GRS Original Article

eISSN 2672-1481
https://doi.org/10.36637/grs.2021.00010
Gyne Robot Surg 2021;2(1):22-27

Robotic or laparoscopic sacrocolpopexy with concomitant total hysterectomy for pelvic organ prolapse compared to abdominal approach

Jiheum Paek[1], **Maria Lee**[2]

[1]*Department of Obstetrics and Gynecology, Ajou University School of Medicine, Suwon;* [2]*Department of Obstetrics and Gynecology, Seoul National University College of Medicine, Seoul, Korea*

Objective: To evaluate the feasibility of robotic or laparoscopic sacrocolpopexy with concomitant total hysterectomy (RLSC) for patients with pelvic organ prolapse (POP) and to assess the perioperative results compared to abdominal sacrocolpopexy (ASC).

Methods: We analyzed retrospectively 249 POP patients who underwent total hysterectomy followed by sacrocolpopexy. We compared the operative results and symptoms after surgery between RLSC group (n=51; 12 robotic and 39 laparoscopic surgery) and ASC group (n=198).

Results: The RLSC cohort showed shorter surgical time (164.4 vs. 201.4 minutes, *P*=0.001) and smaller blood loss (100 vs. 200 mL, *P*<0.0001; postoperative hemoglobin decrease, 1.5 vs. 1.8 g/dL, *P*=0.001). Patients' postoperative satisfaction of RLSC and ASC was 92.2% and 96%, respectively. Each one patient of both the groups underwent surgery again. Although the distribution of each postoperative symptom did not differ between the two groups, the RLSC group had a smaller number of patients who had complaints at least once compared to the ASC group (25% vs. 43.4%, *P*=0.020).

Conclusion: The sacrocolpopexy with concomitant total hysterectomy was feasible for POP without complication. Additionally, robotic or laparoscopic surgery can be considered as a minimally invasive surgical approach for POP.

Key Words: Hysterectomy; Laparoscopy; Robotics; Pelvic organ prolapse

INTRODUCTION

Pelvic organ prolapse (POP) is becoming increasingly commonplace in women with the aging population [1]. The patients with POP often need surgical treatment. The roles of surgical treatment for POP are to decrease disease-induced symptoms and to maintain the anatomy of the vagina without perioperative complication. Surgical treatment is individualized highly according to the kind of previous treatment or the performance status of patients. Various surgical approaches, including transvaginal and abdominal route, have been used popularly. Of these, sacrocolpopexy using a

• Received: January 22, 2021 • Accepted: March 21, 2021
• Correspondening author: **Jiheum Paek**
Department of Obstetrics and Gynecology, Ajou University School of Medicine, 164 World Cup-ro, Yeongtong-gu, Suwon 16499, Korea
E-mail: paek.md@gmail.com

mesh has been regarded as the treatment of choice for POP. Moreover, some studies showed it was feasible and safe in POP patients with kinds of apical prolapse [2,3]. However, it is not clear whether hysterectomy is feasible prior to sacrocolpopexy for POP patients with the uterus. For sacrocolpopexy with concomitant hysterectomy, surgeons expect to get enough space to fix a mesh on the vagina and the sacral promontory for apical suspension. On the other hand, the concurrent hysterectomy is likely to have long surgical time, many chances of operative complications, and increased risk of mesh exposure which may be related to chronic inflammation [4-6].

With the optimal instrumentation and surgical techniques for laparoscopic and robotic surgical approaches are developing. They allow surgeons to perform complex surgical procedures easily and optimally [7]. Furthermore, robotic surgery for various POP situations can become an ideal surgical treatment because it has increased surgeons' dexterity, better visual field, and surgeons-friendly system [8,9]. The objectives of our retrospective cohort study were to evaluate the feasibility of sacrocolpopexy with concomitant total hysterectomy for POP and to compare both operation-related factors and postoperative results between robotic or laparoscopic sacrocolpopexy (RLSC) and abdominal sacrocolpopexy (ASC).

MATERIALS AND METHODS

We identified 249 patients who experienced total hysterectomy followed by RLSC or ASC for treatment of POP with symptomatic stage more than 2 (RLSC: 51 patients; ASC: 198 patients). From March 2015 to July 2017, 39 laparoscopic and 12 robotic sacrocolpopexy were performed by a single surgeon (J.P). These patients were compared to the historical cohort of ASC in our institution. We evaluated the POP quantification (POP-Q) stage, surgical time, blood loss, serum hemoglobin drop, and operation-related morbidity. The surgical time was predefined as total duration required from skin opening to surgical incision repair. We followed up the patients at 2 weeks, 6 weeks, 6 months, and 1 year after surgery. The patients drew up a questionnaire regarding the subjective assessment of symptoms before operation and at 1 year after the operation. The questionnaire which was made by our institution was used. It was composed of questions about the overall satisfaction and the related symptoms, including urinary difficulty, pelvic discomfort, stress urinary incontinence, bladder irritation signs, constipation, and dyspareunia. The overall satisfaction 'no' was regarded as the subjective failure. We defined the objective failure as POP-Q stage more than 2 at 1 year after operation. The patients who underwent surgical procedures again within 1 year after operation

Table 1. Patient characteristics

	RLSC (n=51)			ASC (n=198)	*P*-value[a]
	Robotic (n=12)	Laparoscopic (n=39)	Overall		
Age (years)	62.3±8.2	61.5±2.0	61.7±4.3	61.9±8.9	0.852
Parity	3 (2–6, 3)	3 (2–4, 1)	3 (2–6, 1)	3 (1–6, 2)	0.651
Body mass index (kg/m^2)	26.8±3.9	23.8±0.5	24.4±4.1	24.4±3.0	0.928
Previous abdominal surgery					0.707
Yes	4 (33.3)	4 (10.3)	8 (15.7)	27 (13.6)	
No	8 (66.7)	35 (89.7)	43 (84.3)	171 (86.4)	
Peritoneal adhesion					0.895
Yes	5 (41.7)	1 (2.6)	6 (11.8)	22 (11.1)	
No	7 (58.3)	38 (97.4)	45 (88.2)	176 (88.9)	
Preoperative POP-Q stage	3 (2–4, 0)	3 (3–4, 1)	3 (2–4, 1)	3 (2–4, 0)	0.388

Values are presented as mean±standard deviation, median (range, interquartile range), or number (%).
RLSC, robotic or laparoscopic sacrocolpopexy; ASC, abdominal sacrocolpopexy; POP-Q, pelvic organ prolapse quantification.
[a]This *P*-value was calculated between the overall of RLSC and ASC.

were regarded that they had both subjective and objective failure.

For robotic port placement, a camera port and three robotic arms were used. In addition, we used three ports were used in the laparoscopic group. A 30-degree camera was used for RLSC. For the vaginal cuff closure after hysterectomy, we did intracorporeally continuous running suture with Vicryl#1-0. The procedure of RLSC was equal to that of ASC. We incised the peritoneum from the promontory of the sacrum firstly. A tunnel of the peritoneum from the promontory of the sacrum to the surrounding tissues of the uterosacral ligament was developed. We used a non-absorbable prolene mesh, GYNECARE GYNEMESH® (Ethicon Endo-surgery, Cincinnati, OH, USA). We made it pass through the tunnel of the peritoneum. It was placed on the promontory of the sacrum. The mesh was fixed to the anterior vaginal wall, the posterior vaginal wall, and the anterior longitudinal ligament of sacrum with at least two non-absorbable polydioxanone#1-0 sutures (Ethicon Endo-surgery). We closed the peritoneum using Vicryl#2-0 sutures not to expose the mesh. The $P<0.05$ was regarded that there was statistical significance. All continuous data were

Table 2. Operative results

	RLSC (n=51)			ASC (n=198)	*P*-value[a]
	Robotic (n=12)	Laparoscopic (n=39)	Overall		
Operating time (minutes)	186.3±43.8	157.7±14.9	164.4±27.2	201.4±51	0.001
Operative hemorrhage (mL)	20 (5–100, 50)	100 (50–300, 50)	100 (5–300, 50)	200 (5–1,400, 135)	<0.0001
Decreased serum hemoglobin level (g/dL)	1.5±0.3	1.5±0.1	1.5±0.2	1.8±0.3	0.001
Complication during surgery	0	0	0	0	1.000

Values are presented as mean±standard deviation, median (range, interquartile range), or number.
RLSC, robotic or laparoscopic sacrocolpopexy; ASC, abdominal sacrocolpopexy.
[a]This *P*-value was calculated between the overall of RLSC and ASC.

Table 3. Postoperative assessment

	RLSC (n=51)			ASC (n=198)	*P*-value[a]
	Robotic (n=12)	Laparoscopic (n=39)	Overall		
Patient satisfaction (subjective success rates)	11 (91.7)	36 (92.3)	47 (92.2)	190 (96.0)	0.274
Objective success rates	11 (91.7)	39 (100.0)	50 (98.0)	197 (99.5)	0.368
Reoperation	1 (8.3)	0 (0.0)	1 (2.0)	1 (0.5)	0.368
Postoperative POP-Q stage	0 (0–1, 1)	0 (0–1, 0)	0 (0–1, 0)	0 (0-1, 0)	0.382
Postoperative symptoms	4 (33.3)	9 (23.1)	13 (25.5)	86 (43.4)	0.020
Voiding dysfunction	1 (8.3)	2 (5.1)	3 (5.9)	34 (17.2)	0.047
Overactive bladder	3 (25.0)	4 (10.3)	7 (13.7)	36 (18.2)	0.453
Stress urinary incontinence	2 (16.7)	2 (5.1)	4 (7.8)	18 (9.1)	0.779
Constipation	3 (25.0)	0 (0.0)	3 (5.9)	7 (3.5)	0.432
Dyspareunia	0 (0.0)	1 (2.6)	1 (2.0)	0 (0.0)	0.048

Values are presented as median (range, interquartile range) or number (%).
RLSC, robotic or laparoscopic sacrocolpopexy; ASC, abdominal sacrocolpopexy; POP-Q, pelvic organ prolapse quantification.
[a]This *P*-value was calculated between the overall of RLSC and ASC.

 https://doi.org/10.36637/grs.2021.00010

expressed as mean±standard deviation, and categorical data were reported as an absolute number or percentage. Frequency distributions were compared using the chi-square test and Fisher's exact test. In addition, mean or median values were compared using the Student's *t*-test and Mann-Whitney *U*-tests. The SAS/STAT software, version 9.4 (SAS Institute Inc., Cary, NC, USA) was used for the analysis of data.

RESULTS

The characteristics of enrolled patients were analyzed (Table 1). The preoperative POP-Q stage was same in the two cohorts (median value was 3, *P*=0.388). We compared operative outcomes between the two groups and described the data in Table 2. The RLSC had shorter surgical time (164.4 vs. 201.4 minutes, *P*=0.001) and smaller blood loss (100 vs. 200 mL, *P*<0.0001; postoperative hemoglobin decrease, 1.5 vs. 1.8 g/dL, *P*=0.001). Based on the clinical pathway of our institute, we took urinary drainage out 3 days after operation. In addition, the patients were discharged on the same day if they did not have any problem. For several patients who complaint pelvic discomfort or wanted to stay more in hospital, the catheters were removed when they were discharged.

The duration of the follow-up was 32 months (range, 12–106). We could not find any statistical difference of the overall satisfaction (92.2% vs. 96%) and the rate of needed operative procedures because of relapsed symptoms (2% vs. 0.5%, *P*=0.368) between RLSC and ASC group. Of the RLSC group, one patient underwent laparoscopic sacrocolpopexy again because she had voiding dysfunction with mildly prolapsed vaginal vault at 6 months after initial operation. One patient of the ASC cohort underwent surgery for removal of the attached mesh in the pelvic cavity because she had persistent abdominal pain at 3 months after initial surgery. The two patients who underwent reoperation within one year after initial surgery were regarded that they had both subjective and objective failure. As a result, the rate of objective success in the RLSC and ASC was 98% and 99.5% (*P*=0.368), respectively. For the number of women who experienced relapsed discomfort at least once after surgery, the RLSC cohort was smaller than the ASC (25% vs. 43.4%, *P*=0.020) (Table 3).

DISCUSSION

We evaluated two aspects in terms of POP surgery in this study. One was the feasibility of sacrocolpopexy with concomitant total hysterectomy and the other was the comparison of operative outcomes between robotic or laparoscopic and abdominal approach. As a result, the sacrocolpopexy with concomitant total hysterectomy was feasible for POP without complication. Additionally, minimally invasive approaches showed comparable surgical outcomes and postoperative success rate compared to laparotomy group.

It is not simple issue to do hysterectomy at the same time of sacrocolpopexy. Because it may be related to surgical outcomes, operation-related complications, and hospital cost. Moreover, there were clinical studies that showed total hysterectomy was associated with an increased risk for subsequent POP [10-12]. Sacrohysteropexy with uterus preservation can be another surgical option instead of concomitant hysterectomy. However, few studies focus on its usefulness though we have already showed that robotic or laparoscopic sacrohysteropexy had feasible surgical outcomes in POP [13]. Although sacrocolpopexy following subtotal hysterectomy may overcome the expected problems that might follow sacrocolpopexy with concomitant hysterectomy, it had long operative time and a large amount of blood loss [14,15]. Meriwether et al. [16] reviewed systematically a great number of studies on apical POP repair with uterine preservation compared with concomitant hysterectomy and showed evidence-based guidelines. They analyzed 53 studies that compared uterus preservation to concomitant hysterectomy in patients who needed POP repair. Overall, sacrohysteropexy has improved operative outcomes, including less mesh erosion, shorter surgical time, and less hemorrhage, compared to sacrocolpopexy with concomitant hysterectomy. However, there was no difference of recurrence rate or postoperative symptoms improvement between the two approaches. Furthermore, abdominal sacrohysteropexy aggravated both perioperative outcomes and urinary symptoms after surgery. Therefore, it can be one of treatment options for POP repair whether uterus is preserved or removed according to patients' status and surgical instrumentations. In the present study, patients' overall satisfaction was favorable (RLSC,

92.2% and ASC, 96%) and there was no intraoperative complication. Based on our previous study [13], these results of sacrocolpopexy with concomitant hysterectomy were comparable to those of sacrohysteropexy with uterus preservation.

A meta-analysis showed that robotic or laparoscopic sacrocolpopexy had similar anatomic outcomes to abdominal approach with shorter duration of hospitalization, less blood transfusion and less perioperative bleeding [17]. Laparoscopic suture is more challenging than any other surgical steps for laparoscopic surgery. However, many experiences of laparoscopic surgery enable surgeons to perform this procedure more easily. Moreover, we expect that the advantages of robotic surgical system, including articulated robotic arms and great visual operation field, would allow operators to do suturing and to place a mesh on a proper site. In two meta-analyses, there was no difference of functional outcomes and recurrence rate between robotic and laparoscopic sacrocolpopexy. In addition, both studies showed robotic approach had longer operating time compared to laparoscopic sacrocolpopexy [18,19]. In the present study, the RLSC group showed shorter total necessary time for surgery, smaller blood loss, and few relapsed symptoms after surgery than the ASC. Although we described RLSC showed short operating time, it does not have clinical significance. In addition, robotic sacrocolpopexy group showed longer surgical time than the group who underwent laparoscopic sacrocolpopexy (Table 2). Surgeons had already got proficiency of learning curve for laparoscopic sacrocolpopexy, while the docking and setup procedures of robotic surgery required time additionally besides actual time for surgical procedures. This time was included to the total operating time in this study.

Based on the practical pathway of our institution, we removed urinary catheters from patients 3 days after operation. There were limited studies that evaluated when urinary catheters were taken out after POP surgery. Pan and colleagues [20] showed that they could take urinary catheters out average 2.3 days after operation after laparoscopic surgery for POP. For the first weaknesses of this study, we could not avoid selection bias completely because this study was performed retrospectively. Secondly, the POP-Q score of all the compartments of the pelvic floor could not be shown before and after operation because of the above-mentioned weakness of this study. Thirdly, we could not show the rate of concomitant anti-incontinence surgery and the results of urodynamic study. In addition, the number of robotic cases was too small to speculate the distinguished feasibility of robotic approach for POP patients. In conclusion, the sacrocolpopexy with concomitant total hysterectomy was feasible for POP without complication. RLSC can be considered as a minimally invasive surgical approach for POP.

Conflict of interest

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

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