

Single-port myomectomy: robotic versus laparoscopic

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Objective: To compare the perioperative outcomes of robotic single-site myomectomy (RSSM) and laparoendoscopic single-site myomectomy (LSSM).

Methods: From January 2017 to December 2019, electronic medical records of the consecutively held 17 RSSM and 20 LSSM were reviewed. Parameters including patient's characteristics, the total operation time, size and number of myomas taken out, operative findings, intra and postoperative complications were compared.

Results: Patients who undertook RSSM were younger (27.0 ± 7.1 vs. 32.9 ± 7.9) and only one out of 17 (2.9%) had previous pregnancy compared to 10 out of 20 in LSSM (50.0%). Complex cases with tumors of larger size and accompanied adhesion were done using RSSM. The median operative time was longer in the RSSM (176.1 ± 59.0 vs. 77.5 ± 47.1). All cases were successfully performed via a single port. No cases of postoperative complication including wound dehiscence or intestinal obstruction occurred in either group.

Conclusion: Perioperative outcomes of myomectomy undertaken by robotic single-site surgery and laparoendoscopic single-site surgery were comparable, though myomectomy for the larger myoma were performed with robotic single-site surgery. The role of robotic single-site myomectomy on fertility needs further investigation.

Key Words: da Vinci surgical system; Single-port surgery; Myomectomy; Laparoendoscopic single-site surgery

INTRODUCTION

Laparoendoscopic gynecologic surgeries confer various benefits compared to open surgeries, such as shorter postoperative hospital stay, aesthetic superiority of the incision site, and decreased postoperative pain [1,2]. As each trocar insertion site carries with it the risk of bleeding, infection, and decreased cosmesis, laparoendoscopic single-site surgery where the operation is being held through a single tro-

car site has been developed [3]. Notwithstanding challenges such as instrument clashing, unstable camera platform, reverse handedness, and loss of triangulation, much progress has been made in the field of laparoendoscopic single-site surgery [4].

The latest, fourth-generation robot, da Vinci® Xi surgical system (Intuitive Surgical System, Sunnyvale, CA, USA) came out with overhead docking, narrower arms, and greater range of motion without external collision, enabling

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better anatomic access and meticulous surgical techniques [5,6]. In case of uterine myomectomy, to maintain further pregnancy potential, surgical techniques that enable meticulous removal of the myomas while safely preserving the normal uterine tissue as much as possible is warranted. Therefore, robotic single-site myomectomy (RSSM) can improve the surgical limitations of laparoendoscopic single-site myomectomy (LSSM) and focus more on surgical outcome.

In this study, we reviewed 37 consecutive myomectomy cases undertaken either by RSSM or LSSM. We aimed to investigate the feasibility and safety by comparing the patient's characteristics and perioperative outcomes of RSSM or LSSM.

MATERIALS AND METHODS

The electronic medical records of the 17 RSSM and 20 LSSM held from January 2017 to December 2019 at the National Health Insurance Service Ilsan Hospital were reviewed. The patient was given a comprehensive counseling on the differences between the two modalities including the cost. The final choice was made following an in-depth discussion between the surgeon and the patient. Since this was a retrospective study including consecutive uterine myomectomy cases either done by RSSM or LSSM, clinical characteristics and preoperative findings were not matched with intention.

Two board certified gynecologist (Dr. Jong-Wook Seo, Dr. In Ok Lee) with advanced skills in the conventional laparoscopic and robotic surgery performed all procedures. They both have obtained robot-LESS surgery certificate and implemented more than 150 cases of robot-LESS including hysterectomy, myomectomy, ovarian cystectomy, and sacrocolpopexy. As this was a retrospective study based on the patient's record, no formal consent was obtained from the patient. This study was approved by the Institutional Review Board of the National Health Insurance Service Ilsan Hospital (NHIS 2020-03-049).

For the comparison of patients' characteristics, parameters such as the patient's age, parity, body mass index (kg/m²), previous history of abdominal surgery, vaginal delivery, cesarean delivery, and comorbidities such as hypertension, diabetes mellitus, thyroid diseases were retrieved. The size of

the myoma, number of myomas taken out, and the presence of adhesion were compared as well. For the comparison of the feasibility and safety of the procedure, the total operation time, time to discharge, presence of intra and postoperative complications, conversion to laparotomy, the need for additional trocar insertion, and hemoglobin changes were analyzed.

Surgical procedure

All operations were performed under general anesthesia with endotracheal intubation. Intraoperative analgesics were administered according to the standardized protocol held by the Department of Anesthesiology at the National Health Insurance Service Ilsan Hospital. With the patient in the low lithotomy position, the abdomen, perineum, and vagina were prepared, painted, and draped after urinary catheterization. A 2.0 cm vertical incision (modified Hasson technique) was created in the skin of the umbilicus with a scalpel. After insertion of the wound retractor into the peritoneal cavity, a multichannel single-port system, the Lapsingle® (Sejong Medical, Paju, Korea) was fixed to the outer ring of the wound retractor. The abdomen was insufflated with approximately 2 L of CO₂ gas, and intra-abdominal pressure was maintained at 12 mmHg throughout the operation. In cases of robot-LESS, the same technique was used with the da Vinci® Xi System (Intuitive Surgical System). After completion of the surgery, the fascial defect was closed with a delayed absorbable suture in an interrupted fashion. The skin was closed with an absorbable suture in a subcuticular fashion. All patients were seen and examined in the gynecologic clinic at 1 week, 6 weeks, 6 months after the surgery.

All continuous data with normal distributions were expressed as means±standard deviation. The median and range were utilized for skewed data. Categorical data were reported as an absolute number or percentage. Frequency distributions were compared using chi-square test, and mean or median values were compared using Student's *t* and Mann-Whitney *U* test. All calculated *P* values were two-sided, and *P*<0.05 was considered statistically significant. Data were analyzed using SPSS statistic, version 24.0 (IBM corp., Armonk, NY, USA).

RESULTS

The mean age of RSSM was statistically younger than that of LSSM (27.0 ± 7.1 vs. 32.9 ± 7.9 , $P < 0.05$). Out of 17 patients who took RSSM, only one patient had a cesarean section history (2.9%). The mean size of the uterus was larger in RSSM compared to that of LSSM (15.2 ± 3.3 vs. 7.4 ± 3.0 , $P < 0.0001$). The total number of myomas taken out

were more in RSSM compared to that of LSSM (5 ± 4 vs. 3 ± 2 , $P < 0.0001$) (Table 1).

The total operation time of RSSM took longer than LSSM (176.1 ± 59.0 vs. 77.5 ± 47.1 minutes, $P < 0.0001$). Time to discharge was also longer in RSSM than LSSM (4.1 ± 0.7 vs. 3.7 ± 0.8 days, $P < 0.05$). No intraoperative complications such as bowel or ureter injury occurred. No postoperative complications including infection or wound dehiscence

Table 1. Demographic data

	Robot-assisted (n=17)	Conventional (n=20)	P-value
Age (years)	27.0 ± 7.1	32.9 ± 7.9	0.0010 ^{a)}
Parity	1 (2.9)	20 (50.0)	<0.0001 ^{a)}
BMI (kg/m ²)	22.4 ± 2.9	23.6 ± 4.7	0.1740
Previous vaginal deliveries	0 (0.0)	19 (47.5)	<0.0001 ^{a)}
Previous cesarean deliveries	1 (2.9)	1 (2.5)	0.9240
Previous abdominal surgery	4 (11.4)	2 (5.0)	0.3060
Comorbidities	2 (5.7)	6 (15.0)	0.1940
Size of the largest myoma (cm)	15.2 ± 3.3	7.4 ± 3.0	<0.0001 ^{a)}
Adhesion	10 (58.8)	3 (15.0)	<0.0001 ^{a)}
Number of myomas taken out	5 ± 4	3 ± 2	<0.0001 ^{a)}

Values are presented as mean \pm standard deviation or number (%). Comorbidities: hypertension, diabetes mellitus, hepatitis, hypercholesterolemia, rheumatic disorders, thyroid disorders.

BMI, body mass index.

^{a)} $P < 0.05$.

Table 2. Perioperative data: feasibility & safety

	Robot-assisted (n=17)	Conventional (n=20)	P-value
Hb changes (g/dL)	2.5 ± 1.0	1.9 ± 0.5	NA
Total operation time (minutes)	176.1 ± 59.0	77.5 ± 47.1	<0.0001 ^{a)}
Time to discharge (days)	4.1 ± 0.7	3.7 ± 0.8	0.0100 ^{a)}
Intraoperative complication			NA
Bowel injury	0	0	
Ureter injury	0	0	
Postoperative complications			NA
Infection	0	0	
Dehiscence	0	0	
Conversion to laparotomy	0	0	NA
Additional trocar insertion	0	0	NA

Values are presented as mean \pm standard deviation or number.

NA, not applicable.

^{a)} $P < 0.05$.

were noted in the 6 months follow up period. Conversion to laparotomy or additional trocar insertion did not occur. Hemoglobin changes did not show any difference in the two groups and none of the patients required blood transfusion (Table 2).

DISCUSSION

In this study, we compared robotic single-site surgery using the da Vinci Xi surgical system for myomectomy of uterine myomas with laparoendoscopic single-site surgery. We demonstrated that both surgery were comparable in perioperative outcomes of myomectomy despite the larger myomas were operated with RSSM.

There were notably different patient's characteristics between the two groups. Patients who took RSSM were comparably younger and only one of the 17 patients was married and had a childbirth. Prohibitively expensive cost notwithstanding, patients chose to take RSSM based on the belief that this state of the art procedure might minimize the damage to the uterus therefore having an upper hand in fertility preservation and recurrence of the myoma. Cases done by RSSM included larger tumors (15.2 ± 3.3 vs. 7.4 ± 3.0 cm). The surgeon's preference to undertake RSSM in complicated cases can be explained in the features that da Vinci system provide such as improved ergonomics, tremor filtration, anatomic access with three-dimensional visualization, greater range of motion without external collision and improved anatomic access [3].

Since the launch of da Vinci Xi system in 2017, more than 300 gynecologic cases have been undertaken in this institution. In concurrence of the multicenter analysis comparing robotic, open and laparoscopic modalities for benign indications, with the surgeon's high-volume robotic experience, a preference of single site robot-assisted surgery in higher complexity cases was noted [7] In case of benign hysterectomies, robotic hysterectomies were of higher complexity encompassing a higher rate of adhesive disease and larger uteri. This implies that for an expertise in robotic surgeries the robot may facilitate surgery for higher complexity cases [7]. The total surgery time was longer in RSSM compared to LSSM (176.1 ± 59.0 vs. 77.5 ± 47.1 minutes, $P<0.0001$). Besides the docking time required for RSSM, the complexity of the procedure itself such as larger size of the myoma,

more myomas that needs to be taken out, and accompanied adhesion might have played a role [8].

The technical feasibility and safety of RSSM has been published in areas other than gynecology [9]. In case controlled studies comparing robotic single-site hysterectomy with laparoendoscopic single-site hysterectomy, there were no significant differences in perioperative outcomes [10-12]. The comparison of robotic single-site hysterectomy to multiport robotic hysterectomy showed a reduction in blood loss, length of stay, and cost in robotic single-site hysterectomy [13]. During the study period, no intraoperative bowel or ureter injury occurred, no postoperative complications such as wound infection or dehiscence was noted in the 6 months follow up period. No conversion to laparotomy and none of cases required additional trocar insertion. Estimated blood loss did not show any difference in the two groups and none of the patients required blood transfusion. These findings infer the safety of RSSM compared to LSSM.

Also, to overcome the technical difficulties of laparoendoscopic single site surgery, the latest fourth-generation robot, da Vinci Xi surgical system with single port platform (Intuitive Surgical System) came out with an overhead docking system for simpler docking, narrower arms minimizing instrument clashing, and better visualization [2,14]. The two surgeons involved in this study have performed more than 150 robotic single-site surgery since 2015, therefore operative expertise in either surgical method could be considered as comparable, not affecting the perioperative outcome. The completion of the learning curve is said to be between 50 to 91 robotic procedures in the field of gynecology [15].

As this study was a retrospectively held observational study with a limited number of study population, certain limitations exist in head-to-head comparison of RSSM and LSSM. In conclusion, cases with a larger tumor, more myomas that needs to be taken out, and accompanied adhesion were done by RSSM, suggesting the surgeon's preference of RSSM in complicated surgeries. Nevertheless, perioperative outcomes were not different between RSSM and LSSM. It seems to play as much a role in complex myomectomy requiring uterine preservation. The role of RSSM in reservation in future pregnancy needs to be delineated with prospective trial involving a larger number of cases.

Conflict of interest

No potential conflict of interest relevant to this article was reported.

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