Gynecology; *and Gynecological Oncology*

Robotic Surgery for the Treatment of Apical Pelvic Organ Prolapse at a Single Institution

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ABSTRACT

OBJECTIVE: We sought to present implementation of robotic surgery for the treatment of apical pelvic organ prolapse at our clinic, with short-term outcomes.

STUDY DESIGN: Clinical data of 11 consecutive patients with apical pelvic organ prolapse, who underwent robotic sacrocolpopexy or hysteropexy between July 2015 and August 2016, were collected prospectively. Primary endpoint of the study was anatomic cure and the secondary endpoint was symptomatic cure. Anatomic cure was defined as lack of anterior or posterior prolapse beyond the hymen and apical prolapse beyond the midvagina. Symptomatic cure was lack of vaginal bulge sensation.

RESULTS: Of the 11 patients, 9 underwent sacrocolpopexy and two underwent hysteropexy. Sacrocolpopexy was performed concomitantly with hysterectomy in 7 of the 9 patients. Mean operating time for all procedures was 254±65 minutes. No conversion to open surgery was required and no intraoperative complication was observed in any of the patients. The median hospital stay was 3 days. Four complications occurred postoperatively: 1 case of pulmonary thromboembolism, 2 cases of vaginal vault cellulitis and 1 case of mesh erosion. In total, 10 of 11 patients (90.9%) met the criteria for anatomic and symptomatic cure.

CONCLUSION: Robotic pelvic support procedures can be readily adopted to routine clinical practice with high anatomic and symptomatic cure rates.

Keywords: Robotic surgery, Pelvic organ prolapse, Surgical success

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Introduction

The prevalence of pelvic organ prolapse (POP) is increasing probably due to the aging of the world population (1). The estimated lifetime risk of surgery for POP is reported to be 12% by the age of 80 years (2). The gold standard procedure for the treatment of apical POP is sacrocolpopexy, which corrects the anatomical pathology in 78-100% of cases (3). Sacrocolpopexy is associated with lower risk of recurrent POP, postoperative stress urinary incontinence and dyspareunia than vaginal procedures (4). Although there are growing evidences indicating that high satisfaction and low recurrence rates can be accomplished using a variety of sacral hysteropexy techniques, the role of preservation of uterus at the time of prolapse surgery remains controversial (5).

Abdominal procedures for the repair of POP are often performed via open surgical approach in clinical practice. The conventional laparoscopic approach has dramatically decreased the morbidity of these procedures (6). However, laparoscopic treatment of POP has not become widespread due to long operative time, the need for advanced laparoscopic skills and a well-trained assistant. Over the last decade, the robot-assisted laparoscopic (robotic) approach has rapidly entered into daily practice. With its advanced technological features, short learning curve, enhanced mobility and image capability, the robotic approach has eliminated many technical challenges associated with conventional laparoscopy.

In this paper, we aimed to present the implementation of robotic approach for the abdominal repair of the apical POP at our clinical practice, including operative findings and short-term outcomes.

Material and Method

Study design and patients

From July 2015 to August 2016, a total of 11 consecutive

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patients with apical POP who underwent robotic sacrocolpopexy with or without hysterectomy or sacral hysteropexy were included into this prospective planned data collection. The decision of uterine preservation during surgery for POP was based on patient preference after a thorough counseling about the potential risks and benefits. A written informed consent was obtained from all patients and the study was performed in accordance with the ethical standards described in an appropriate version of the 1975 Declaration of Helsinki, as revised in 2013.

All the operations were performed by the same surgeon (A.U.) using da Vinci® XI robotic surgical system (Intuitive Surgical Inc., Sunnyvale, California). Clinical data regarding age at surgery, body mass index (BMI), parity, prior pelvic surgery, baseline POP quantification (POP-Q) stage and POP-Q points, type of POP surgery, operating time, change in hematocrit levels, length of hospital stay, and perioperative complications were recorded for all patients following institutional review board approval. Patients were re-evaluated for POP-Q points, recurrence of POP, and surgical success at the 6th month of postoperative period.

For the purpose of this study, the surgical success was assessed in two categories: anatomic cure and symptomatic cure. The primary endpoint of the study was the anatomic cure, which was defined as lack of anterior or posterior prolapse beyond the hymen (Aa and Ba ≤ 0), no apical (cervix or apex of the vaginal vault) prolapse beyond the midvagina (C <–total vaginal length/2), and no prolapse re-operation or pessary use. The secondary endpoint of the study was the symptomatic cure, which was defined as lack of vaginal bulge sensation.

Surgical techniques

The procedures were performed in the lithotomy position under general anesthesia. A Foley catheter was inserted into the bladder. The abdomen was entered 2-3 cm above the umbilicus in the midline in a way that the distance to the target organ was approximately 20 cm. Pneumoperitoneum was created using a Veress needle, and the maximum pressure was set at 12 mmHg. An 8-mm robotic trocar was inserted into the abdomen through the incision made to the umbilicus level. The robotic camera was manually passed through this trocar, and intraabdominal organs were visualized. Two other robotic trocars were then inserted to 8 cm lateral to both sides of the camera trocar under laparoscopic vision. An additional fourth robotic trocar was inserted at least 6 cm lateral to the third trocar on the right side, and a 12 mm assistant port was placed at the left upper quadrant between the camera trocar and the left robotic trocar (Figure 1).

The patient-side cart of the robotic surgical system was approached to the patient from the right side and docked with the patient in a 30-degree Trendelenburg position. The monopolar scissors were inserted through the right robotic trocar; Maryland® bipolar forceps, through the left robotic trocar; and ProGrasp® forceps, through the fourth robotic trocar.

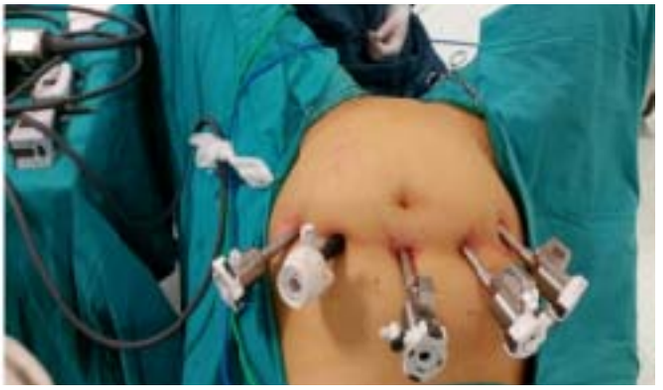

Figure 1: Positions of the trocars

a) Sacrocolpopexy

A tight sponge stick that was covered with a glove was used for the manipulation of the vagina. The anterior and posterior vaginal walls were carefully dissected by 4 to 5 cm. There was no need to place a rectal probe to facilitate the posterior wall dissection in none of the cases. For the preparation of presacral space, first, the rectosigmoid colon was retracted to the left side by incising the peritoneum in the right medial pararectal sulcus, from the level of the sacral promontory to the apex of the vagina. Then, the presacral dissection was maintained until the anterior longitudinal ligament of the sacrum was identified. A "Y shaped'' type 1 polypropylene mesh was used in all patients. The distal ends of the mesh were secured using 6 to 8 interrupted sutures of 2-0 polydioxanone (PDS) on each sides of vagina. After positioning the mesh with light tension to the sacral promontory, the proximal end was attached to the anterior longitudinal ligament of the sacrum using two interrupted sutures of 2-0 polypropylene. Finally, the peritoneal incision was continuously sutured with 2-0 polyglactin, and the mesh was made entirely retroperitoneal.

b) Sacral hysteropexy

A "T shaped'' type 1 polypropylene mesh was preferred in sacral hysteropexy. The bladder was mobilized from the cervix and proximal vagina in order to expose approximately 4 cm of the underlying pubocervical fascia anteriorly. Then, the peritoneum of the posterior cervix was incised at the level of utero-sacral ligaments. This incision was continued as peritoneal relaxing incision, medial to the right ureter, from the cervix to the level of the sacral promontory. Bilateral peritoneal windows were then created in the broad ligament just at the level of the isthmus and lateral to the uterine artery. Afterwards, the left and the right arms of the mesh were passed through the each peritoneal opening and attached to the anterior aspect of the cervix using 4 to 6 interrupted sutures of 2-0 non-absorbable polyester (Ethibond Excel™, Ethicon Inc., Somerville, NJ, USA). Then, the central portion of the mesh was secured on the posterior aspect of the cervix with two more sutures of 2-0 polyester. The surgical technique for the preparation of the presacral space and fixation of the proximal end of the mesh to the sacral promontory was identical to that performed during sacrocolpopexy.

Results

Table 1 displays the baseline characteristics and intraoperative findings of patients. The mean age at surgery was 55.6 ± 7.3 years and the mean BMI was 27.2 ± 3.4 kg/m^2. Two patients had a history of total hysterectomy, while 1 patient had a previous sacrocolpopexy. The median POP-Q stage at baseline was 3. The mean baseline POP-Q points were as follows: Aa, 2.0 ± 2.2; Ba, 2.6 ± 1.1; and C, 3.6 ± 1.2. Of the 11 patients, 9 underwent sacrocolpopexy and two underwent hysteropexy. Sacrocolpopexy was performed concomitantly with hysterectomy in 7 of the 9 patients. The mean robotic operating time for all procedures was 254 ± 65 minutes. The estimated blood loss was less than 100 mL in all patients. No conversion to open surgery was required and no intraoperative complication was observed in any of the patients.

The early postoperative and short-term outcomes of patients were summarized in table 2. The median hospital stay was 3 days. We observed a total of 4 complications postoper-

Table 1: Baseline characteristics and intraoperative findings of patients

Variables	Values
Age, mean ± SD, years	55.6±7.3
Body mass index, mean ± SD, kg/m^2	27.2±3.4
Parity, median (range)	3 (1-6)
ASA physical status, median (range)	1 (1-2)
Prior pelvic surgery, n (%)	
Total abdominal hysterectomy	2 (18.2)
Sacrocolpopexy	1 (9.1)
Baseline POP-Q stage, median (range)	3 (2-3)
Baseline POP-Q points, mean ± SD	
Aa	2.0±2.2
Ba	2.6±1.1
C	3.6±1.2
POP surgery, n (%)	
Sacrocolpopexy	9 (81.8)
Sacral hysteropexy	2 (18.2)
Concomitant procedure, n (%)	
Total hysterectomy	7 (63.6)
TOT	2 (18.2)
Colporrhaphy	2 (18.2)
Robotic operating time, mean ± SD, minutes	254±65
Conversion to open surgery	–
Intraoperative complication	–

SD; Standard deviation, ASA: American Society of Anesthesiologists, POP-Q; Pelvic organ prolapse quantification system, TOT: Trans-obturator tape

Table 2: Postoperative outcomes of patients

Variables	Values
Decrease in hematocrit levels, mean ± SD, %	4.5 ± 2.6
Length of hospital stay, median (range), days	3 (2-4)
Postoperative complications, n (%)	
Pulmonary thromboembolism	1 (9.1)
Vaginal vault cellulitis	2 (18.2)
Mesh erosion	1 (9.1)
POP-Q points at postoperative 6th months, median (interquartile range)	
Aa	-1 (1.7)
Ba	-1 (1.7)
C	-7 (2)
Recurrent apical POP, n (%)	–
Anatomic cure, n (%)	10 (90)
Symptomatic cure, n (%)	10 (90)

SD: Standard deviation, POP-Q: Pelvic organ prolapse quantification system

atively. Of the patients who underwent sacrocolpopexy, 1 patient developed pulmonary thromboembolism on the day after the surgery and 2 patients developed vaginal vault cellulitis on postoperative days 7 and 10. These patients were managed conservatively and had uneventful postoperative clinical course. One case of mesh erosion occurred in a patient with sacrocolpopexy concomitant with hysterectomy 4 weeks after the surgery, and was managed successfully with excision of the mesh through the vagina. The median POP-Q points at postoperative 6th months were as follows: Aa, -1; Ba, -1; and C, -7. Based on our definitions for surgical success, a total of 10 patients (90.9%) met the criteria for anatomic as well as symptomatic cure. No apical failure was identified. The patient that failed to achieve a satisfactory surgical outcome was in the sacral hysteropexy group and experienced isolated anterior compartment failure.

Discussion

The current article represents our initial experience with the robotic surgery for the treatment of apical POP. The study demonstrates that robotic pelvic support procedures including sacrocolpopexy or sacral hysteropexy can be readily adopted to clinical practice with high anatomic cure rates, significant improvement in symptoms, and few complications.

Over the past three decades, minimally invasive laparoscopic approach has evolved into the standard of care in many gynecologic procedures. However, this evolution from the classical open surgery to a minimally invasive surgery could not have been achieved adequately, particularly in some oncological and urogynecological procedures that require advanced surgical manoeuvres, skills and experience. The introduction of robotic surgical system into clinical use provided a potential solution to these problems due to its advantages of wristed instrumentation, tremor filtering, restoration of depth perception and improved three-dimensional vision.

It has been reported that robotic surgery has accelerated learning and performance of the minimally invasive procedures in the laparoscopically-naive surgeons (7,8). In a study describing the implementation process of robotic sacrocolpopexy, Bradley et al. (9) reported that there was no demonstrable learning curve for transition from open approach to robotic surgery. The authors suggested that if surgeons are already past their learning curve for the open surgical equivalent, it will likely decrease their learning curve with robotic approach. Also in our study, both authors were surgeons who had previously performed sacrocolpopexy via open approach, but had no experience of laparoscopic sacrocolpopexy or hysteropexy. In spite of that, we could perform the robotic sacrocolpopexy and hysteropexy within the acceptable operating time limits, without a major intraoperative complication.

Literature regarding robotic surgery in the treatment of POP is still developing. In a recent meta-analysis examining the results of 27 studies, Serati et al. (10) reported that the rates of conversion to open surgery, intraoperative complication and mesh erosion were <1%, 3% and 2%, respectively. Objective cure rates ranged from 84% to 100%. The authors noted that laparoscopic, robotic and open approaches had similar outcomes, but laparoscopic approach was less costly than robotic approach, although the latter had lower costs than open approach.

We achieved comparable surgical success rates compared with the previous studies (9-10). None of the cases was required conversion to laparotomy in our study cohort. The fact that the first 11 cases of robotic surgeries could be performed without a major complication and with a high patient and surgeon satisfaction, supports the literature regarding feasibility of implementing robotic surgery in a laparoscopically-naive centre. One potential explanation for this relatively easy implementation process may be because the high maneuverability and range of motion of robotic instruments is much closer to open surgery than to conventional laparoscopy.

The potential limitations of our study include its small sample size, short follow-up time, and single-institutional nature with inherent problems of selection and referral bias. The high cost of robotic surgery is the main obstacle to reach a satisfactory sample size in a short time. Therefore, our study should be considered as a preliminary study for future trials.

In conclusion, based on our results and available data in the literature, the robotic approach is a safe and feasible alternative to conventional laparoscopic and open approaches in the treatment of apical POP. Acquired surgical skills from open sacrocolpopexy can be easily transferable to robotic sacrocolpopexy.

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