometriotic cysts, no statistically significant differences could be found comparing the specimens

### TABLE 1

Comparison of the presence of ovarian tissue inadvertently excised in different ovarian cysts during laparotomy and laparoscopy.

<table>
<thead>
<tr>
<th>Type of ovarian cyst</th>
<th>Laparoscopy (n = 150)</th>
<th>Laparotomy (n = 110)</th>
<th>( P ) value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endometrioma</td>
<td>49 (65%)</td>
<td>40 (80%)</td>
<td>.07</td>
</tr>
<tr>
<td>Nonendometrioma</td>
<td>24 (32%)</td>
<td>25 (41%)</td>
<td>.2</td>
</tr>
</tbody>
</table>

obtained by the two different surgical methods (see Table 2). In both groups, no follicles were found in most of the specimens (grade 0), and none of the specimens showed grade 3 or 4 patterns.

**DISCUSSION**

Laparoscopy usually is considered the approach of choice for treating benign ovarian cysts such as ovarian endometrioma. Compared with laparotomy, laparoscopy is associated with a faster recovery, better and closer visualization, shorter hospital stays (2–4), and less possible adhesion formation (14). As previously mentioned, benign ovarian cysts are common in young women, so residual ovarian function after operation is important. The technique chosen for surgery, laparotomy versus laparoscopy, is crucial for sparing ovarian tissue.

The best choice in laparoscopic cystectomy is still controversial. Two prospective, randomized, controlled trials have compared cystectomy of endometrioma with fenestration and coagulation. In first study, Beretta et al. (6) showed that cystectomy was superior for improving the pain and subfertility caused by ovarian endometrioma. In the second study, Alborzi et al. (5) reported that laparoscopic cystectomy of endometrioma was associated with better outcomes in terms of pregnancy rate and pain relief and had a lower rate of reoperation even for larger cysts. Furthermore, in a retrospective study by Saleh and Tulandi (15), laparoscopic fenestration and ablation of the cyst wall yielded a less desirable outcome when compared with cyst excision (according to reoperation rate); however, in a retrospective series by Hemmings et al. (16), the patients undergoing laparoscopic fenestration and bipolar coagulation achieved pregnancy in a shorter period than those who underwent laparoscopic cystectomy.

A major concern that remains is the loss of follicles associated with the stripping procedure. There are different ideas about the association of the type of laparoscopic technique with ovarian reserve in endometriotic cyst cases, a condition that is not unusual in cases of infertility. Some studies have shown that, after a cystectomy with stripping techniques, ovaries performed worse compared with nonoperated ones when the patients underwent ovarian stimulation for assisted reproduction (17–19). On the other hand, other studies found no statistically significant difference in the follicular response of diseased ovaries to ovulation induction after laparoscopic cystectomy or fenestration-coagulation compared with the response of contralateral normal ovaries (20, 21). Also, in a group with bilateral endometrioma, in which each ovary was operated by a different method, the response of the ovaries was similar (20).

A study done on ovarian reserve after laparoscopic stripping techniques compared endometrioma and dermoid cysts by ultrasound (7). The data indicated that this technique reduced ovarian tissue in endometriomas but was not associated with a similar loss of ovarian tissue in dermoid cysts. The investigators believed that the reduction of ovarian tissue in endometrioma was not the result of the surgical procedure itself but rather was related to the nature of endometriotic cysts, in which a real cyst capsule is not present.

In an experiment with 42 patients, Muzii et al. (10) showed that in nonendometrial cysts that have real anatomic cyst capsules (dermoid, serous cystadenoma, and mucinous cystadenoma) some ovarian tissue is removed only in 6% of patients; in resection of the endometriotic cysts, ovarian tissue was present in 54% of cases. However, they showed that ovarian tissue adjacent to the endometrioma was morphologically different from normal ovarian tissue, so they called stripping technique a tissue-sparing procedure. Moreover, Muzii et al. (11, 12) showed that in 48 patients ovarian tissue was excised with endometriotic cyst wall in most cases, and this tissue

<table>
<thead>
<tr>
<th>Grade</th>
<th>Laparoscopy (n = 75)</th>
<th>Laparotomy (n = 50)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endometrioma</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>10 (13%)</td>
<td>10 (20%)</td>
<td>.31</td>
</tr>
<tr>
<td>1</td>
<td>28 (37%)</td>
<td>21 (42%)</td>
<td>.60</td>
</tr>
<tr>
<td>2</td>
<td>11 (15%)</td>
<td>9 (18%)</td>
<td>.61</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0</td>
<td>—</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>0</td>
<td>—</td>
</tr>
<tr>
<td>Nonendometrioma</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>15 (20%)</td>
<td>12 (20%)</td>
<td>1.00</td>
</tr>
<tr>
<td>1</td>
<td>8 (11%)</td>
<td>9 (15%)</td>
<td>.45</td>
</tr>
<tr>
<td>2</td>
<td>1 (1%)</td>
<td>3 (3%)</td>
<td>.21</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0</td>
<td>—</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>0</td>
<td>—</td>
</tr>
</tbody>
</table>

*Notes:* Grade 0: complete absence of follicles. Grade 1: only primordial follicles. Grade 2: primordial and primary follicles. Grade 3: some secondary follicles. Grade 4: pattern of primary and secondary follicles in normal ovary.

was at normal functional development stages only near the ovarian hilus. Furthermore, they suggested that different techniques in laparoscopy (direct stripping versus circular excision) had no significant influence on the quality of the resected tissue.

In our study, 260 patients had ovarian cystectomy by laparoscopy or laparotomy. This has been the first time that histopathologic findings of ovarian tissues removed with a benign cyst wall in laparoscopy or laparotomy have been compared. Histologic analysis of excised specimens from ovarian cystectomy showed that some ovarian tissues were inadvertently removed with the cyst wall in 48% of cases operated by laparoscopy and 59% by laparotomy; this difference was not statistically significant. In endometriotic cysts, without considering the type of surgery, some ovarian tissues were inadvertently removed with the cyst pseudocapsule (65% in laparoscopy and 80% in laparotomy); however, the tissue removed with the cyst walls showed no normal ovarian morphology, and only primordial follicles (grade 1) were found in most cases. In nonendometriotic cysts, ovarian tissues that were removed with cyst walls were similar with laparotomy and laparoscopy, and most histologic analyses showed no follicles in the specimens (grade 0).

The role of stripping techniques in maintaining ovarian reserve seems to be similar whether laparotomy or laparoscopy is used. Some ovarian tissues were removed with cyst walls in many cases, especially with endometriotic cysts, but they did not exhibit the morphologic characteristics of normal ovarian tissue.

REFERENCES