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Laparoscopic Surgery for Large Ovarian Cysts-Review

Gamal Eltabbakh*

Lake Champlain Gynecologic Oncology, South Burlington, Vermont, USA

***Corresponding author:** Gamal Eltabbakh, Cornelius Lake Champlain Gynecologic Oncology, South Burlington, Vermont, USA, Tel: 802-859-9500; Fax: 802-859-9944; E-mail: geltabbakh@lcog.com

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Abstract

Introduction: Laparoscopic surgery has been increasingly applied to different gynecologic problems with excellent surgical outcome and rapid recovery. Large ovarian cysts, a relatively common gynecologic problem, pose certain challenges to laparoscopic management.

Objective: The aim of the present study was to review published reports on laparoscopic surgery for large ovarian cysts and summarize their findings regarding patients' selection, surgical outcome, technical methods and the final pathology report.

Methods: A review of the English language literature of the MEDLINE (PubMed) database was performed using the key words: ovarian cysts, laparoscopy, large, huge and robotic. An additional collection of reports was found by systematically reviewing all references from retrieved papers. The review was limited to case reports including 5 or more patients and excluded laparoscopic surgery for ovarian cysts in pregnancy.

Results: A total of 20 studies including 852 patients were identified. There was one prospective randomized study. The operative and postoperative complication rates were 1.9% and 3.9% of the cases were converted to laparotomy. Borderline ovarian tumors and ovarian cancers were identified in 2.5% and 3.1% of the patients, respectively. The incidence of borderline tumors and ovarian cancer varied depending on the selection criteria used for management of women with large ovarian cysts laparoscopically. Criteria for patients' selection and surgical techniques employed to reduce tumor spill and extract the large cysts are reviewed.

Conclusions: Laparoscopy is a safe technique for managing patients with large ovarian cysts and is associated with low conversion and complication rates. The chance of finding unexpected ovarian cancer varies according to the patients' selection criteria but is low overall.

Keywords: Ovarian cysts; Laparoscopic surgery; Laparoscopy; Pregnancy; Ovarian cancer

Introduction

The last two decades have witnessed increased utilization of laparoscopic surgery among women with gynecologic problems including benign and malignant conditions. The appeal of laparoscopic surgery includes small incisions, less post-operative pain, short hospital stay, early ambulation, and early recovery, fewer complications related to the incision and better patients' satisfaction and quality of life. Despite being performed through small incisions, the visualization of the operative field, surgical outcome and the ability to achieve the surgical objectives have been similar among patients undergoing laparoscopic surgery compared to those whose surgery was performed through laparotomy.

Ovarian cysts are the most common cause of pelvic masses among women and adnexal masses are a common indication for gynecologic surgery. It is estimated that approximately 5-10% of women in the United States will undergo surgery for an adnexal mass [1]. Ovarian cysts are the fourth most common cause for gynecologic admission in the United States [2]. Laparoscopic surgery has been the primary method of management of women with ovarian cysts requiring surgical intervention.

Traditionally, large ovarian cysts have been managed by laparotomy. Compared to laparotomy, laparoscopy has the advantages of being an outpatient procedure, no requiring large incision, decreasing postoperative complications related to incision, allowing early ambulation and return to normal activities and decreasing the chance of deep venous thrombosis and pulmonary embolism. In addition, the small laparoscopic incisions are cosmetically more appealing than the large incision. Ultrasound or computed tomography- guided aspiration of large ovarian cysts has been attempted in select groups of patients. This procedure cannot be recommended except in exceptional situations (pain associated with large cysts in pregnant or frail patients) as it might lead to dissemination of malignant cells, does not provide histologic confirmation of the nature of the cyst and recurrence of the cysts is rather common.

Yuen et al. [3] in a randomized prospective study comparing laparoscopy to laparotomy in the management of women with ovarian cysts less than 10 cm in diameter documented a significant reduction in operative morbidity, post-operative pain, analgesic requirements, hospital stay and recovery period among women undergoing laparoscopy.

In a Cochrane database system review, Medeiros et al. [4] reported that the results of nine randomized controlled trials (N=482 women) showed that laparoscopic surgery was associated with fewer adverse events of surgery, less post-operative pain, greater likelihood of being pain free after two days and fewer days in hospital than laparotomy. In one study that reported costs, laparoscopy was associated with a significant reduction in costs compared to laparotomy.

Panici et al. [5] enrolled 227 patients with benign adnexal masses in a randomized clinical study, which compared management by laparoscopy to management by minilaparotomy. The authors found than only 3 (4.7%) patients required conversion from laparoscoy to laparotomy and that post-operative pain and minor complications were significantly less common among patients who underwent laparoscopy.

However, the laparoscopic management of the large cystic ovarian lesions is not without its challenges. Large ovarian cysts can interfere with identification of the ureter, bowel, bladder and other important structures. A cyst, which fills the pelvis and is palpable at the level of the umbilicus might be punctured by the *vs.* needle or the camera trocar. Such an event takes on clinical significance as the ability of preoperative sonography to differentiate benign from malignant cystic lesions varies inversely with increasing lesion size. Accordingly, such an event might result in an upstaging of a patient with a localized ovarian neoplasm and convert a patient potentially cured by surgery to one in need of systemic therapy. Panici et al. [5] reported such events to be significantly more frequent among patients whose lesions measured greater than seven centimeters in diameter. Encountering an unanticipated ovarian malignancy and inadvertent rupture of such a lesion are not the only concerns incumbent upon such an unpleasant surgical surprise. The issues of staging and adequacy of resection must be addressed as they impact initiation of systemic therapy, and ultimate prognosis. Such issues are intimately related to the experience of the operator and the ability of the patient and the surgical team to perform the technical maneuvers (steep Trendelenburg, maintenance of adequate pneumoperitoneum, etc.) required to ensure an optimal operation.

The downside of such events is not limited to malignant ovarian lesions. Puncture and subsequent spillage of the contents of large cystic teratomas (dermoid) can result in impressive chemical peritonitis with resultant adhesions formation and bowel dysfunction.

Aim of the Study

The aim of the present study was to review published reports on laparoscopic surgery for large ovarian cysts and summarize their findings regarding patients' selection, surgical outcome, technical methods and the final pathology report.

Methods

A review of the English language literature of the MEDLINE (PubMed) database was performed using the key words: ovarian cysts, laparoscopy, large, huge and robotic. An additional collection of reports was found by systematically reviewing all references from retrieved papers. The review was limited to case reports including 5 or more patients. We excluded papers addressing laparoscopic surgery for ovarian cysts during pregnancy.

Results

Despite the presence of many case reports of successful laparoscopic surgery for women with large ovarian cysts [6-9], we identified only 20 studies [10-29] including 852 patients of laparoscopic management of ovarian cysts defined as large or huge. There was only one prospective randomized study [10]. Table 1 summarizes the case series reported on the subject. The operative and postoperative complication rates were 1.9% and 3.9% of the cases were converted to laparotomy. The most common reasons for conversion to laparotomy included unexpected finding of cancer and technical difficulty secondary to adhesions. Serous [14,16] or mucinous [10,25] cystadenomas were the most common pathologic findings. Borderline ovarian tumors and ovarian cancers were identified in 2.5% and 3.1% of the patients, respectively. The incidence of borderline tumors and ovarian cancer varied depending on the selection criteria used for management of women with large ovarian cysts laparoscopically. Studies that included patients with solid components of the cysts, elevated CA 125 or ascites were associated with higher incidence of borderline tumors or ovarian cancer than studies that limited laparoscopic management to completely cystic or septated lesions with normal CA 125 and no ascites.

Author	Study Type	Number of Patients	Conversion to Laparotomy	Complications	Borderline Ovarian Tumors	Ovarian Cancer
Alobaid et al. [11]	Retrospective	5	0	0	0	0
Chong et al. [12]	Retrospective (2 laparoscopic and 1 laparotomy groups)	25 and 33	0	4	0	0
Djukic et al. [13]	Prospective	25	0	0	0	0
Eltabbakh et al. [14]	Prospective	33	2	0	2	0
Ghezzi et al. [15]	Retrospective	186	12	3	8	17
Gocmen et al. [16]	Retrospective	46	1	0	1	0
Kumakiri et al. [17]	Retrospective (two groups)	21 and 32	0	0	0	0
Lim et al. [18]	Retrospective	81	4	2	3	2

Oh et al. [19]	Retrospective	10	0	0	0	0
Ou et al. [20]	Retrospective	18	0	0	0	1
Panici et al. [10]	Randomized controlled trial	60	8	0	0	1
Roda et al. [21]	Retrospective	12	1	0	0	0
Quinlan [22]	Retrospective	132	0	0	5	0
Sagiv et al. [23]	Retrospective	21	2	0	0	1
Salem [24]	Retrospective	15	0	0	0	0
Song et al. [25]	Retrospective	31*	4	3	0	4
Takeda et al. [26]	Retrospective	35	2	3	2	0
Vizza et al. [27]	Retrospective	25	0	0	0	0
Vishwanath et al. [28]	Retrospective	15	1	1	0	0
Vlahos et al. [29]	Retrospective	19	0	0	0	0
Total		**852**	**33 (3.9%)**	**16 (1.9%)**	**21 (2.5%)**	**26 (3.1%)**

Table 1: Case series and studies of laparoscopic surgery for large ovarian masses.

Most authors [5,14] defined large ovarian cysts as those whose maximum diameter exceeds 10 cm. However, other authors defined large ovarian cysts as those reaching the level of the umbilicus [24] and extremely large when they are described as reaching above the level of the umbilicus [23]. Takeda et al. [26] defined large ovarian cysts as those whose excised tissue weight including cystic contents was more than 500 gm. Chong et al. [12] defined large ovarian cysts as those whose diameter was >8 cm on pre-operative imaging studies. Panici et al. [10], defined large ovarian cysts as those whose diameter was between 7 and 18 cm. Quinlan [22] defined large ovarian cysts as those larger than 18 weeks pregnancy. I believe that using a definite measurement is more reproducible and reflective of the actual size of the cyst as the level of the umbilicus might vary among women depending on their body habitus. Additionally, the location of the ovarian cyst might differ from time to time as a result of the size of the other pelvic organs (e.g. the bladder or the uterus).

Panici et al. [10] reported on the single randomized controlled trial that addressed laparoscopic management of women with large adnexal masses. These authors compared regular operative laparoscopy to laparoscopically guided minilaparotomy among 60 women with non-endometriotic adnexal cysts with diameter between 7 and 18 cm. The authors found that laparoscopically-guided minilaparotomy when compared with laparoscopy was able to reduce intraperitoneal spillage with minimal increase in patient short- and long-term discomfort and length of recovery [10].

Chong et al. [12] compared 25 patients who underwent single-port assisted extracorporeal cystectomy, 33 patients who underwent conventional laparoscopy and 25 patients who underwent laparotomy. Those authors found that single-port assisted extra-corporeal cystectomy offered an alternative to conventional laparoscopy and laparotomy with comparable surgical outcomes. Furthermore, cyst content spillage was significantly lower than that in conventional laparoscopy.

Djukic et al. [13] prospectively followed 25 patients treated with laparoscopic ovarian cystectomy of large ovarian neoplasms. These authors demonstrated that the affected ovary resumed its normal volume within three months after surgery despite the thinned appearance of the ovarian cortex present on ultrasound pre-operatively.

Song et al. [25] studied single port gasless laparoscopy-assisted minilaparotomy in the management of a group of patients with large ovarian cysts and suspicion of malignancy based on imaging studies and tumor markers. These authors allowed patients with some ascites into the study. Not surprising, the proportion of ovarian cancers found among their study population (12.9%) was the highest among all the studies that investigated laparoscopic surgery among women with large ovarian masses. Eltabbakh et al. [14] allowed only patients whose sonographic and tomographic features were consistent with benign cysts. Subsequently, these authors found no cases of ovarian cancer among their study population [14].

None of the studies evaluated laparoscopic management of women with large ovarian masses who were found to have unanticipated ovarian malignancy reported on survival among patients so managed.

Panici et al. [10] and Ghezzi et al. [15] reported high tumor spillage rates of 80% and 65%, respectively among their study population. Though pseudomyxoma peritonei is one of the potential complications of leakage of mucinous ovarian cysts, Mage et al. [30] observed no cases of pseudomyxoma peritonei after laparoscopic management of mucinous ovarian cysts.

Although the size of an ovarian cyst was found to be an independent predictor of the risk of malignancy [31], most large ovarian cysts are benign. Geomini et al. [32] reported that the accuracy of frozen section diagnosis is dependent on the adnexal tumor size and that in masses >10 cm, a benign result of the frozen section was less reliable than in masses <10 cm. It is for this reason, among others, that the American College of Obstetricians and Gynecologists has

recommended referral of the following patients to a gynecologic oncologist [33] for evaluation of selected ovarian lesions:

- Postmenopausal women who have a pelvic mass, and at least one of the following indicators: elevated CA 125; ascites; nodularity; fixation; evidence of extra-ovarian metastases; a family history of one or more first-degree relative with ovarian cancer or breast cancer.
- Premenopausal women with a pelvic mass and at least one of the following indicators; elevated CA 125 >200 U/mL; ascites; extraovarian metastases; a family history of one or more first-degree relatives with ovarian or breast cancer.

It will also be reasonable to add premenopausal or postmenopausal women with known BRCA 1 or 2 germline mutations and a pelvic mass other than functional ovarian cysts.

We depend primarily on transvaginal sonography to determine the degree of suspicion of malignancy. However, pre-operative ultrasound has limitations in morbidly obese patients, patients who have never been sexually active, patients with a narrow vagina and those with phobia of vaginal exams. When the cyst is very large, transvaginal ultrasound might not be able to visualize the entirety of the lesion and a combination of abdominal ultrasound and/or computed tomography might be needed. The ultrasound features associated with malignancy include solid component, wall nodularity, thick septations (>2 mm) and Doppler blood flow in the solid areas of the cyst [34]. The degree of suspicion for ovarian cancer is higher in postmenopausal compared to premenopausal patients and in patients with bilateral as compared to unilateral ovarian masses [35]. Other imaging studies including magnetic resonance imaging as well as the level of tumor maker CA 125 elevation are also of value. However, with regard to the CA 125 it is important to note that there is no single value of CA 125 that can reliably diagnose or exclude malignancy and that ovarian endometriomas may be associated with very high CA 125 values [36].

There is no agreement regarding the size of a cystic lesion, which a priori contraindicates laparoscopic approach to surgical management. Roda et al. [21] performed laparoscopic surgery on 12 patients whose average maximum cyst diameter was 25 cm and included a patient whose cyst diameter was 41 cm. Lim et al. [18] performed laparoscopic surgery on 5 patients whose cystic lesions measured >30 cm. Quinlan [22] reported that he removed 10 liters of fluid from a cystic ovarian lesion subsequently removed laparoscopically. Pelosi and Pelosi [8] reported on laparoscopic removal of a 103-pound ovarian tumor. However, with extremely large ovarian masses, there is an increasing risk of retroperitoneal extension, which complicates laparoscopic management due to the presence of the bowel anterior to the cyst and close proximity of the ureters to the posterior aspect of the lesion. Large ovarian cysts, which grow into the mesentery of the sigmoid colon, particularly in obese patients, present a special challenge as adipose tissue and its incumbent vascularity may obscure identification of appropriate tissue planes which permit optimal dissection.

Smorgick et al. [37] described the laparoscopic removal of 263 ovarian cysts. The overall rate of inadvertent intraoperative rupture was 16.6%. These authors found no significant correlation between inadvertent intraoperative rupture and adnexal torsion, pelvic adhesions, bilateral adnexal surgery, concomitant uterine surgery, presence of pelvic endometriotic foci, pregnancy, and surgeon's experience [37]. In multivariate analysis, only cyst size and cystectomy procedure were positively and significantly associated with inadvertent cyst rupture [37]. The prognostic significance of intraoperative rupture of malignant ovarian cysts is controversial. Maiman et al. [38] reported that surgical rupture might unfavorably influence prognosis. However, in multivariate analysis of stage I ovarian cancer patients, Dembo et al. [39] demonstrated that factors that influenced relapse rate were tumor grade, dense adhesions and ascites and that intraoperative rupture had no adverse effect on prognosis.

The following techniques might help in avoiding intraperitoneal cyst leakage during laparoscopic removal:

- Avoiding blind transumbilical insertion of the Veress needle or the laparoscopic trocar in cysts approaching the umbilicus,
- Use of open laparoscopic entry [40],
- Insertion of the Veress needle through the Palmer's point,
- Use of the Bonnano suprapubic catheter (Becton Dickinson, Rutherford, NJ, USA) for cyst aspiration [14],
- Use of the SAND balloon catheter (Hakko Medical, Tokyo, Japan) [26,27],
- Aspiration of the cyst inside an endobag,
- Pre-operative ultrasound guided cyst aspiration,
- Aspiration through a nephrostomy tube using the Seldinger technique,
- extracorporeal aspiration through a minilaparotomy and
- Aspiration and extraction through the vagina in patients undergoing concomitant laparoscopic assisted vaginal hysterectomy.

After placement of the tip of the Bonnano catheter inside the cyst and removal of the stilette, the hub of the catheter is connected to direct suction thus shortening the time needed for full aspiration of the cyst. The curved tip of the Bonnano catheter reduces the chance of spillage of the cyst's contents, and the multiple holes allow for rapid aspiration even though the cyst contents might be thick. The SAND balloon catheter has two balloons at the tip of the catheter and can hold the cyst wall between the two balloons. When the two balloons at the tip of the catheter are inflated, each swells to a diameter of approximately 25 mm, compresses the cyst wall and minimizes spillage.

Although somewhat controversial, intra-operative rupture or leakage of a malignant ovarian cyst might upstage the patient from stage IA or B to stage IC with potential need for postopertive chemotherapy. In this regard, pre-operative patient selection is of utmost importance. Referral to or consultation with a gynecologic oncologist is recommended for cysts with solid components (except those expected to be dermoid cysts), intracapsular tumor excrescences, ascites or CA 125 >35 U/mL in postmenopausal or >200 U/mL in premenopausal patients.

The following techniques have been used to extract the large cyst wall:

- Extraction after placement of the cyst wall in retrieval endobags either through the umbilical incision or one of the other puncture sites,
- Extraction with the uterus through the vagina in patients undergoing concomitant laparoscopic hysterectomy,
- Extraction through a minilaparotomy,
- Extraction through a posterior colpotomy.

Generally, laparoscopic endobags come in two sizes 3" × 6" and 5" × 8" depending on the size of the specimen. Sterile gloves and condoms have also been used for specimen retrieval.

After extraction of the cyst, copious irrigation with 1-4 liters of normal saline is performed and the fluid is aspirated. This is particularly important in patients with dermoid or mucinous cysts.

Conclusions

With proper patient selection, the size of an ovarian cyst should not constitute a contraindication to laparoscopic surgery. Experience in advanced laparoscopic surgery and the availability of a gynecologic oncologist should make the procedure safely applicable to a broader patient population.

Conflict of Interests

There is no conflict of interests to report.

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