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Original Article

Robotic-assisted laparoscopic complex myomectomy: A single medical center's experience

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ABSTRACT

Objective: Conventional laparoscopic myomectomy (LM) has inherent limitations due to its rigid structure. The robotic system is a newly developed technology equipped with a flexible EndoWrist that offers good performance in delicate motions. Our objective was to share our clinical experience in the management of complex myomectomy using this robotic system.

Materials and methods: From October 2010 to March 2012, 21 patients with symptomatic complex uterine myomas were evaluated. Complex myomectomy was defined as surgery involving more than two fibroids, large fibroids, or preexisting pelvic adhesions. We recorded and analyzed the preoperative characteristics of the patients and the fibroids, the detailed surgical time, and several postoperative outcomes to evaluate the feasibility and efficacy of robotic-assisted LM (RALM) for complex fibroids.

Results: A total of 21 patients were enrolled in this study. The mean age of the patients was 40.1 ± 4.5 years and the mean size of the largest fibroid was 7.3 ± 3.5 cm. RALM achieved satisfactory results, including a short postoperative hospital stay (3.1 ± 0.9 days), a low conversion rate (none of our patients required conversion to either a minilaparotomy or conventional open surgery), and a low complication rate (1 case in 21 patients, 4.8%). The average estimated blood loss was 235.7 ± 283.3 mL.

Conclusion: Our study results demonstrated that RALM is a safe and effective method for handling complex fibroids.

Introduction

Laparoscopic surgery has been embraced by gynecologic surgeons for decades. Compared with laparotomy, laparoscopic surgery usually has the advantages of shorter hospitalization, faster recovery, less morbidity, and better cosmetic outcome [1,2]. In recent years, the increasing demand for myomectomy has reflected the desire for expanded fertility associated with the prevalence of delayed marriage and childbearing [3]. As a consequence, the use of laparoscopic myomectomy (LM) has been expanding because it provides a good alternative therapy to laparotomy [4]. However, LM is technically more difficult than abdominal myomectomy, especially in surgeries involving more than two fibroids, large fibroids, and pelvic adhesions. This is attributed to some technical limitations associated with using such a rigid instrument, including difficulties in identifying an appropriate pseudocapsule plane and performing a strong and layered closure for the uterine incisions [5].

Robotic surgical systems are expected to provide a solution to overcome these shortcomings [6,7]. The da Vinci robotic surgical system was developed for laparoscopic surgery in 2000 and approved by the U.S. Food and Drug Administration in 2005 for use in gynecologic surgery. With advanced EndoWrist technology, robotic systems offer surgeons natural dexterity and the wide-angled motion of joints, such as those in the human hand and wrist [8]. Using a three-dimensional, high-definition visual system offers a

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better operative field of view. Based on the aforementioned advantages, robotic technology appears to overcome the limitations inherent in traditional laparoscopy and promote the endoscopic surgical performance of myomectomy [9], especially in cases with complicated conditions such as large myomas, multiple myomas, or pelvic adhesions formed between the uterus and adjacent tissues and organs.

In October 2010, we began assessing robotic-assisted LM (RALM) in a prospective setup. This study describes our clinical experience in managing complex myomectomies in 21 consecutive patients, focusing on the feasibility and potential advantages as well as the pitfalls and challenges of using RALM.

Materials and methods

From October 2010 to March 2012, 37 patients underwent robotic-assisted surgery at a tertiary medical center in northern Taiwan. Of these, 22 patients were diagnosed with symptomatic complex uterine myomas and underwent RALM surgery. Complex myomectomy was defined as surgery involving more than two fibroids, large fibroids (diameter ≥8 cm), or preexisting pelvic adhesions. All patients were operated on consecutively using the da Vinci Si robotic surgical system (Intuitive Surgical Inc., Sunnyvale, CA, USA) at our institution. Preoperative characteristics and postoperative data of the 22 patients were screened. One patient received not only a myomectomy but also a bilateral salpingectomy and adhesiolysis for severe pelvic adhesion and was therefore excluded from the study. All surgical procedures were performed by a single surgeon, according to the procedure described in the following section.

Under general anesthesia, the patients were placed in the Trendelenburg position, with a urinary catheter and uterine manipulator (Kronner Medical Mfg., Roseburg, Oregon, United States) placed before the surgery. After pneumoperitoneum was created by CO_2 insufflation pressure using a transumbilical Veress needle, five bladeless trocars were placed in the patient's abdomen as follows: one 12-mm central port, three 8-mm ports for the robotic arms, and with one additional 12-mm port for the assistant (Fig. 1). Following the docking of the robotic arms, the three-dimensional zero-degree stereoscopic endoscope and EndoWrist instruments were then inserted into the robotic ports, including monopolar scissors, PK forceps, and a large/mega needle driver (Intuitive Surgical Inc.). Then, the surgeon moved to the console to control the robot remotely. Vasopressin (30 μ/mL diluted in 90 mL saline solution) was injected at various points on the dome of the uterus and at the region of attachment of the uterus to the myoma. After enucleation of the myomas, the myometrial edges were reapproximated in two-layer sutures with interrupted figure-eight intracorporeal knots (Polysorb 0). The left lower quadrant port was then converted into the insertion site of the morcellator (Karl Storz, Tuttlingen, Baden-Württemberg, Germany). The morcellation and extraction of the excised myomas were executed using the traditional laparoscopic method after disassembling the robotic system. Finally, a closed wound vacuum reservoir was inserted and placed in the cul-de-sac. All trocars were removed under direct visualization. Adequate suturing was performed to approximate the fascia and subcutaneous tissues.

The preoperative characteristics that may have an influence on surgical outcomes were age, body mass index history of abdominal surgery, and identities of the myomas (Table 1). The important time intervals were the following: (1) *docking time*, defined as the time spent attaching the robotic camera and arms to the previously placed trocar sites; (2) *console time*, defined as the time spent operating at the robotic console, including enucleation time and suture time; 3) *morcellation time*, defined as the time spent retrieving the specimen by morcellation and the laparoscopic grasper; (4) *total operative time*, defined as the time from skin incision to skin closure; and (5) *total anesthesia time*, defined as the time from intubation to awakening (Table 2). The outcome measures were estimated blood loss, transfusion rates, conversion rate, complications rate, and the duration of the postoperative hospital stay (Table 3).

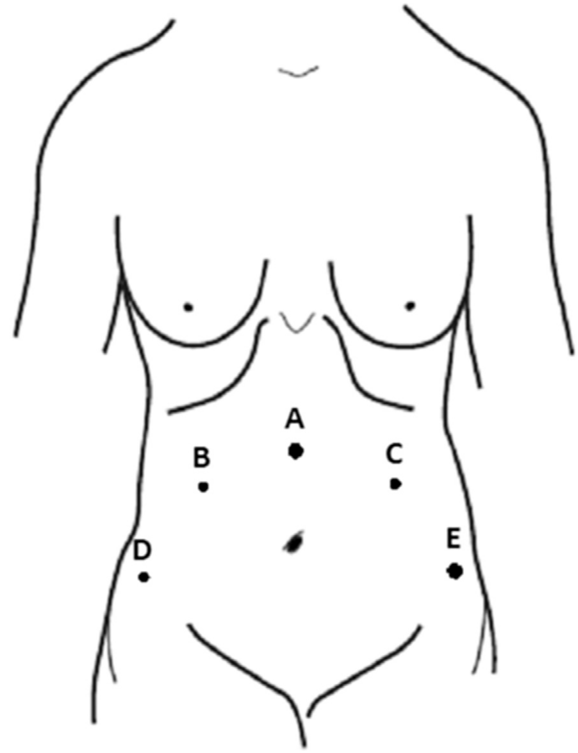

Fig. 1. Port placement. Point A, 12-mm camera port through the Lee–Huang point (located in the middle upper abdomen between the xiphoid process and umbilicus). Points B–D, 8-mm ports for robotic arms. Point E, 12-mm assistant port. The intervals between successive trocars are all approximately 10 cm.

Statistical analysis

In our study, mean and standard deviation were used to describe normal distribution, and the median and interquartile range were used for nonnormal distribution. The mean docking time in different time frames was compared using independent sample *t* tests. All statistical analyses were performed using SPSS statistical software version 19.0 for Windows (SPSS, Inc., Chicago, IL, USA). A *p* value <0.05 was considered statistically significant.

Table 1
Patient and fibroid characteristics.

Age (y)	40.1 ± 4.5
Body mass index (kg/m^2)	24.1 ± 4.4
History of abdominal surgery	4 (19.0%)
Adhesion lysis	3 (14.3.0%)
Fibroids	
Number[a]	3.1 (1.0–17.0)
Size of largest (cm)[b]	7.3 ± 3.5 (2.0–17.9)
Weight (g)[b]	367.4 ± 317.7 (10–1070)
Location within uterus, *n* (%)	
Anterior	17 (81.0%)
Posterior	9 (42.9%)
Fundal	10 (47.6%)
Broad ligament	0

[a] Value is expressed as the mean (minimum–maximum).
[b] Data are shown as the mean ± standard deviation (minimum–maximum).