Current diagnosis and management of ovarian cysts

S.A. Farghaly

The Joan and Sanford I. Weill Medical College, The Graduate School of Medical Sciences, and The New York- Presbyterian Hospital, Weill Cornell Medical Center, Cornell University, New York (USA)

Summary

The epidemiology of ovarian cysts is unclear due to the lack of consistent reporting and a high likelihood of spontaneous resolution. In the USA, postmenopausal women have an ovarian cyst incidence of 18% over a 15-year period. Worldwide, about 7% of women have an ovarian cyst at some point in their lives. In Europe, a large screening trial revealed a 21.2% incidence of ovarian cysts among healthy postmenopausal women. The American College of Obstetricians and Gynecologists (ACOG) stated that simple cysts found on ultrasound may be safely followed without intervention, even in postmenopausal women. These cysts are not likely cancer precursors, nor markers of increased risk, and can be managed conservatively. Simple ovarian cysts appear to be stable or resolve by the next annual examination. These findings support recent recommendations to follow unilocular simple cysts in postmenopausal women without intervention. For those patients, ovarian cancer screening and follow up include a CA-125 blood test and transvaginal ultrasonography (TVU) at baseline, an annual TVU for three additional years, and annual CA-125 tests for five years beyond baseline. The TVU screening examination is considered positive (abnormal and suspicious for ovarian cancer) when findings included: 1) ovarian volume greater than 10 cubic cm; 2) cyst volume greater than ten cubic cm; 3) any solid area or papillary projection extending into the cavity of a cystic ovarian tumor of any size; or, 4) any mixed (solid/cystic) component within a cystic ovarian tumor. Women with positive screening examinations are referred to gynecologic oncology unit for follow-up investigation. Diagnostic consideration and surgical management of ovarian cysts are discussed.

Key words: Ovarian cysts; Diagnosis; Surgical management; SPA robotic surgery for ovarian cysts; Large ovarian cysts.

Introduction

In clinical practice, ovarian neoplasms are a common problem affecting pre- and postmenopausal patients. They are the fourth most common reason for gynecologic hospital admission in the United States. It has been estimated that approximately 10% of women in the United States will undergo surgical procedure for a suspected ovarian neoplasm during their lifetime [1]. Functional ovarian cysts and benign neoplasms make up most of these abnormalities.

Most functional cysts resolve and can be observed, although they can cause menstrual irregularities, pain, and rare intraperitoneal bleeding. There are several histopathologic types. Ovarian cystadenomas are benign tumors with simple cyst walls, small in size, and more likely to bilateral. Mucinous cystadenomas are multicystic and could achieve large size. Mature cystic teratomas are the most frequent germ cell tumor and are composed of one or more of the three primitive germ cell layers. They vary in size and presentation. They are often asymptomatic and may be more prone to torsion.

Ovarian thecomas originate in the medulla. They produce estrogen, and may have concomitant endometrial hyperplasia or neoplasia. Ovarian fibromas are likely to originate in the ovarian cortex, are usually asymptomatic, can grow to a large size, and may result in Meigs syndrome with ascites and pleural effusions.

Endometriomas are a result from the invagination of endometriotic tissue into the ovary. The ideal treatment of this tumor is cystectomy. The American College of Obstetrics and Gynecology (ACOG) and the Society of Gynecologic Oncologists (SGO) published joint guidelines for referral to a gynecologic oncologist. According to these guidelines, the provider should refer postmenopausal women who have a pelvic mass that is suspicious for malignant ovarian neoplasm based on elevated CA-125, ascites, a nodular fixed pelvic mass, evidence of abdominal or distant metastasis, or a family history of one or more relatives with ovarian or breast cancer. The same criteria apply to premenopausal women except the threshold for CA-125 elevation is greater than 200 U/ml [2].

Diagnostic consideration

Sonography (particularly three-dimensional sonography), magnetic resonance imaging (MRI), and computed tomography (CT) imaging are each recommended for differentiating malignant from benign ovarian masses. Serum CA-125, as a standalone modality is not diagnostic for ovarian malignancy.

Surgical procedures

1) Laparoscopy is a reasonable alternative to laparotomy. The choice between laparoscopy and laparotomy should be based on patient and clinician preferences. The benefits of laparoscopy include reduced postoperative analgesic re-

Revised manuscript accepted for publication July 15, 2014

quirement, earlier mobilization reducing chances of deep venous thrombosis (DVT), cosmetic advantages, earlier discharge from the hospital, and return to normal activity. One should note that fertility-preserving surgery is an acceptable alternative to more extensive surgery in patients with low-malignant-potential tumors, those with well-differentiated surgical Stage I ovarian cancer, and who have the desire to conceive in the future. Full discussion, regarding this option with a gynecologic oncologist is important. It is estimated that approximately 80% of benign ovarian tumors can be successfully removed using minimally invasive technique. The additional advantages of this approach include: improved magnification and avoidance of unnecessary laparotomy in patients with benign ovarian tumors [3]. It has been shown that laparoscopic ovarian cystectomy is associated with decreased postoperative adhesion formation compared with laparotomy [4]. Cases of dermoid cysts and endometrioma spillage should be avoided as they could cause chemical peritonitis and increase the risk of postoperative adhesions. Rupture of dermoid cyst, during surgery my cause granulomatous reaction [5].

It was noted that ovarian cystectomy/oophorectomy performed by laparoscopy was associated with less postoperative pain than laparotomy [6-7]. It has been shown that the incidence of operative complications such as transfusion rate, visceral damage, infection, thromboembolism, and perioperative mortality was similar between the laparoscopy and the laparotomy group. However, the duration of surgery tended to be longer in the laparoscopy group than in the group who had laparotomy [6]. There was no difference in the recurrence rate of ovarian tumors between the two study groups. All these pooled results were homogenous. In the study by Damiani *et al.* [8], laparoscopy was found to have a lower surgical cost than laparotomy [mean difference in cost (1,000 USD in 1993).

There are some disadvantages for utilizing laparoscopy in treating ovarian cysts, for example left-side adnexal masses in patients who have undergone hysterectomy can be difficult, because resection on and around the rectosigmoid and its mesentery is frequently required. Nonetheless, the feasibility often can be determined only after laparoscopic inspection. Maiman *et al.* [9] reported on laparoscopic mismanagement of ovarian tumors. The mismanagement included aspiration of malignant cysts without removal (38%), partial removal of malignant cysts (33%), absence of utilization of frozen section (60%), and no serum tumor markers (88%). Delayed laparotomy as a second procedure was noted in 71% of patients, with an average delay of 4.8 weeks between procedures. Rupture of ovarian cyst capsule is another disadvantage of laparoscopy in the oncologic setting. Laparoscopy is more likely than laparotomy to result in capsular rupture, because with laparoscopy masses often must be drained before removal. Webb *et al.* [10] reported that the five-year survival for the 53 patients with unruptured cysts was 78% compared with 56% for those with ruptured cysts. This retrospective, univariate analysis did not stratify for tumor adherence or high-grade lesions, both of which were more common in the patients with ruptured cysts. The avoidance of ovarian tumor mismanagement is important when suspicious adnexal masses are diagnosed. Certain guidelines must be observed. Inspection of the entire intraperitoneal cavity should be performed first, with special attention paid to the diaphragms, the omentum, and the pelvic peritoneum. Intraperitoneal washings for cytologic testing should be performed before the initiation of any operative procedure. Avoidance of capsular rupture should not be overlooked. The use of large laparoscopic sacs, drainage of cysts or morcellation of masses may be accomplished within these sacs, allowing removal through small abdominal wall or colpotomy incisions without peritoneal contamination. If intra-abdominal cystic drainage is necessary for very large masses. Also, the capsular puncture site should be closed after drainage. The use of frozen section is critical to avoid delay in definitive surgical management and chemotherapy. In addition, the patient should be physically and psychologically prepared for cancer surgery. Some surgeons see some disadvantages of colpotomy, including incisional infection, peritonitis, and technical complexity, particularly in patients after hysterectomy, however bringing the opening of the collection bag out an anterior abdominal wall incision, is likely to have comparable results.

2) Single port access (SPA) robot-assisted laparoscopic surgery utilizing *da Vinci* surgical system may be used as a minimally access invasive surgery in cases of ovarian cysts. Robotic surgery is feasible and safe for patients with either benign or malignant gynecologic disease even with severe pelvic adhesions. The ease of operating the robotic system may overcome the limitations and long learning curve of conventional laparoscopic surgery in complicated conditions. The success of robotic surgery depends on teamwork. There have been reports showing that a gynecologist can master robotic surgical staging in 20 patients [11].

My own experience is that, there is no significant difference between novice and expert laparoscopists when learning to master an operation using the da Vinci surgical system. There are some disadvantages for this surgical system, namely: high cost, bulkiness of the device, loss of haptic feedback, and inconvenience for the assistant to manipulate the uterus and to exchange instruments. This could be improved as the robotic and surgical instrumentation technologies evolve. It is worth noting that in case of discovery of a malignant mass, the robot does not allow access to the upper quadrants of the abdominal cavity and requires de-installation of the robot and 180° rotation of the operating table before placement of new trocars to complete the procedure [12,13].

In cases of malignant ovarian tumor, robot-assisted laparoscopic surgery for those patients is safe and effective

alternative to laparoscopic and laparotomy surgery. It has the advantage of three-dimensional vision, ergonomic, intuitive control, and wristed instrument that approximate the motion of the human hand. It can decrease the incidence of intraoperative complications and postoperative wound complications without significantly increasing operative time or blood loss. The procedure is cost-effective with acceptable operative, pathological, and short and long term clinical outcome. It retains the advantage of minimally invasive surgery [14]. The disadvantages of robot-assisted surgery include the cost, bulkiness, and availability of the robot in different hospitals. With the cost of the equipment being as high as two million US dollars, the annual maintenance fees, and the cost of semi-disposal instruments. Additional costs include the extra operating room time needed to assemble, disassemble, and prepare for the robotic portion of the surgery. In addition, it is awkward for the assistant to work around the robot to interchange equipment, manipulate the uterus, and exchange instruments in the accessory ports. In a standard laparoscopic surgery, it is easier and faster to exchange instruments.

Surgical approach to large ovarian cysts

Laparoscopic or robot-assisted laparoscopic management of these cysts could be safely performed following a thorough preoperative assessment of their size and nature in order to achieve complete removal of the ovarian pathology and avoid spillage. In my experience, preoperative Doppler ultrasound, CT, and levels of serum tumor markers are imperative during the preoperative evaluation of patients. Ovarian cysts were considered suspicious in the presence of at least one of the following features: thick/irregular cyst wall, thick septa, and solid papillary projections [15]. The risk of malignancy of ovarian cysts after careful preoperative assessment could be reduced to 0.2% to 0.6%. [16]. Cyst rupture represents common events during surgical management of ovarian cystic masses [17]. The incidence of tumor spillage in laparoscopically managed large ovarian masses varies between 22% and 100%, [16, 18-20], whereas the risk of rupture during laparotomy has been reported to be in the range of 10% to 26% [21]. There are several techniques to prevent spillage during laparoscopy: 1) the use of grasping forceps through the five-mm port site to obliterate the puncture site and minimize spillage [22], 2) the removal of the specimen through a laparoscopic bag [23]. In addition, a thorough peritoneal lavage is recommended at the end of the procedure, especially if spillage has occurred. In my experience, laparoscopic or robot-assisted laparoscopic management of ovarian tumors is feasible for large ovarian cysts and offer additional benefits: decreased hospitalization reduced postoperative pain, faster return to normal activities, and better cosmetic results. There is always a concern about the adverse impact of cyst rupture in cases of malignancy.

The impact of intraoperative cyst rupture in early-stage ovarian cancer is controversial. There is no significant difference in survival or disease-free interval described between patients with iatrogenic Stage IC epithelial ovarian cancer and Stage IA and IB disease. Dembo *et al.*, [23] demonstrated that tumor grade and presence of dense adhesions or ascites are the sole prognostic factors for tumor relapse. Another study showed that the survival rate reached 78% in patients with intact tumor, 87% in those with punctured cysts, and 84% in those with spontaneous rupture [24]. In addition, it has been shown that the degree of differentiation was the most powerful prognostic factor for disease-free survival, followed by rupture before surgery, rupture during surgery, FIGO stage, and age. Histological type, dense adhesions, extracapsular growth, ascites, and size of the tumor had no prognostic value for disease-free survival [25]. Another potential risk is the accuracy of frozen section diagnosis. It is known that specificity and sensitivity are high in ovarian tumors regardless of size [26]. In my view, definite surgery for ovarian tumor, in women of reproductive age should not be performed based on frozen section results prior to the final histopathological report.

Conclusion

The laparoscopic approach to benign ovarian masses offers significant advantages over conventional laparotomy, as it reduces morbidity, hospital stay, and recovery, without increasing the risk of spillage of the cyst contents. In addition, robot-assisted laparoscopic surgery has the advantages of the wrist motion which allows for precise surgery, and suturing than conventional "straight stick" laparoscopy. The three-dimensional vision in robot-assisted surgery provides substantial depth of field perception. Overall, minimally invasive surgery should replace laparotomy in the management of ovarian masses.

References

[1] Hilger W. S., Magrina J. F., Magtibay P. M.: "Laparoscopic management of the adnexal mass". *Clin. Obstet. Gynecol.*, 2006, *49*, 535.
[2] ACOG Committee on Gynecologic Practice: "The role of the generalist obstetrician-gynecologist in the early detection of ovarian cancer". *Gynecol. Oncol.*, 2002, *87*, 237.
[3] Bassil S., Canis M., Pouly J.L., Manhes H., Mage G., Bruhat M.A.: "Fertility following laparoscopic treatment of benign adnexal cysts". *In:* Donnez J., Nissole M., De Cherney A. (eds). *An atlas of laser operative laparoscopy and hysteroscopy.* 1st ed. London: Parthenon Publishing Group, 1994, 164.
[4] Lundorff P., Hahlin M., Kallfelt B., Thorburn J., Lindblom B.: "Adhesion formation after laparoscopy surgery in tubal pregnancy: a randomized trial versus laparotomy". *Fertil. Steril.*, 1991, *55*, 911.
[5] Nissole M., Bassil S., Donnez J.: "Laparoscopic management of ovarian cysts". *In:* Donnez J., Nissole M., DeCherney A. (eds). *An atlas of laser operative laparoscopy and hysteroscopy.* 1st ed. London: Parthenon Publishing Group, 1994, 145.
[6] Medeiros L.R., Fachel J.M.G., Garry R., Stein A.T., Furness S.: "Laparoscopy versus laparotomy for benign ovarian tumours". *Cochrane Database Syst. Rev.*, 2005, *3*, CD004751.

[7] Morgante G., Ditto A., La Marca A., Trotta V., De Leo V.: "Surgical treatment of ovarian dermoid cysts". *Eur. J. Obstet. Gynecol. Reprod. Biol.*, 1998, *81*, 47.
[8] Damiani G., Campo S., Dargenio R., Garcea N.: "Laparoscopic versus laparotomic ovarian cystectomy in reproductive age women: an economic evaluation". *Gynaecological Endoscopy*, 1998, *7*, 19.
[9] Maiman M., Seltzer V., Boyce J.: "Laparoscopic excision of ovarian neoplasms subsequently found to be malignant". *Obstet. Gynecol.*, 1991, *77*, 563.
[10] Webb M.J., Decker D.G., Mussey E., Williams T.J.: "Factors influencing survival in stage I ovarian carcinoma". *Am. J. Obstet. Gynecol.*, 1973, *116*, 222.
[11] Seamon L.G., Fowler J.M., Richardson D.L., Carlson M.J., Valmadre S., Phillips G.S., *et al.: "*A detailed analysis of the learning curve: robotic hysterectomy and pelvic-aortic lymphadenectomy for endometrial cancer". *Gynecol. Oncol.*, 2009, *114*, 162.
[12] Magrina J.F., Espada M., Munoz R., Noble B.N., Kho R.M.C.: "Robotic adnexectomy compared with laparoscopy for adnexal mass". *Obstet. Gynecol.*, 2009, *114*, 581.
[13] Magrina J.F., Zanagnolo V., Noble B.N., Kho R.M., Magtibay P.: "Robotic approach for ovarian cancer: perioperative and survival results and comparison with laparoscopy and laparotomy". *Gynecol. Oncol.*, 2011, *121*, 100.
[14] Farghaly S.A.: "Robot–assisted laparoscopic surgery in Patients with Advanced Ovarian Cancer: Farghaly's Technique". *Eur. J. Gynaecol. Oncol.*, 2013, *34*, 205.
[15] Marret H.: "Doppler ultrasonography in the diagnosis of ovarian cysts: indications, pertinence and diagnostic criteria". *J. Gynecol. Obstet. Biol. Reprod. (Paris)*, 2001, *30*, S20.
[16] Mahajan N.N., Gaikwad N.L., Mahajan K.N.: "Minimal access approach to the management of large ovarian cysts". *Surg. Endosc.*, 2008, *22*, 406.
[17] Göçmen A., Atak T., Uçar M., Sanlikal F.: "Laparoscopy-assisted cystectomy for large adnexal cysts". *Arch. Gynecol. Obstet.*, 2009, *279*, 17.
[18] Sagiv R., Golan A., Glezerman M.: "Laparoscopic management of extremely large ovarian cysts". *Obstet. Gynecol.*, 2005, *105*, 1319.
[19] Takeda A., Sakai K., Mitsui T., Nakamura H.: "Management of large cystic adnexal tumor by gasless laparascopic-assisted surgery with wound retractor". *J. Minim. Invasive Gynecol.*, 2007, *14*, 644.
[20] Darwish A.M., Amin A.F., Mohammad S.A.: "Laparoscopic management of paratubal and paraovarian cysts". *JSLS*, 2003, *7*, 101.
[21] Fanfani F., Fagotti A., Ercoli A., Bifulco G., Longo R., Mancuso S., Scambia G.: "A prospective randomized study of laparoscopy and minilaparotomy in the management of benign adnexal masses". *Hum. Reprod.*, 2004, *19*, 2367. Epub 2004 Jul 8.
[22] Göçmen A., Atak T., Uçar M., Sanlikal F.: "Laparoscopy-assisted cystectomy for large adnexal cysts". *Arch. Gynecol. Obstet.*, 2009, *279*, 17.
[23] Dembo A.J., Davy M., Stenwig A.E., Berle E.J., Bush R.S., Kjorstad K.: "Prognostic factors in patients with stage I epithelial ovarian cancer". *Obstet. Gynecol.*, 1990, *75*, 263.
[24] Sjövall K, Nilsson B, Einhorn N.. Different types of rupture of the tumor capsule and the impact on survival in early ovarian carcinoma. Int J Gynecol Cancer. 1994;4:333-336.
[25] Vergote I., De Brabanter J., Fyles A., Bertelsen K., Einhorn N., Sevelda P., *et al.*: "Prognostic importance of degree of differentiation and cyst rupture in stage I invasive epithelial ovarian carcinoma". *Lancet*, 2001, *357*, 176.
[26] Fallon M.A., Wilbur D.C., Prasad M.: "Ovarian frozen section diagnosis: use of whole-slide imaging shows excellent correlation between virtual slide and original interpretations in a large series of cases". *Arch. Pathol. Lab. Med.*, 2010, *134*, 120.

Address reprint requests to:
S.A. FARGHALY, M.D., PhD
The Weill Cornell Medical College, and
The New York Presbyterian Hospital
Weill Cornell University Medical Center
884 Second Avenue
10017 New York, NY (USA)
e-mail: samirfargaly@yahoo.com