Arch Gynecol Obstet
DOI 10.1007/s00404-012-2445-9

GENERAL GYNECOLOGY

Is tumor size the limiting factor in a laparoscopic management for large ovarian cysts?

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Received: 10 March 2012 / Accepted: 19 June 2012

Abstract
Purpose To assess the feasibility and short-term surgical outcome of laparoscopic surgery among women with large ovarian cysts.
Methods We retrospectively evaluated consecutive 81 patients who received laparoscopic management for ovarian cysts with diameter $\geq$ 10 cm and without radiologic features suggestive of malignancy, from March 2008 to September 2011.
Results Laparoscopic surgery was successful in 77 (95.1 %) of the total patients. The mean (range) operative time, estimated blood loss (EBL) and hospital stay were 107.6 (55–250 min), 226.9 (10–1300 mL) and 6.1 (4–15 days), respectively. The surgical procedures performed included salpingooophorectomy (SO) ($n = 44$), ovarian cystectomy (OC) ($n = 22$), adhesiolysis ($n = 1$), salpingectomy ($n = 2$) and total laparoscopic hysterectomy (TLH) with SO ($n = 8$). Conversion to laparotomy occurred with four patients. One patient had postoperative bleeding and one had minor complications associated with wound oozing at the umbilical port site. Histopathological examination revealed benign tumors in 76 patients (93.8 %), borderline ovarian tumor in three patients (3.7 %) and invasive epithelial ovarian cancer in two patients (2.5 %). Clinicopathological variables according to tumor size were not statistically different. Complications did not appear in any patients during the follow-up period.
Conclusion With proper patient selection, laparoscopy is a feasible and safe treatment for women with large ovarian cysts and tumor size did not have effect on laparoscopic management. However, surgeons should carefully consider the potential risk of malignancy in such patients.

Keywords Laparoscopy · Ovarian cyst · Tumor size · Complication

Introduction

The large ovarian cyst presents a major challenge for the laparoscopic surgeon. Although laparoscopic surgery has become an accepted method for the management of typical ovarian cysts, large ovarian cysts continue to be treated by laparotomy due to safety concerns. Increased probability of malignancy and technical problems related to cardiopulmonary functional changes may complicate surgery in such cases [1]. Most patients with large ovarian cysts are managed by conventional laparotomy. Limitations of laparoscopic surgery in terms of treating large ovarian cysts include technical difficulty associated with trocar insertion, reduced visualization, difficulty in removal of cysts, increased concern regarding cyst rupture and spillage of contents inside the body cavity, potential risk of malignant ovarian neoplasm, chemical peritonitis in women with teratoma, and concern about incomplete surgical staging of women found to have ovarian cancer [2].

We retrospectively evaluated the feasibility and surgical outcomes and whether tumor size is limiting factor for laparoscopic surgery in the management of large ovarian cysts.

Materials and methods

In this study, data from consecutive 81 patients with large ovarian cysts were collected between March 2008 and

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Published online: 12 July 2012

September 2011 at Gil Hospital, Gachon University of Medicine and Science. This study was approved our institutional review board. All patients received a preoperative ultrasound, with or without computed tomography (CT). Inclusion criteria included large ovarian cyst with diameter 10 cm or more in preoperative sonography or CT, absence of ascites, absence of complex mass, no evidence of intraperitoneal spread, and no enlarged retroperitoneal lymph nodes. Sonographic features suggesting malignancy included thick and/or irregular septa, solid mass, complex consistency, and ascites. Patients with signs of malignancy were excluded from laparoscopic treatment. Preoperative abdominopelvic CT was performed in cases where suspicious sonographic features were detected. If the case proved to be mostly of a benign nature, and no signs of malignancy were observed, laparoscopic surgery was indicated. Exclusion criteria included cyst size less than 10 cm, patients scheduled for laparotomic surgery, and cases with suspected malignancy.

These patients were stratified into three groups; patients with ovarian cyst 10–20 cm ($n = 70$), patients with ovarian cyst 20–30 cm ($n = 6$), and patients with size more than 30 cm ($n = 5$). The groups were compared as regard to postoperative stay, operation time, estimated blood loss (EBL), conversion to laparotomy, body mass index (BMI), postoperative complications and pathological findings.

Laparoscopy was performed under general anesthesia with endotracheal intubation. A uterine manipulator was inserted for patients who had not undergone hysterectomy and who had sexual contact. Open laparoscopy was used for peritoneal access in all patients. A puncture of about 1 cm diameter at the umbilical or supraumbilical area was performed and dissection of the abdominal layer was executed under direct vision until entering the peritoneal cavity. Additional 0.5–1 cm diameter punctures were made in the bilateral lower quadrants and suprapubic region, under direct vision, and pnuemoperitoneum was established using carbon dioxide at pressure settings of 15–12 mmHg. After inspection of the pelvis, ovaries, upper abdomen, omentum, liver and diaphragm surfaces for any growths or other signs of malignancy, reusable monopolar electrosurgical scissors, bipolar electrosurgical desiccating and cutting forceps, and variable tissue forceps were used to perform the indicated surgical procedures. For extremely large ovarian cysts which occupy whole pelvis and upper abdomen, the incision for laparoscopy was made beneath the xiphoid process using the Hasson cannula (Fig. 1). An additional 5 mm trocar was inserted in the right subcostal area and the cyst contents were aspirated under direct vision. After reducing the size of an extremely large cyst, salpingooophorectomy was performed. The management of the ovarian cyst included cystectomy or salpingooophorectomy, depending on the patient age and obstetric history. In ovarian cystectomy, the capsule was stripped from the ovarian stroma using grasper forceps. Bipolar forceps was used to coagulate the bleeding vessels at the capsule base. The removal of all surgical specimens was performed with endobags, in cases of adnexal surgery, or through the vagina in cases of hysterectomy. After the specimen extraction, the abdominal and pelvic cavities were thoroughly irrigated with copious amount of normal saline.

All statistical analyses were performed with the SPSS for window version 12.0 (SPSS Inc, Chicago, IL). ANOVA

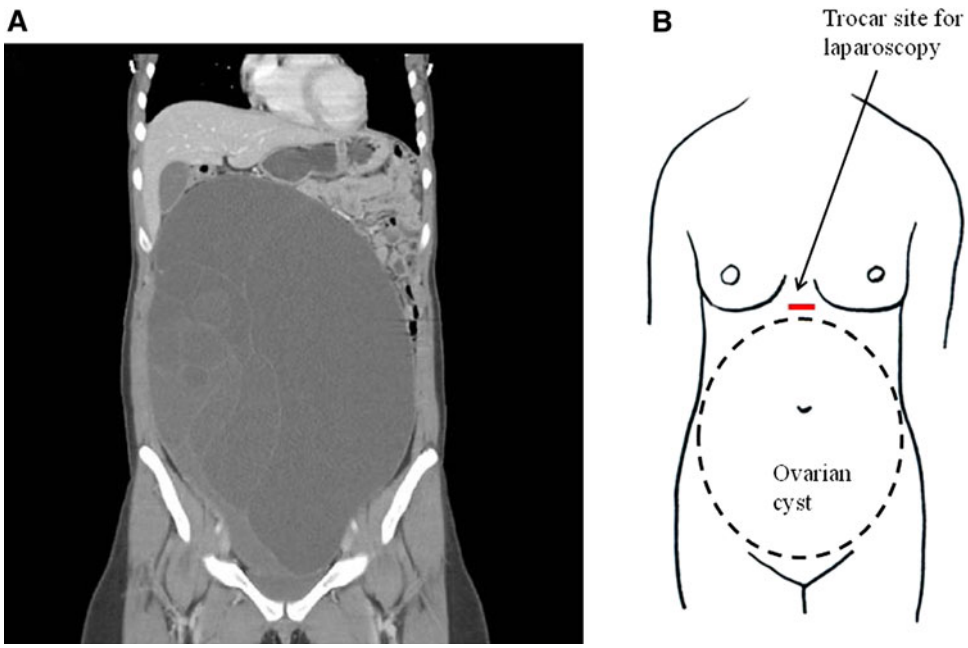

Fig. 1 **a** Coronal view of abdominopelvic CT in a patient with extremely large ovarian cyst, which occupying whole pelvis and upper abdomen. **b** Trocar incision site was made beneath the xiphoid process

test was used to compare the patients' characteristics and outcomes and Chi-square test was used to see the differences in postoperative complications and conversion rates in between the groups, with significance set at $p < 0.05$. Post hoc test was performed by Tukey's test.

Results

Patient characteristics are shown in Table 1. The median age of the patients was 39 (range 14–78) years. The average maximal diameter of the ovarian cysts was 14.6 cm (range 10.0–35.0 cm). The mean BMI was 22.4 kg/m^2 (range 10.7–37.1). Chief complaints were abdominal pain and abdominal discomfort. The mean operative time, EBL and hospital stay were 107.6 (range 55–250 min), 226.9 (range 10–1,300 mL) and 6.1 (range 4–15 days), respectively. Conversion to laparotomy occurred in four patients (4.9 %) due to intraoperatively diagnosed intraligamentary leiomyom, intraoperative bleeding, peritoneal inclusion cyst and pelvic adhesion, respectively.

Table 1 Characteristics of the patients

Variables	$n = 81$
Age (years)	
Median (range)	39 (14–78)
BMI (kg/m^2)	
Median (range)	22.4 (10.7–37.1)
Diameter of the cysts (cm)	
Mean (range)	14.6 (10.0–35.0)
$10 \leq 20$	70 (86.4 %)
$20 \leq 30$	6 (7.4 %)
>30	5 (6.2 %)
Operation time (min)	
Mean (range)	107.6 (55.0–250.0)
EBL (mL)	
Mean (range)	226.9 (10–1600)
Hospital stay (days)	
Mean (range)	6.1 (4–15)
Symptoms	
Incidental finding	17 (21.0 %)
Abdominal pain	24 (29.6 %)
Abdominal distension	14 (17.3 %)
Palpable mass	15 (18.5 %)
Irregular cycles	2 (2.5 %)
Vaginal bleeding	3 (3.7 %)
Dyspepsia	4 (4.9 %)
Urinary frequency	2 (2.5 %)
Type of laparoscopic surgery (%)	
Salpingectomy	2 (2.5 %)
Ovarian cystectomy	22 (27.2 %)
Salpingooophorectomy	44 (54.3 %)
Adhesiolysis	1 (1.2 %)
Hysterectomy with salpingooophorectomy	8 (9.9 %)
Conversion to laparotomy	4 (4.9 %)

BMI body mass index, *EBL* estimated blood loss

The laparoscopic surgical procedures performed included salpingooophorectomy (SO) ($n = 44$), ovarian cystectomy (OC) ($n = 22$), adhesiolysis ($n = 1$), salpingectomy ($n = 2$) and total laparoscopic hysterectomy (TLH) with SO ($n = 8$). Major intraoperative complication occurred in one patient who underwent conversion to laparotomy due to intraoperative bleeding caused by severe pelvic adhesion. Major postoperative complication occurred in one patient who underwent conversion to laparotomy due to the necessity for peritoneal inclusion cyst removal. This patient showed postoperative bleeding in the abdominal cavity and recovered after embolization. One patient showed the minor postoperative complication of umbilical trocar site oozing. No complications were observed in the other patients.

Histopathological examination revealed benign tumors in 76 patients, borderline ovarian tumor in 3 (3.7 %) patients and invasive mucinous adenocarcinoma in 2 (2.5 %) patients (Table 2).

Clinicopathological factors were not significantly different according to tumor size. Conversion to laparotomy and borderline or malignant tumor were most frequent in group of tumor size 10–20 cm (Table 3).

All of the five patients, who had borderline tumor or invasive ovarian cancer did not show any findings suggestive of malignancy on sonography or CT (Table 4). The two patients who had mucinous adenocarcinoma received adjuvant chemotherapy with six cycles of carboplatin, performed without complete surgical staging because no evidence of tumor dissemination on pre- and postoperative imaging studies was revealed, and these patients refused re-operation. These two patients had no recurrence during their follow-up periods of 24 and 32 months, respectively. Of the three patients, who had borderline ovarian tumors,

Table 2 Pathologic findings

	n (%)
Serous cystadenoma	15 (18.5)
Mucinous cystadenoma	21 (25.9)
Endometrioiss	11 (13.6)
Mature cystic teratoma	16 (19.7)
Tubal cyst	6 (7.4)
Borderline malignancy	3 (3.7)
Invasive epithelial ovarian cancer	2 (2.5)
Fibroma	2 (2.5)
Other benign cyst	5 (6.2)

Table 3 Clinicopathologic factors according to tumor size

Variables	Tumor size (cm)			*P* value
	10–20 (n = 70)	20–30 (n = 6)	>30 (n = 5)	
Age (years, mean ± SD)	39.8 ± 13.6	37.8 ± 16.7	30.0 ± 12.2	0.305
Tumor diameter (cm, mean ± SD)	12.6 ± 2.7	24.0 ± 2.4	31.7 ± 2.3	<0.001
EBL (mL, mean ± SD)	229.7 ± 283.3	175.0 ± 61.2	250.0 ± 297.9	0.880
Operation time (min, mean ± SD)	104.7 ± 41.0	133.3 ± 40.7	118.0 ± 18.2	0.211
BMI (kg/m^2) (mean ± SD)	22.8 ± 4.1	24.0 ± 3.9	24.5 ± 2.8	0.534
Hospital stay (days, mean ± SD)	6.1 ± 2.1	6.0 ± 1.7	6.0 ± 1.6	0.985
Borderline or malignant tumor by histopathological examination	3 (3.7 %)	1 (1.2 %)	1 (1.2 %)	0.200
Conversion	4 (4.9 %)	0	0	0.718

EBL estimated blood loss, *BMI* body mass index, *SD* standard deviation

Table 4 Characteristics of patients diagnosed as borderline ovarian tumor or invasive ovarian cancer

Patients	Age	Maximal tumor diameter (cm)	Operation name	Sonographic or CT findings	Histologic diagnosis
1	41	24	Laparoscopic LSO	Multiple septation without solid portion	Mucinous borderline tumor
2	42	25.3	TLH BSO	Internal septation without solid portion	Mucinous carcinoma in the background of mucinous cystadenoma of borderline malignancy
3	43	19.4	Laparoscopic LSO	Well-circumscribed cystic mass without septations or internal complexity	Serous borderline tumor
4	16	35	Laparoscopic RSO	Multiple septation without solid portion	Mucinous adenocarcinoma, well differentiated in the background of mucinous borderline tumor
5	54	12.5	TLH BSO	Multiple septation without solid portion	Mucinous borderline tumor

CT computed tomography, *LSO* left salpingooophorectomy, *RSO* right salpingooophorectomy, *TLH BSO* total laparoscopic hysterectomy with bilateral salpingooophorectomy

two underwent SO and one received TLH BSO. These three patients have been followed-up for 8, 9 and 24 months, respectively, and no recurrences have occurred. Long-term follow-up of all the patients revealed no complications related to the laparoscopic surgery.

Discussion

There has been an increasing trend over the last several decades in the use of laparoscopic surgery for women with adnexal cysts. A random, prospective study in patients with benign ovarian masses showed that laparoscopic surgery can reduce operative morbidity, postoperative pain and analgesics use, hospital stay, and recovery period [3]. Several studies have reported laparoscopic surgery for patients with large ovarian cysts but the number of patients included in these reports was small [4–6]. Experience related to laparoscopic surgery as a treatment modality for large ovarian masses remains limited.

In these previous studies, large adnexal cysts were defined as those with the largest diameter exceeding 10 cm, as observed in preoperative imaging studies [2, 7]. In the present study, we also used 10 cm as the minimum size criteria for a large adnexal cyst.

Major concerns regarding laparoscopic surgery among women with these larger adnexal masses include rupture of the cyst, spillage of the cyst contents into the body cavity, limited operation field, difficulty of extraction of the mass, and malignant potential of such masses. The most serious concerns were intraperitoneal spillage and trocar site implantation of malignant cells. Spillage of materials, in the cases of mature cystic teratoma or endometrioma, can theoretically produce chemical peritonitis. Intraoperative spillage of mucinous cysts may initiate pseudomyxoma peritonei, and spillage of malignant cells may cause peritoneal seeding of cancer. Therefore, the treatment of the cyst must include careful and copious peritoneal lavage performed immediately after the procedure, using several liters of irrigation saline, and with the patient in a reverse

Trendelenburg position [8]. In addition, the extraction of the adnexal mass should be performed carefully. Although it is uncertain whether or not an intraoperative rupture has the same prognostic significance as ovarian surface involvement and/or positive peritoneal washings in stage I ovarian cancers [9], most investigators suggested that intraoperative rupture is not significant [10–12]. It is controversial and uncertain whether or not intraoperative rupture of a stage IA ovarian cancer truly causes a worse outcome, and whether or not these patients should receive adjuvant chemotherapy [11]. In multivariate analysis of stage I cancer, factors that influenced prognosis were tumor grade, appearance of dense adhesions and ascites. Intraoperative spillage of tumor cells demonstrated no adverse effect on prognosis [12]. We considered intraoperative rupture as equivalent to a FIGO stage IC tumor and provided adjuvant chemotherapy. Nevertheless, a serious attempt should be made to avoid spillage and thorough irrigation should be administered at the end of the procedure.

Cyst rupture and spillage may have occurred in some of our cases during cyst aspiration and attempts were made to minimize the spillage of the cyst contents. In cases of large endometrioma or teratoma, we performed copious irrigation and aspiration with large amounts of normal saline, and we did not encounter any resulting chemical peritonitis.

Port-site metastasis after laparoscopic removal of malignant tissue is another reported complication [13, 14]. In our cases, we extracted ovarian cysts using endobags to prevent port-site metastasis. We had three borderline ovarian tumor cases and two cases of invasive carcinoma, but no metastatic lesions were observed on trocar sites during the follow-up periods.

Because of the potential risk of malignancy, the selection of patients for laparoscopic management of large ovarian cysts is very important. It is generally agreed that ovarian cancer should not be managed laparoscopically especially when operators are not able to perform the surgical procedure without rupture [15]. A French, retrospective multicenter study suggested there was no difference in outcome after laparoscopic management of ovarian cancer, but surgical staging was suboptimal in a significant number of laparoscopically managed cases [16]. The selection of suitable candidates can be successfully accomplished by excluding those with tumors with suspicious ultrasound or CT/MRI appearance, or elevated CA125 levels. Suspicious ultrasound features for a cyst include thick septations, solid components within the cyst, accumulation of ascites, and rich blood flow in masses or septations. In the present study, we did not use CA125 levels in the selection of patients and instead used ultrasound features and CT/MRI images. However, postoperative diagnosis of invasive carcinoma in the present study was higher (2.5 %) than in other studies using the CA125 level criteria for patient selection. Other studies using more strict criteria for patients' selection reported no invasive ovarian cancer after postoperative histopathologic examination [4, 8, 10].

One of two patients who were diagnosed with invasive carcinoma had no remarkable sonographic findings except multiple septation, and her serum CA125 was within normal range. Moreover, she presented with intermittent abdominal pain and ovarian tumor torsion was suspected initially. Another patient with invasive carcinoma also had a multiseptated cyst and her serum CA125 was observed to be slightly elevated to 66.6 mIU/L.

The hospital stay is considerably shorter for patients who receive laparoscopic surgery. However, the length of stay was relatively longer in our study than in others and it may be explained by the policies of the insurance system in our country and the most patient preference for delaying discharge until after the removal of surgical stitches.

In our small series study, we observed a higher incidence of postoperatively diagnosed malignancy than seen in other studies. However, with proper patient selection, laparoscopy can be applied in the management of large ovarian cysts. According to the results of this study, laparoscopic management of large ovarian cysts is a safe and effective method, but patient selection should be carefully evaluated due to the risk of postoperative malignancy. The potential risk of malignancy is more important in the selection of patients with laparoscopic management of large ovarian cysts. In this study, five cases are not well done operated by laparoscopy, because in three cases a borderline ovarian tumor and in two cases invasive carcinoma was found. Because of rupture of the cyst it became stage 1c at least.

Conclusion

In the present study, laparoscopic management of large ovarian cysts was a safe and effective method, but we observed a higher incidence of postoperatively diagnosed malignancy than seen in other studies. Therefore, potential risk of malignancy is more limiting factor of laparoscopic management for large ovarian cyst rather than tumor size. With proper patient selection, laparoscopy may be a feasible and safe treatment for women with large ovarian cysts. Surgeons should carefully consider the potential risk of malignancy in such patients.

Conflict of interest The authors declare that they have no conflict of interest.

References

1. Nagele F, Magos AL (1996) Combined ultrasonographically guided drainage and laparoscopic excision of a large ovarian cyst. Am J Obstet Gynecol 175:1377–1378
2. Eltabbakh GH, Charboneau AM, Eltabbakh NG (2008) Laparoscopic surgery for large benign ovarian cysts. Gynecol Oncol 108:72–76
3. Yuen PM, Yu KM, Yip SK, Lau WC, Rogers MS, Chang A (1997) A randomized prospective study of laparoscopy and laparotomy in the management of benign ovarian masses. Am J Obstet Gynecol 177:109–114
4. Shindolimath VVJS, Patil KV, Ammanagi AS (2009) Laparoscopic management of large ovarian cyst at a rural hospital. J Gynecol Endosc Surg 1:94–97
5. Salem HA (2002) Laparoscopic excision of large ovarian cysts. J Obstet Gynaecol Res 28:290–294
6. Goh SM, Yam J, Loh SF, Wong A (2007) Minimal access approach to the management of large ovarian cysts. Surg Endosc 21:80–83
7. Ou CS, Liu YH, Zabriskie V, Rowbotham R (2001) Alternate methods for laparoscopic management of adnexal masses greater than 10 cm in diameter. J Laparoendosc Adv Surg Technol A 11:125–132
8. Gocmen A, Atak T, Ucar M, Sanlikal F (2009) Laparoscopy-assisted cystectomy for large adnexal cysts. Arch Gynecol Obstet 279:17–22
9. Leitao MM Jr, Boyd J, Hummer A, Olvera N, Arroyo CD, Venkatraman E, Baergen RN, Dizon DS, Barakat RR, Soslow RA (2004) Clinicopathologic analysis of early-stage sporadic ovarian carcinoma. Am J Surg Pathol 28:147–159
10. Vergote I, De Brabanter J, Fyles A, Bertelsen K, Einhorn N, Sevelda P, Gore ME, Kaern J, Verrelst H, Sjovall K, Timmerman D, Vandewalle J, Van Gramberen M, Trope CG (2001) Prognostic importance of degree of differentiation and cyst rupture in stage I invasive epithelial ovarian carcinoma. Lancet 357: 176–182
11. Sevelda P, Dittrich C, Salzer H (1989) Prognostic value of the rupture of the capsule in stage I epithelial ovarian carcinoma. Gynecol Oncol 35:321–322
12. Dembo AJ, Davy M, Stenwig AE, Berle EJ, Bush RS, Kjorstad K (1990) Prognostic factors in patients with stage I epithelial ovarian cancer. Obstet Gynecol 75:263–273
13. Magrina JF (2000) Laparoscopic surgery for gynecologic cancers. Clin Obstet Gynecol 43:619–640
14. Kruitwagen RF, Swinkels BM, Keyser KG, Doesburg WH, Schijf CP (1996) Incidence and effect on survival of abdominal wall metastases at trocar or puncture sites following laparoscopy or paracentesis in women with ovarian cancer. Gynecol Oncol 60: 233–237
15. Canis M, Rabischong B, Houlle C, Botchorishvili R, Jardon K, Safi A, Wattiez A, Mage G, Pouly JL, Bruhat MA (2002) Laparoscopic management of adnexal masses: a gold standard? Curr Opin Obstet Gynecol 14:423–428
16. Lecuru F, Desfeux P, Camatte S, Bissery A, Robin F, Blanc B, Querleu D (2004) Stage I ovarian cancer: comparison of laparoscopy and laparotomy on staging and survival. Eur J Gynaecol Oncol 25:571–576