Case Report

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Robotic transumbilical single-site re-staging surgery of ovarian granulosa cell tumor – case report and technical points with video

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Introduction: Robotic laparo-endoscopic single-site (R-LESS) surgery is a potential advancement from the conventional single-site surgery in minimally invasive surgery (MIS) management for early ovarian cancer including granulosa cell tumors. This case report details the use of a novel robotic surgical system for a trans-umbilical single-site re-staging procedure to assess its feasibility and safety. It also discusses the technical challenges encountered during omentectomy, one of the most challenging steps of the surgery, since it requires changing of instrument direction from pelvic to abdominal area.

Case presentation: We presented a case of a female in 40 years old who came to our hospital for a re-staging surgery. She underwent open abdominal right ovarian and fallopian tube resection in local hospital, and post-operative pathology reported ovarian granulosa cell tumor. Since she insisted to have MIS, robotic laparo-endoscopic trans-umbilical single-site re-staging surgery was planned for her. The scope of the surgery was total hysterectomy, left ovarian and fallopian tube resection, and omentectomy. The whole surgery took 240 min. Console time was 173 min. Intra-operative bleeding was 50 mL. The patient left our hospital 3 days after surgery with no complications.

Discussion: Ovarian granulosa cell tumor is not common. Staging can be performed under MIS in highly selected patients. During infra-colic omentectomy, spaces were rather narrow for valid movement of robotic arms. To solve this problem, assistant played crucial role for traction and exposure.

Conclusion: To conclude, single-site robotic surgery was feasible for staging of ovarian granulosa cell tumor with highly selected patients.

Keywords: case report, omentectomy, ovarian granulosa cell tumor, re-staging surgery, robotic laparoscopic single-site surgery

Introduction

Ovarian granulosa cell tumor (GCT) contributes to <5% of ovarian tumor, and 70% of sex cord-stromal tumor[1,2]. Though rarely seen, 60%–95% of GCT are at early stages, with 5-year survival rate reaching 98%[1]. Staging surgery is the first-line treatment for GCT, including salpingo-ovariotomy, hysterectomy, omentectomy, total inspection of abdomen and pelvis, irrigation fluid cytology, and biopsy of suspected metastases[2,3]. Laparotomy is traditional approach for GCT[4]. Researchers are currently studying on minimally invasive surgery (MIS) for early-stage ovarian cancer with no differences in surgical outcomes, recurrence, and survival rate comparing with laparotomy[4,5]. In gynecology, MIS is increasingly common due to its superiority in surgical bleeding, complications, hospital stay, and cosmesis[4,5]. National Comprehensive Cancer Network (NCCN) guideline has recommended minimally invasive staging surgery for highly selected patients performed by experienced surgical team[6].

Single-site is another step forward of laparo-endoscopic surgery. However, problems such as lack of instrument triangulation, inflexibility, limited surgical visions, and narrowed working space severely decrease efficiency and increase learning curve[7,8]. For trans-umbilical single-site hysterectomies, traditional instruments are usually too short for vaginal stump suture[9]. The introduction of robotic laparo-endoscopic single-site surgery (R-LESS) solves these problems with its endo-wristed arm, long instruments, and 3-D visualization[10,11]. For R-LESS in gynecologic oncology, spaces between trans-umbilical port and omentum, also bowel, are usually too narrow to realize valid movements. When there are adhesions in anterior abdominal wall and bowel during R-LESS, traditional laparoscopy has to be applied for adhesiolysis[5,12]. Though there are many studies on R-LESS in gynecology, surgeries mostly includes pelvis such as hysterectomies and pelvic lymph-node resection[13,14]. Published reports of R-LESS involving abdominal

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procedures are limited[15,16]. As far as we concerned, there hasn't been any cases reporting R-LESS for staging surgery of GCT yet.

In this case, we present a trans-umbilical R-LESS for GCT re-staging with a novel robotic system (SR-ENS-600, SHURUI Inc., Beijing), accompanied by video illustration. This robotic system is specially designed for single-site purpose. It has been approved by National Medical Products Administration of China in June, 2023 and has gained its indication for gynecologic surgeries. Also, technical points for trans-umbilical infra-colon omentectomy were detailed descripted with video illustration. This case report follows SCARE guidelines[17].

Case

The case was approved by Ethical Committee of the First Affiliated Hospital of Xi'an Jiaotong University (No. 227 Yanta West Road, Xi'an, Shaanxi, China) on 23/11/2023 (Approval No. XJTU1AF2023LSYY-069). Written informed consent was gained from the participant before study began. Medication and surgical procedures in this case comply with the principles in the Declaration of Helsinki. All members in the surgical team were fully trained of SR-ENS-600 surgical robot before study began.

A woman in 40 years old, gravida 3 para 2 (both cesarean deliveries), admitted to outpatient department for a second-look surgery on 23/01/2024. Two weeks before admission, she went to local hospital due to abnormal uterine bleeding. Pelvic CT revealed a giant cyst on right ovary (153 × 73 mm, Fig. 1). She underwent open abdominal right ovariectomy in that hospital. Intra-operative frozen pathology reported benign ovarian tumor with no tumor cells in the irrigation fluid of pelvis. However, post-operative pathology presented ovarian adult granulosa cell tumor [immunohistochemistry: S-100(+), PAX8(−), CK20(−), α-inhinbin(+), CR(−), CK7(−), P63(−), KI67(10%), WT-1(+), P53(−), CD99(+), CK(−)]. Family and medical histories were not remarkable.

The primary diagnosis was ovarian granulosa cell tumor. The patient urged to have single-site second-look surgery since she already had suffered from 3 open abdominal surgeries. She had no expectation in preserving fertility. Through detailed consultation, a trans-umbilical robotic laparo-endoscopic single-site surgery was scheduled, including hysterectomy, right ovarian-fallopian tube resection, and omentectomy.

Surgical procedures were described as follow. After general anesthesia, the patient was placed in Trendeleburg lithotomy position. A 2.5 cm trans-umbilical cut was made and port was established through Hasson approach[18]. Generally, subcutaneous fat and tissues were dissected with Kelly hemostat to expose peritoneum. By lifting the peritoneum, the abdomen cavity was entered with a scalpel. Incision was palped with surgeon's small finger to ensure there was no adhesion. After that, SR-ENS-600 surgical robot was docked with camera 30° downward (Fig. 2). Total hysterectomy and right adnexectomy were performed. Vaginal stump was consecutively closed with barbed suture.

For omentectomy, the patient was changed into reversed Trandeleburg position. Patient cart, robot arms, and port were 180° shifted to expose abdominal cavity. Adhesions were carefully dissected with attention to colon, which hided blow omentum. Bilateral arteries of omentum were resected with monopolar scissors and bipolar forceps. This procedure needed reposition of the external robot arms for better vision. Then, robot arms were placed in the midline. Gastroepiploic ligament was incised to expose transverse colon. During this step, assistant should keep lifting the ligament for better exposure. Gastroepiploic arteries were carefully preserved to ensure the intact function of stomach. After that, assistant dragged transverse colon to cranial side with atraumatic forceps so that the majority of omentum was visualized under camera. The latter layers of omentum were then incised through the edge of serous layer of transverse colon. Then, the omentum was completely dissociated and was removed from the single-port with forceps (Fig. 3). Before withdrawing robot, pelvic and abdominal cavities were inspected to ensure no active bleeding or visible metastasis existed. Peritoneum, white linea alba, and subcutaneous tissues were consecutively closed. Detailed surgical

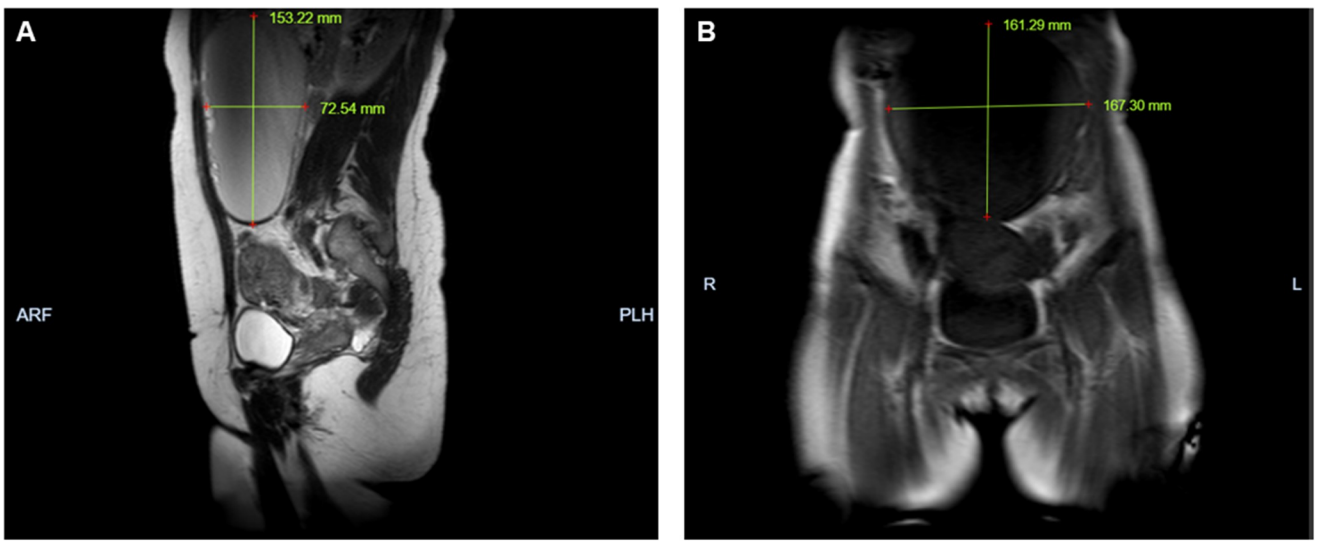

Figure 1. CT image of the pelvic mass before initial open abdominal surgery in sagittal view (A) and coronal view (B).

Figure 2. SR-ENS-600 robot console cart (A/B) and intra-operative display (C).

procedures were illustrated in Supplementary Digital Content, video 1 (http://links.lww.com/MS9/A668).

The surgery took 240 min. Console time was 173 min. Intra-operative bleeding was 50 mL. The patient left our hospital 3 days after surgery with no complications. Post-operative pathology reported uterine myoma (X1), hyperplastic endometrium, chronic cervical inflammation, no tumor cells found in the resected tissues, left ovarian corpus luteum, left fallopian tube. The patient was finally diagnosed as juvenile ovarian granulosa cell tumor stage IA based on International Federation of Gynecology and Obstetrics.

Discussion

We introduced a patient with GCT who underwent re-staging R-LESS. We successfully performed hysterectomy, left salpingo-ovariotomy, and omentectomy. Technical points were descripted with video illustration for duplication of surgical procedure in further clinical practices.

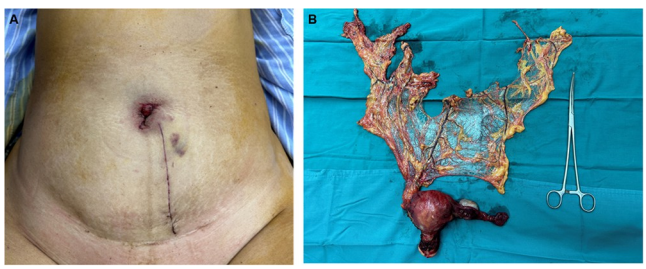

Figure 3. Post-operative scar and macroscopic outlook of resected viscera. (A). post-operative scar after R-LESS. Three scars can be observed from patient's lower abdomen. One old, transverse 12 cm scar, which was 10 cm above symphysis pubis, was due to cesarean deliveries. One vertical 15 cm scar on the lower left abdomen was caused by initial open abdominal surgery. One fresh trans-umbilical 2.5 cm scar, hidden in umbilicus region, was because of R-LESS. (B). macroscopic view of the resected uterus, left adnexa, and omentum.

Laparoscopy has been proven to be effective and safe for staging of ovarian cancer. However, questions exist in port metastasis, tumor spillage, metastasis caused by CO_2 pneumoperitoneum, and staging adequacy[5,19]. Current studies provided extremely rare port-site metastases cases and no differences in 10-year progression-free survival (68% vs 64%, P = 0.6) and overall survival (98% vs 97%, P = 0.8) between laparotomy and laparoscopy[4]. However, current researches only contain case series and retrospective studies[5]. Considering attractive short-term advantages and no differences in long-term outcomes compared with laparotomy, laparoscopy is regarded as optional in highly selected patients with experienced surgical team[6]. For re-staging surgery of GCT, the percentage of up-staging after laparoscopy was 19% and 28% for laparotomy[2]. It is of crucial importance for both pre-operative and intra-operative investigations.

Scarce cases report omentectomy through R-LESS for ovarian cancer due to technical reasons. First, robotic arms and camera were crowded through single-port. Though R-LESS partly compensated for instrument triangle compared with traditional single-site laparoscopy, collision and inflexibility were still obvious[20,21]. In this case, a specially designed R-LESS platform, SR-ENS-600, was used. It used dual continuum configuration, facilitating its snake-like arm to reach 9 cm on diameter. This feature reestablished instrument triangle, largely reduced instrument collision and inflexibility. Studies had been published in general surgery, urinary, and also gynecology[7,22,23]. Second, in R-LESS omentectomy, camera was almost vertically opposite to the center of omentum, severely obstructing surgical visions[12]. Space between camera and omentum was too narrow for vertical movement of instruments[21]. To overcome this drawback, exposing and patients positioning were important, which assistant was crucial in successfully performing the surgery. We detailed and illustrated what the assistant should do in Supplementary Digital Content, video (http://links.lww.com/MS9/A668)

This case report firstly detailed described a re-staging R-LESS for ovarian GCT patient with a novel robotic system. Also, human-centered medication was implemented throughout the whole inpatient experience. The major drawback of this case was that pelvic lymph nodes resection was not performed. Lymph node metastasis rate for GCT was 3.1%, which resection was suggested to be omitted[1,24]. However, we did scrutinize pre-operative CT image and whole pelvis during operation to exclude pelvic metastasis. Also, peritoneal multi-point biopsy and abdominal exfoliative cytology were omitted since cytology had been performed during the first surgery and gained negative result. Besides, we looked through operation record of the first surgery. The tumor was completely resected with no rupture. We concluded there was little chance for peritoneal metastasis. Currently, the scope of omentectomy has not been defined by NCCN[6]. In a recent randomized controlled trial of 106 epithelial ovarian cancer cases, participants were divided into infra-gastric and infra-colic omentectomy. The result revealed infra-gastric omentectomy was better than infra-colic omentectomy in diagnosis rate in patients higher than IIB, though only 19 patients showed omentum metastasis. The scope for granulosa cell tumor still lacks reliable studies. Further studies shall focus on the long-term survival of GCT after R-LESS in a large population.

Ethical approval

The case was approved by Ethical Committee of the First Affiliated Hospital of Xi'an Jiaotong University (No. 227 Yanta West Road, Xi'an, Shaanxi, China) on 23rd Nov, 2023 (Approval No. XJTU1AF2023LSYY-069).

Consent

Written informed consent was obtained from the patient for publication and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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Author's contributions

Conceptualization, Q.L.; data curation, L.Z. and R.C.; formal analysis, Y.X.; investigation, Y.L.; methodology, Q.L. and Y.X.; project administration, L.Z. and R.C.; resources, Y.L.; writing – original draft, L.Z. and R.C.; writing – review & editing, L.Z., Q.L., and Y.X.

Conflicts of interest disclosure

None.

Research registration unique identifying number (UIN)

The study was approved by the ethic committee of the First Affiliated Hospital of Xi'an Jiaotong University (No. XJTU1AF2023LSYY-069). Written informed consent was gained from the participant before study began.

Guarantor

Lanbo Zhao.

Provenance and peer review

This paper was not invited.

Data availability statement

All the videos are available at Obstetrics and Gynecology Department, the First Affiliated Hospital of Xi'an Jiaotong University, Xi'an, Shaanxi, China.

Assistance with the study

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