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Original Article

Ovarian Suspension With Adjustable Sutures: An Easy and Helpful Technique for Facilitating Laparoendoscopic Single-Site Gynecologic Surgery

Kuo-Hu Chen, MD, PhD*, Li-Ru Chen, MD, MSc, and Kok-Min Seow, MD, PhD

From the Department of Obstetrics and Gynecology, Taipei Tzu-Chi Hospital, The Buddhist Tzu-Chi Medical Foundation, Taipei, Taiwan, and School of Medicine, Tzu-Chi University, Hualien, Taiwan (Dr. K-H. Chen), Mackay Memorial Hospital, Taipei, Taiwan, and Department of Mechanical Engineering, National Chiao-Tung University, Hsinchu, Taiwan (Dr. L-R. Chen), and Department of Obstetrics and Gynecology, Shin Kong Wu Ho-Su Memorial Hospital, and Department of Obstetrics and Gynecology, National Yang-Ming University, Taipei, Taiwan (Dr. K-M Seow).

ABSTRACT **Study Objective:** To describe a method of ovarian suspension with adjustable sutures (OSAS) for facilitating laparoendoscopic single-site gynecologic surgery (LESS) and to investigate the effect of OSAS on LESS.

Design: Prospective cohort study (Canadian Task Force classification: II-2).

Setting: University teaching hospital.

Patients: One hundred seventy-eight patients with benign 5- to 15-cm cystic ovarian tumors who underwent LESS with OSAS (suspension group, n = 90) and without OSAS (control group, n = 88).

Interventions: For patients who underwent OSAS (suspension group), 1 end of double-head straight needles with a polypropylene suture was inserted into the pelvic cavity through the abdominal skin to penetrate the cyst or ovarian parenchyma and puncture outside the abdominal skin. After cutting off the needles, both sides of the remaining suture were held together by a clamp, without knotting, so that the manipulator could "lift," "loosen," or "fix" the stitches to adjust the tension.

Measurements and Main Results: The average time to create OSAS was 2.9 min. For the suspension and control groups, the average blood loss was 81.4 and 131.8 mL ($p < .001$), and the operative time was 42.0 and 61.3 min ($p < .001$), respectively. There were no significant differences in the incidence of complications (5.6% vs 9.1%; $p = .365$), but there were significant differences in conversions to standard non–single-site laparoscopy (5.6% vs 15.9%; $p = .025$) and laparotomy (1.1% vs 6.8%; $p = .040$). Logistic regression analysis revealed that the ratios of conversion to standard non–single-site laparoscopy (odds ratio [OR], 0.126; 95% confidence interval [CI], 0.311–0.508) and laparotomy (OR, 0.032; 95% CI, 0.002–0.479) were much lower in the suspension group; the risk of complications was comparable (OR, 0.346; 95% CI, 0.085–1.403).

Conclusion: OSAS is an easy, safe, and feasible method that offers advantages during LESS. Although routine use of OSAS is not necessary, OSAS can be considered during LESS to facilitate the surgery. Journal of Minimally Invasive Gynecology (2015) 22, 767–775 © 2015 AAGL. All rights reserved.

Keywords: Laparoendoscopic single-site surgery; LESS; Ovarian suspension with adjustable sutures; OSAS; Single incision laparoscopic surgery; SILS

Laparoendoscopic single-site surgery (LESS), which is also known as single incision laparoscopic surgery or single-port access surgery, has increased in popularity because of its advantages, which includes fewer surgical wounds and more rapid recovery [1]; it serves as a good "outlet" for removal of the tumor. LESS has been shown to be a safe and feasible method while performing surgery

Corresponding author: Professor Kuo-Hu Chen, MD, PhD, Department of Obstetrics and Gynecology, Taipei Tzu-Chi Hospital, The Buddhist Tzu-Chi Medical Foundation, No. 289, Jianguo Road, Xindian, New Taipei City, Taiwan.
E-mail: alexgfctw@yahoo.com.tw

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on the gastrointestinal [2–6] and genitourinary tracts [7,8]. Similarly, the application of LESS in gynecology has been shown to be safe and effective among surgeries for benign conditions involving the uterus [9–12] and adnexa [13–18], as well as gynecologic malignancies [19–22]. However, difficult approaches to tumors resulting from position or hypermobility, or even pelvic adhesions, continue to pose a major problem for laparoscopists who perform single-site surgery. Despite the many instruments that have been designed [23–25] and the strategies developed [23,26,27] to facilitate LESS, difficult access to the tumor is often an important cause of excessive bleeding, longer operative time [6,28], and the need to convert to a standard non–single-site laparoscopy or laparotomy. In some patients with pelvic adhesions, the adnexa are adhered to the pelvic sidewalls or embedded in the pouch of Douglas, thus resulting in poor exposure of the tumor during LESS. Another problem associated with pelvic adhesions is that the adherent intestines or omentum may block the path of instruments to the tumor. In addition, hypermobility of the adnexa or the tumor may contribute to difficulty in fixation during manipulation of the tumor. Furthermore, Fader and Escobar [1] have reported that compared with adnexectomy, cystectomy is technically challenging due to the difficulty in achieving the optimal traction–countertraction required for enucleation of cysts. These are common causes that remarkably affect LESS, because the action of grasping and cutting the tumor is often limited during single-site laparoscopic surgery.

Currently, internal retractors (Endograb; Virtual Ports, Misgav, Israel) are available to facilitate laparoscopic surgery, including laparoscopic cholecystectomy [29,30]. Internal retractors are internally anchored retracting devices that can be introduced into the abdomen through a 5-mm port and removed at the end of surgery. Once employed, 1 of the 2 grasping ends is attached to the target organ, whereas the other end is anchored to the abdominal wall. The devices allow retraction equivalent to that achieved with a designated retracting instrument, thus decreasing the problems of instrument clashing and loss of triangulation, which has been encountered in LESS. However, the disadvantage or inconvenience of the devices is that the instruments provide a nonadjustable force of retraction once applied on the target organ. If the force of retraction has to be changed, the surgeon needs to manipulate the devices by re-grasping the ends of the devices onto the abdominal wall. Moreover, the application of the internal retractors requires experienced surgeons and assistants who are skillful in the technique. Furthermore, the devices must be purchased in advance. Because of the tiny sizes, the devices are difficult to find if lost in the abdominal cavity.

Based on previous experience, and inspired by colposuspension and other urogynecologic surgeries [31,32], we speculated that suspension of the tumor or ovary using an adjustable suture as needed might "lift," "loosen," or "fix" the tumor or ovary, thereby facilitating LESS. We describe a technique of ovarian suspension with adjustable sutures (OSAS) for assisting in difficult LESS ovarian surgery, and we investigate the effect of OSAS compared with cases without OSAS. For the purpose of being easy to learn and use during LESS, the technique must be simple and helpful so that most laparoscopists can easily apply the technique to assist in single-site surgeries.

Methods

Study Design and Sample

This prospective study was conducted in a university teaching hospital with >1000 beds between April 2012 and March 2013. The study was approved by the hospital institutional review board. All patients who required single-site laparoscopic ovarian surgery and met the criteria mentioned in the following were invited to participate in the study. Before surgery, every participant was examined using pelvic ultrasonography or computed tomography to evaluate the adnexa or the tumor; specifically, the size and location (unilateral vs bilateral) of the mass, and the possibility of malignancy (benign vs malignant) were evaluated. Due to practical difficulties in execution, the participants were not randomized. Instead, 2 cohorts were recruited at different times and compared. During the first 6 months, all of the participants underwent LESS without OSAS, and were classified as the control group. During the second 6 months, all of the participants underwent LESS with OSAS, and were classified as the suspension group. All participants were recruited by an ordinary survey rather by than physician preference (purposed sampling) in an effort to decrease selection bias.

Criteria for Inclusion and Exclusion

Only patients with ovarian tumors that had a maximal diameter between 5 and 15 cm, were hypermobile, and had different degrees of pelvic adhesions were recruited for the study. Only patients with cystic, as opposed to solid, ovarian tumors were included in the study. Because total excision of the adnexa is usually easier than oophorocystectomy during single-site laparoscopic surgery, the patients who underwent oophorectomy or salpingo-oophorectomy were excluded from the study. Emergency surgeries and surgeries combined with excision of other organs were also excluded due to the added operative time. In addition, because of the possible effect of tumor rupture, patients who were highly suspected to have a malignancy of the adnexa before laparoscopic surgery were excluded from the study. In our study, 4 patients were excluded based on this criterion, 3 and 1 of whom were proved to have ovarian cancer and borderline malignancy, respectively. Otherwise, all qualified patients who were willing to participate were enrolled in the study to avoid selection bias. All specimens of ovarian tumors were sent for definite diagnosis. As possible confounders, the characteristics of the participants