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JMIG The Journal of Minimally Invasive Gynecology

AAGL ELEVATING GYNECOLOGIC SURGERY WORLDWIDE

Original Article

Effectiveness of Laparoscopic Pectopexy for Pelvic Organ Prolapse Compared with Laparoscopic Sacrocolpopexy

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ABSTRACT **Study Objective:** To evaluate the clinical benefits of laparoscopic pectopexy vs laparoscopic sacrocolpopexy in women with pelvic organ prolapse (POP).

Design: Prospective cohort study.

Setting: A tertiary hospital.

Patients: We included 203 patients with POP.

Interventions: Laparoscopic pectopexy or laparoscopic sacrocolpopexy.

Measurements and Main Results: Anatomic effectiveness was measured using the POP Quantification system, both before and after operation. Functional recovery effectiveness was evaluated using complications and recurrence rates within 1 year. Quality of life was assessed by the Pelvic Floor Distress Inventory-20 and Incontinence Quality of Life questionnaires at enrollment and postoperative months 3, 6, and 12. Comparisons between groups were performed using *t* test, chi-square test, and mixed-effects model with repeated measures. The analysis included 203 eligible patients (sacrocolpopexy, 101; pectopexy, 102). The proportion of robotic-assisted surgeries was lower in the pectopexy group than in the sacrocolpopexy group (15.7% vs 41.6%, p <.001). The average operation time of pectopexy was shorter than that of sacrocolpopexy (174.2 vs 187.7 minutes) with a mean difference of 13.5 minutes (95% confidence interval, 3.9−23.0; p = .006). Differences of intraoperative blood loss, length of hospital stay, and postoperative 7-day complications between groups were not significant. Anatomic successes were obtained in both groups with similar improvement in POP Quantification scores. The rate of urinary symptoms recurrence was higher in the pectopexy group (13.7%) than in the sacrocolpopexy group (5.0%) at the 1-year follow-up (odds ratio, 3.1; 95% confidence interval, 1.1−8.8, p = .032). The Pelvic Floor Distress Inventory-20 and Incontinence Quality of Life scores were better improved at postoperative months 3, 6, and 12 for laparoscopic pectopexy than for sacrocolpopexy.

Conclusion: Laparoscopic pectopexy revealed comparable anatomic success, shorter operation time, and better improvement in quality of life scores of prolapse, colorectal-anal, and urinary symptoms at 1-year follow-up, possibly being an alternative when sacrocolpopexy is not practicable. However, clinicians should pay more attention to the recurrence of urinary symptoms after pectopexy. Journal of Minimally Invasive Gynecology (2023) 30, 833−840. © 2023 AAGL. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/)

Keywords: Effectiveness; Laparoscopic pectopexy; Laparoscopic sacrocolpopexy; Pelvic organ prolapse; Quality of life

The authors declare that they have no conflict of interest.

This study was supported by Science and Technology Innovation Plan of Shanghai Science and Technology Commission (22Y11906200), National Natural Science Foundation of China (82204047), Pudong Medical Combination (PFYLT2022-17, 2023LYPYB03), Shanghai Hospital Development Center (SHDC2022CRS050).

The original data are available at appropriate request.

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Submitted January 29, 2023, Revised June 16, 2023, Accepted for publication June 17, 2023.

Available at www.sciencedirect.com and www.jmig.org

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https://doi.org/10.1016/j.jmig.2023.06.011

Pelvic organ prolapse (POP) substantially affects the quality of life (QOL) of women, with a global prevalence of 20% to 65% [1,2]. With a rapidly growing population [3], China stands to be affected by the increasing medical and financial burden. Surgery is the major treatment option for patients with POP at POP Quantification (POP-Q) stage ≥II, who have failed or declined conservative treatments [4]. Apical support is an important factor for the successful outcome of pelvic reconstruction surgery. Apical suspension can be performed transabdominally or transvaginally using native tissue or a synthetic mesh [5]. Laparoscopic sacrocolpopexy has been recognized as the standard treatment for advanced POP [6]. However, it is still associated with some problems, such as the difficult surgical field at the ventral side of the sacrum [7], and injuries to the adjacent organs may occur while operating in this vicinity [8]. Although the objective success rate of laparoscopic sacrocolpopexy is as high as 78% to 100% [9], on average, there was a 94.4% satisfaction rate, 6.2% prolapse reoperation rate, and 2.7% mesh erosion rate [10]. Moreover, laparoscopic sacrocolpopexy has a steep learning curve [11].

To cope with these predicaments, Banerjee and Noé [12] first introduced laparoscopic pectopexy using synthetic mesh anchored to the bilateral pectineal ligaments in 2011. This surgery is presumed to have fewer complications because the surgical field is limited to the anterior pelvis, with a decreased risk of injury to the adjacent organs. Previous researches have compared the effectiveness of laparoscopic pectopexy and sacrocolpopexy, in which the QOL has barely been investigated [13,14], and studies have been limited to Caucasian western women, but the procedure is yet to be studied in Asian population. Moreover, most previous clinical studies were performed using a retrospective design [7,11,15], with small sample size [11,13,14] or the lack of comparable group [8,11−14,16]. High-quality comparative studies are warranted to provide evidence for decision making for both surgeons and patients.

To fill this knowledge gap, we conducted the present prospective cohort study, including patients with POP who underwent surgery in Shanghai, China. We aimed to compare the effectiveness of laparoscopic pectopexy for POP, on anatomic and functional recovery, and the QOL, with that of sacrocolpopexy.

Materials and Methods

Population and Data Sources

This prospective cohort study was conducted at Shanghai First Maternity and Infant Hospital in Shanghai, China. It was conducted in accordance with the Declaration of Helsinki and Strengthening the Reporting of Observational Studies in Epidemiology statements. The ethics committee of Shanghai First Maternity and Infant Hospital approved the study protocol (no. KS22203). All participants provided a written informed consent form before enrollment.

Women with POP were recruited from the hospital between August 2020 and July 2021, with a final follow-up on July 31, 2022. Participants were eligible if they were 40 to 75 years old and had uterus prolapse with POP-Q stage ≥III or apical vaginal prolapse with POP-Q stage ≥III, no contraindications to surgery, and good liver and kidney function. Participants were excluded if their general condition was poor; they had serious heart, liver, kidney, and blood diseases and could not tolerate surgery; they were pregnant and lactating women; they had fertility requirements; or follow-up could not be completed owing to poor compliance, relocation, death, or other reasons. Data on participants' demographic characteristics and disease histories were collected during enrollment.

Surgical Procedures

Patients with POP underwent laparoscopic pectopexy or sacrocolpopexy based on the diagnosis and clinical evaluations conducted by the same attending surgeon. None of the patients underwent concomitant procedures for incontinence. Based on the location and severity of the prolapse, nature of symptoms, and patient's general health, the doctor communicated with the patient about the benefits and risks of the selected surgery. Thus, the surgeon and patient determined the treatment goals and made joint decisions.

The laparoscopic pectopexy procedure was performed as follows. The peritoneum was incised from the right round ligament toward the pelvic sidewall using bipolar scissors and electrosurgery. The external iliac vein and iliopectineal ligament on both sides were exposed using both blunt and sharp dissection. To prepare the site for mesh fixation, the peritoneum was incised from the proximal of the cervix toward the iliopectineal ligament bilaterally. A 4 × 18 cm mesh with a weight of ≤35 g/m^2 (DynaMesh-PR soft, FEG Textiltechnik mbH Aachen, Germany) was placed into the intra-abdominal cavity. The 2 ends of the mesh were intracorporeally fixed on both sides of the iliopectineal ligaments using nonabsorbable sutures. The mesh was fixed to the anterior surface of the cervix in a tension-free position using a nonabsorbable suture. Thereafter, the peritoneum was closed using an absorbable suture, covering the peritoneal mesh.

The laparoscopic sacrocolpopexy included the following procedures. The vaginal vault was lifted using a malleable metal retractor. The region from the sacral promontory to the vesicovaginal and rectovaginal fasciae was exposed by dissecting the peritoneum. The anterior region (vesicovaginal fasciae) was dissected down to the bladder trigone. The posterior region (rectovaginal fasciae) was dissected down to the levator ani muscle and perineal body. A Y-shaped mesh measuring 27 × 5 cm with light weight (ARTISY, Ethicon, Johnson & Johnson Institute, United States) were prepared preoperatively. The mesh was positioned and secured to the muscular layer of the anterior and posterior vaginal walls using interrupted suture [17]. The fixed end of the sacral mesh was pulled upward to the anterior sacral

suture site and intermittently sutured to the anterior longitudinal ligament of the sacrum in front of the S1 vertebral body with 2-0 nonabsorbable sutures. The suture depth should include the entire anterior longitudinal ligament layer, and the mesh should be completely flattened. The lateral peritoneum was closed with 2-0 absorbable sutures, and the mesh was embedded in the retroperitoneum. The postoperative 1-day POP-Q score was measured immediately on the day after surgery by the same surgeon.

Outcomes

Perioperative details, including operation time, blood loss volume, and hospital stay, were recorded. The operation time was calculated by subtracting the time at the "end of surgery" from the time at the "start of surgery," including all concomitant procedures (laparoscopy, colporrhaphy, anti-incontinence surgery, and cystoscopy). After discharge, follow-up visits were scheduled at the outpatient clinic at 3, 6, and 12 months. Postoperative discomfort, complications, and POP recurrence were examined at each follow-up. The patients were interviewed if they have any of the urinary symptoms, including urinary incontinence, urinary urgency and/or frequency, urine leakage, weak or prolonged urinary stream, feeling of incomplete emptying, etc. [4]. Recurrence of urinary symptoms was defined as the urinary symptoms disappeared after surgery and recurred at follow-up. The POP-Q scores were measured at months 6 and 12 of follow-up. Both operation procedures were designed to treat anterior and middle pelvic prolapse; thus, Aa and C points were recorded during the follow-up. No significant anatomic problems were observed in the posterior pelvis during the follow-up; therefore, Ap and Bp values were not recorded.

QOL was assessed using the Pelvic Floor Distress Inventory-20 (PFDI-20) and Incontinence QOL (I-QOL) questionnaires pre- and postoperatively (3, 6, and 12 months). The PFDI-20 has 20 items with 3 subscales, Pelvic Organ Prolapse Distress Inventory 6, Colorectal-Anal Distress Inventory 8, and Urinary Distress Inventory 6. Respondents were asked whether they experienced symptoms and, if so, how troublesome symptoms were on a scale of 1 (not at all) to 4 (quite a bit). Higher scores indicate a greater degree of pelvic floor-related distress. The I-QOL contains 22 items and aims to assess urinary incontinence in 3 domains: avoidance and limiting behavior, psychosocial impact, and social embarrassment. The I-QOL score was calculated on a scale of 0 to 100, with higher scores indicating a better QOL [18].

Statistical Analysis

The null hypothesis was the changes at postoperative month 12 from baseline in PFDI-20 scores were not significantly different between the groups. The sample size was calculated using a two-sample *t* test (inequality), assuming equal variance. Initially a small sample survey was conducted, including 42 patients with POP who underwent laparoscopic pectopexy (21 patients) or sacrocolpopexy (21 patients). The PFDI-20 score at postoperative month 12 was assessed via telephone follow-up. The average change in the PFDI-20 score was −71 in the pectopexy group and −58 in sacrocolpopexy group. Accordingly, a sample size of 91 participants per group was estimated to achieve 80% power to detect a between-group difference of 13 in the PFDI-20 score, assuming a standard deviation of 31 and a two-sided significance level of 5%. To compensate for a 10% loss to follow-up, the total sample size was increased to 202.

Continuous variables were reported as mean ± standard deviation when the variables were normally distributed (assessed by Kolmogorov−Smirnov test); otherwise, the median and range were reported. The differences between groups were assessed using Student's *t* test for normally distributed variable; otherwise, the Mann-Whitney U test was applied. Categorical variables were reported as numbers and percentages (%). Chi-square test or Fisher exact test was used to compare categorical data. Further sensitive analyses were performed in subgroups stratified by whether with robotic assistance or not.

The percent change in the PFDI-20 score from baseline at months 3, 6, and 12 was analyzed applying mixed-effects model with repeated-measures approach using treatment, time, and treatment multiplied by time interaction as independent variables and age (continuous), diabetes mellitus (yes or no), uterine surgery history (yes or no), robotic-assisted surgery (yes or no), and baseline score as covariates. Maximum likelihood was used to estimate unknown covariance parameters. The least squares means of PFDI-20 scores were also estimated using mixed-effects with repeated measures. The same statistical analytic approach was used for the I-QOL score. Differences were considered statistically significant when the p value was <.05. Statistical analyses were performed using SAS version 9.4 (SAS Institute Inc., Cary, NC). Graphs were generated using GraphPad Prism software for Windows (version 9.2.0, GraphPad Software, San Diego, CA, www.graphpad.com).

Results

A total of 217 women with POP were initially recruited and 14 were excluded (7 aged <40 years and 7 aged >75 years). The final analysis included 203 eligible patients who underwent surgery (sacrocolpopexy, 101; pectopexy, 102). Age, body mass index, and other baseline characteristics were similar between the groups (Table 1).

The surgical details and intra-/postoperative complications of sacrocolpopexy and pectopexy are presented in Table 2. For the whole population, 4 patients (3.9%) in the pectopexy group and no patient in the sacrocolpopexy group underwent uterus preservation surgery; 16 operations (15.7%) were performed with robotic assistance in the pectopexy group, and 42 (41.6%) in the sacrocolpopexy group, with a between-group odds ratio of 0.3 (95% confidence

Table 1

Participants baseline characteristics (n = 203)

Variables	Sacrocolpopexy (n = 101)	Pectopexy (n = 102)	p value
Age (yrs)	61.6 ± 7.2	63.2 ± 8.2	.146*
BMI (kg/m^2)	23.8 ± 2.3	23.9 ± 2.6	.737*
Gravity	3 [2−4]	2 [2−3]	.315†
Parity	1 [1−2]	1 [1−2]	.392†
Menopause	90 (89.1)	92 (90.2)	.799‡
Hypertension	40 (39.6)	46 (45.1)	.428‡
Diabetes mellitus	18 (17.8)	10 (9.8)	.098‡
Respiratory diseases	3 (3.0)	6 (5.9)	.498§
Surgery history‖	59 (58.4)	65 (63.7)	.438‡
Pelvic surgery history	26 (25.7)	27 (26.5)	.906‡
Uterine surgery history	10 (9.9)	4 (3.9)	.093‡
Prolapse surgery history	7 (6.9)	7 (6.9)	.985‡

BMI = body mass index; SD = standard deviation.
Values are presented as mean ± SD or median [interquartile range] for continuable variable and numbers (percentage) for category variables.
* Student's *t* test.
† Mann-Whitney U test.
‡ Chi-square test.
§ Fisher exact test.
‖ Surgical history refers to the history of all surgical procedures during the patient's past life, including pelvic surgery, uterine surgery, prolapse surgery as well as cholecystectomy, breast lump removal, appendectomy, etc.

interval [CI], 0.1−0.5; p <.001). The average operation time of pectopexy (mean, 174.2 minutes) was significantly shorter than that of sacrocolpopexy (187.7 minutes) with a mean difference of 13.5 minutes (95% CI, 3.9−23.0; p = .006). Furthermore, sensitivity analyses of the subgroup without robotic assistance also revealed a shorter average operation time in the pectopexy group than in the sacrocolpopexy group, with a mean difference of 19.6 minutes (95% CI, 9.3−29.8; p <.001). Results for the subgroup with robotic assistance are shown in Supplemental Table 1. There was more concomitant hysterectomy in sacrocolpopexy group than pectopexy group (40 [39.6%] vs 7 [7.1%], p <.001). To explore the effects of uterine preservation on operative time, subgroup analyses stratified by concomitant hysterectomy or not were further performed. In the subpopulation of without concomitant hysterectomy, shorter average operation time was also observed in the pectopexy group (17.7 minutes; 95% CI, 5.9 to −29.6; p = .004) (Supplemental Table 2).

Two patients (2.0%) in the pectopexy group and none in the sacrocolpopexy group had intraoperative complications, with no statistical significance between groups (p = .498). There were both 14 patients had postoperative 7-day complications in both groups (13.7% vs 13.9%, p = .978). The length of hospital stay, blood loss, and occult stress urinary incontinence were comparable between 2 groups. Similar

Table 2

Surgical characteristics and intraoperative/postoperative complications

	All patients (n = 203)				Patients without robotic assistance (n = 145)			
Variables	Sacrocolpopexy (n = 101)	Pectopexy (n = 102)	Difference/OR (95% CI)	p value	Sacrocolpopexy (n = 59)	Pectopexy (n = 86)	Difference/OR (95% CI)	p value
Uterus preservation	0 (0)	4 (3.9)	-	.121*	0	4 (4.7)	-	.146*
Concomitant hysterectomy	40 (39.6)	7 (7.1)	0.1 (0.05−0.3)	<.001†	2 (3.4)	2 (2.4)		1.000*
Robotic-assisted surgery	42 (41.6)	16 (15.7)	0.3 (0.1−0.5)	<.001†	-	-	-	-
Operating time (min)	187.7 ± 33.9	174.2 ± 35.0	−13.5 (−23.0 to −3.9)	.006‡	187.5 ± 32.8	168.0 ± 29.0	−19.6 (−29.8 to −9.3)	<.001§
Hospital stay (d)	12.5 ± 2.9	11.8 ± 2.6	−0.6 (−1.4 to 0.1)	.098‡	13.8 ± 2.8	11.9 ± 2.8	−1.8 (−2.8 to −0.9)	<.001§
Blood loss (mL)	46.2 ± 9.3	46.2 ± 11.6	−0.1 (−3.0 to 2.8)	.967‡	48.6 ± 7.5	45.7 ± 12.4	−2.9 (−6.2 to 0.3)	.078§
Intraoperative complications	0	2 (2.0)	-	.498*	0	2 (2.3)	-	.514*
Postoperative 7-d complications	14 (13.9)	14 (13.7)	1.0 (0.4−2.2)	.978†	10 (16.9)	13 (15.1)	0.9 (0.4−2.1)	.767†
PE/DVT	3 (3.0)	7 (6.9)	2.4 (0.6−9.6)	.331*	2 (3.4)	7 (8.1)	2.5 (0.5−12.6)	.311†
Urinary system infection	10 (9.9)	7 (6.9)	0.7 (0.2−1.8)	.435†	7 (11.9)	6 (7.0)	0.6 (0.3−1.8)	.312†
Mesh exposure	1 (1.0)	0	-	.498*	1 (1.7)	0	-	.407*
Hypostatic pneumonia	1 (1.0)	0	-	.498*	1 (1.7)	0	-	.407*
Occult stress urinary incontinence	5 (5.0)	1 (1.0)	0.2 (0.0−1.7)	.119*	1 (1.7)	1 (1.2)	0.7 (0.0−11.1)	1.000*

CI = confidence interval; DVT = deep vein thrombosis; OR = odds ratio; PE = pulmonary embolism.
* Fisher exact test.
† Chi-square test.
‡ Students' *t* test.
§ Mann-Whitney U test.

Table 3

Pelvic Organ Prolapse Quantification (POP-Q) follow-up at 6 months and 1 year

POP-Q point	Sacrocolpopexy (n = 101)	Pectopexy (n = 102)	Difference (95% CI)	p value
Aa				
Baseline	2.5 ± 0.8	2.4 ± 0.8	−0.1 (−0.3 to 0.1)	.331
Postoperative 6 month	−3.0 ± 0.1*	−2.8 ± 0.5*	0.2 (0.0−0.3)	.004
Postoperative 12 month	−3.0 ± 0.3*	−2.8 ± 0.5*	0.1 (−0.0 to 0.3)	.054
C				
Baseline	2.0 ± 2.1	1.5 ± 2.0	−0.5 (−1.1 to 0.1)	.079
Postoperative 6 month	−7.0 ± 0.5*	−6.9 ± 0.5*	0.1 (−0.1 to 0.2)	.487
Postoperative 12 month	−6.9 ± 0.5*	−6.9 ± 0.6*	0.0 (−0.1 to 0.2)	.591

CI = confidence interval.
* p <.001 compared with baseline.

results were observed in the subgroup without robotic assistance (Table 2).

The anatomic success was evaluated using POP-Q scores. The POP-Q scores (points: Aa, Ba, C, Ap, and Bp) of the 2 groups significantly improved immediately after surgery, indicating anatomic success in both groups (Supplemental Table 3). The follow-up of points Aa and C at 6 and 12 months postoperatively demonstrated good anatomic maintenance effects in both groups (Table 3).

Clinical outcomes at 12-month follow-up are presented in Table 4. One patient (1.2%) had a recurrence of POP in the sacrocolpopexy group, whereas none in pectopexy group. A higher recurrence rate of urinary symptoms in the pectopexy group (13.7%) was observed compared with the sacrocolpopexy group (5.0%) (odds ratio, 3.1; 95% CI, 1.1−8.8, p = .032). Nine (8.9%) and 6 de novo urinary symptoms (5.9%) occurred in the sacrocolpopexy and pectopexy groups (p = .410), respectively. Three (3.0%) and 6 de novo constipation symptoms (5.9%) occurred in the sacrocolpopexy and pectopexy groups, respectively. Except for urinary recurrence symptoms, all other clinical follow-up outcomes were comparable between the 2 groups. Sensitivity analyses showed similar results (Table 4 and Supplemental Table 4).

The QOL assessed using the PFDI-20 and I-QOL questionnaires significantly improved after both surgeries (Fig. 1 and Table 5). Pectopexy induced more changes in the PFDI-20 and I-QOL scores from baseline at each follow-up (Supplemental Table 5). Furthermore, compared with the sacrocolpopexy group, the pectopexy group showed a greater percent decrease in PFDI-20 from baseline with between-group differences of −13.5 (95% CI, −19.5 to −7.5) at month 3, −10.0 (−16.0 to −4.0) at month 6, and −7.6 (−13.7 to −1.4) at month 12. Meanwhile, the pectopexy group had a greater percent increase in I-QOL from baseline than the sacrocolpopexy group, with between-group differences of 14.0 (8.7, 19.3), 14.2 (8.9, 19.5) and 14.7 (9.2, 20.2) at months 3, 6, and 12, respectively (Table 5).

Table 4

Clinical follow-up outcomes at month 12

Clinical findings	All patients (n = 203)				Patients without robotic assistance (n = 145)			
	Sacrocolpopexy (n = 101)	Pectopexy (n = 102)	OR (95% CI)	p value	Sacrocolpopexy (n = 59)	Pectopexy (n = 86)	OR (95% CI)	p value
Recurrence pelvic organ prolapse	1 (1.0)	0	-	.498*	1 (1.7)	0	-	.407*
Recurrence urinary symptoms	5 (5.0)	14 (13.7)	3.1 (1.1−8.8)	.032†	1 (1.7)	12 (14.0)	9.4 (1.2−74.4)	.011†
De novo urinary symptoms	9 (8.9)	6 (5.9)	0.6 (0.2−1.9)	.410†	7 (11.9)	4 (4.7)	0.4 (0.1−1.3)	.122*
De novo constipation	3 (3.0)	6 (5.9)	2.0 (0.5−8.4)	.498*	1 (1.7)	6 (7.0)	4.4 (0.5−37.1)	.241*

CI = confidence interval; OR = odds ratio.
* Fisher exact test.
† Chi-square test.

Fig. 1

The least squares means estimates of the (A) PFDI-20 score and (B) I-QOL score. A mixed-effects model with repeated measures adjusted for age, diabetes mellitus, history of uterine surgery, robotic-assisted surgery, and baseline scores was used. I-QOL = Incontinence Quality of Life; PFDI-20 = Pelvic Floor Distress Inventory Questionnaire.

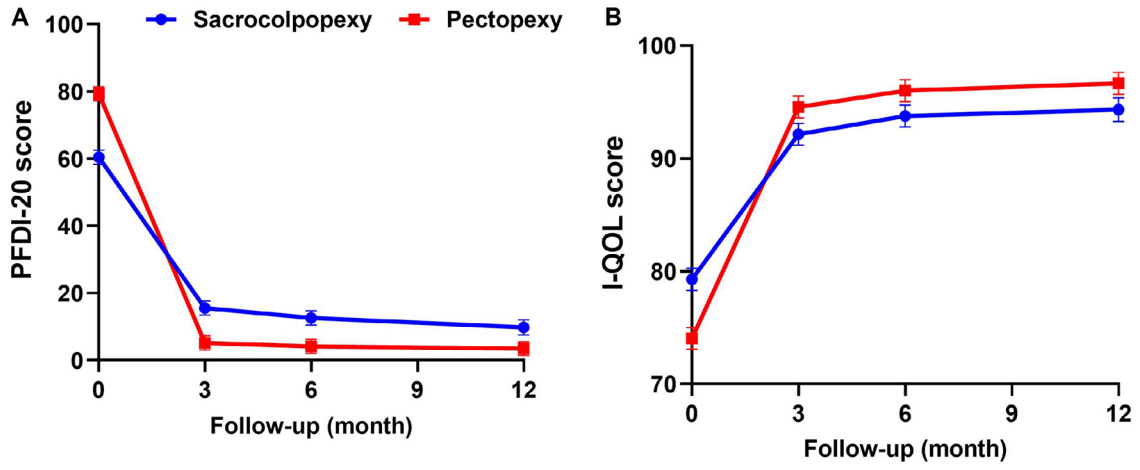

Table 5

Percent changes of PFDI-20 and I-QOL score from baseline at each follow-up

Percent changes	Sacrocolpopexy (n = 101)	Pectopexy (n = 102)	Difference (95% CI)	p value
PFDI-20				
Month 3	−74.5 ± 38.5	−88.0 ± 22.7	−13.5 (−19.5 to −7.5)	<.001
Month 6	−80.4 ± 32.7	−90.4 ± 18.5	−10.0 (−16.0 to −4.0)	.001
Month 12	−85.9 ± 25.5	−91.6 ± 16.7	−7.6 (−13.7 to −1.4)	.016
I-QOL				
Month 3	18.4 ± 22.3	32.4 ± 28.4	14.0 (8.7−19.3)	<.001
Month 6	20.5 ± 21.8	34.7 ± 28.3	14.2 (8.9−19.5)	<.001
Month 12	23.6 ± 24.7	35.8 ± 28.7	14.7 (9.2−20.2)	<.001

I-QOL = Incontinence Quality of Life; PFDI-20 = Pelvic Floor Distress Inventory Questionnaire.
A mixed-effects model with repeated measures adjusted for age, diabetes mellitus, uterine surgery history, robotic-assisted surgery, and baseline scores was used.

Discussion

We found that laparoscopic pectopexy and sacrocolpopexy had similar anatomic results after 1 year. The intraoperative blood loss, length of hospital stay, and postoperative 7-day complications were comparable between groups. Notably, the average operation time for pectopexy was shorter in both the whole population (on average 13.5 minutes faster) and the subpopulation that without robotic assistance (19.6 minutes faster). The postoperative PFDI-20 and I-QOL scores were improved in both groups, but more significant in the pectopexy group, and the PFDI-20 and I-QOL in both groups had clinical significance. However, the rate of urinary symptoms recurrence was higher in the pectopexy group than sacrocolpopexy after 1 year.

These findings are largely consistent with literature. Noé et al [14] reported that laparoscopic pectopexy revealed less average operation time (43.1 vs 52.1 minutes) and less blood loss than sacrocolpopexy. Another trial showed that laparoscopic pectopexy was associated with lower rates of postoperative lateral-defect cystocele and constipation than sacrocolpopexy at 20 months postoperatively; however, the rates of other complications or recurrence were comparable between the groups [13]. Researchers reported that laparoscopic pectopexy took shorter operation time and similar rates of complications or less postoperative discomfort than sacrocolpopexy [7,11].

Previous studies comparing the effectiveness of laparoscopic pectopexy and sacrocolpopexy for POP have mostly focused on the anatomic success, perioperative complications, and POP recurrence [7,11−14]. To the best of our knowledge, only one study compared the QOL after pectopexy and sacrocolpopexy [19]. Various questionnaires on the QOL are available in the literature, making comparisons difficult [16,20,21]. We assessed the QOL using PFDI-20 and I-QOL questionnaires. The strength of PFDI-20 is that it gives a comprehensive assessment of QOL, including the

prolapse, colorectal, and urinary, rather than just one aspect of pelvic floor function. The I-QOL assessed the most important concerns related to the symptoms associated with urinary incontinence, social life, intimate relationships, and psychophysical health [22]. In the current study, the between-group differences of PFDI-20 changes actually became smaller over time, suggesting the PFDI-20 scores became more similar at 1 year. In general, laparoscopic pectopexy improved postoperative QOL more than sacrocolpopexy. A retrospective study with limited sample size (n = 45) [19] reported that Urinary Distress Inventory 6 and Pelvic Organ Prolapse Distress Inventory 6 scores had improved significantly at 1-year follow-up after both pectopexy and sacrocolpopexy procedures, and the postoperative and preoperative scores were similar between groups. Unfortunately, the differences of QOL score changes were not tested between groups. We report the total scores of the PFDI-20, which takes full advantage of its strength. Furthermore, studies have revealed that the minimal clinically important difference (MCID) in FPDI-20 scores ranges from −23 to −45 [23,24], whereas the MCID in I-QOL scores ranges from 4 to 11 [25,26]. In this study, the absolute values of postoperative PFDI-20 changes from baseline were >45, and the I-QOL changes were >11 in each group, all of which met the MCID criteria.

The study has several strengths. To the best of our knowledge, this is the first prospective cohort study with a sufficient sample size in mainland China to evaluate the effectiveness of laparoscopic pectopexy for POP. Second, the effectiveness was evaluated in different dimensions, including anatomy, function, and QOL. Third, repeated measurements were obtained to illustrate the trajectory of the postoperative QOL. Fourth, the follow-up rate and compliance were high. However, this study had some limitations. The long-term postoperative follow-up is absence. Second, only one hospital was included; multicenter study with long-term follow-up is warranted. Third, all procedures were performed by the same surgeon. The postoperative POP-Q measurements were performed by the operating surgeon rather than by independent observers or assessors, which might produce some bias. Fourth, there were differences in the robotic/laparoscopic surgical approaches and, finally, the lack of randomization and blinding of group allocation. High-quality randomized controlled clinical trials will be required in the future.

Conclusions

Laparoscopic pectopexy for advanced POP revealed comparable anatomic success, shorter operation time (on average, 13 minutes faster), and better improvement in QOL scores of prolapse, colorectal-anal, and urinary symptoms at the 1-year follow-up compared with sacrocolpopexy. Notably, the improvements of QOL scores are clinically meaningful. However, urinary symptoms showed a high recurrence rate. Pectopexy can be considered in patients where sacrocolpopexy carries a higher risk of injury, even if it cannot yet be recommended as an alternative to sacrocolpopexy until long-term follow-up data are produced. Simultaneously, clinicians must pay further attention to the recurrence of urinary symptoms after pectopexy procedures.

References

1. Brown HW, Hegde A, Huebner M, et al. International urogynecology consultation chapter 1 committee 2: epidemiology of pelvic organ prolapse: prevalence, incidence, natural history, and service needs. *Int Urogynecol J*. 2022;33:173–187.
2. Schulten SFM, Detollenaere RJ, Stekelenburg J, IntHout J, Kluivers KB, van Eijndhoven HWF. Sacrospinous hysteropexy versus vaginal hysterectomy with uterosacral ligament suspension in women with uterine prolapse stage 2 or higher: observational follow-up of a multicentre randomised trial. *BMJ*. 2019;366:l5149.
3. Lancet T. Population ageing in China: crisis or opportunity? *Lancet*. 2022;400:1821.
4. Barber MD. Pelvic organ prolapse. *BMJ*. 2016;354:i3853.
5. Maher C, Feiner B, Baessler K, Christmann-Schmid C, Haya N, Marjoribanks J. Transvaginal mesh or grafts compared with native tissue repair for vaginal prolapse. *Cochrane Database Syst Rev*. 2016;2:CD012079.
6. Deffieux X, Sentilhes L, Savary D, et al. Indications of mesh in surgical treatment of pelvic organ prolapse by vaginal route: expert consensus from the French College of Gynecologists and Obstetricians (CNGOF). *J Gynecol Obstet Biol Reprod (Paris)*. 2013;42:628–638.
7. Biler A, Ertas IE, Tosun G, et al. Perioperative complications and short-term outcomes of abdominal sacrocolpopexy, laparoscopic sacrocolpopexy, and laparoscopic pectopexy for apical prolapse. *Int Braz J Urol*. 2018;44:996–1004.
8. Kale A, Biler A, Terzi H, Usta T, Kale E. Laparoscopic pectopexy: initial experience of single center with a new technique for apical prolapse surgery. *Int Braz J Urol*. 2017;43:903–909.
9. Lee RK, Mottrie A, Payne CK, Waltregny D. A review of the current status of laparoscopic and robot-assisted sacrocolpopexy for pelvic organ prolapse. *Eur Urol*. 2014;65:1128–1137.
10. Ganatra AM, Rozet F, Sanchez-Salas R, et al. The current status of laparoscopic sacrocolpopexy: a review. *Eur Urol*. 2009;55:1089–1103.
11. Chuang FC, Chou YM, Wu LY, Yang TH, Chen WH, Huang KH. Laparoscopic pectopexy: the learning curve and comparison with laparoscopic sacrocolpopexy. *Int Urogynecol J*. 2022;33:1949–1956.
12. Banerjee C, Noé KG. Laparoscopic pectopexy: a new technique of prolapse surgery for obese patients. *Arch Gynecol Obstet*. 2011;284:631–635.
13. Noé KG, Schiermeier S, Alkatout I, Anapolski M. Laparoscopic pectopexy: a prospective, randomized, comparative clinical trial of standard laparoscopic sacral colpocervicopexy with the new laparoscopic pectopexy-postoperative results and intermediate-term follow-up in a pilot study. *J Endourol*. 2015;29:210–215.
14. Noé KG, Spüntrup C, Anapolski M. Laparoscopic pectopexy: a randomised comparative clinical trial of standard laparoscopic sacral colpocervicopexy to the new laparoscopic pectopexy. Short-term postoperative results. *Arch Gynecol Obstet*. 2013;287:275–280.
15. Astepe BS, Karsli A, Köleli I, Aksakal OS, Terzi H, Kale A. Intermediate-term outcomes of laparoscopic pectopexy and vaginal sacrospinous fixation: a comparative study. *Int Braz J Urol*. 2019;45:999–1007.
16. Karslı A, Karslı O, Kale A. Laparoscopic pectopexy: an effective procedure for pelvic organ prolapse with an evident improvement on quality of life. *Prague Med Rep*. 2021;122:25–33.

17. Kettle C, Dowswell T, Ismail KM. Continuous and interrupted suturing techniques for repair of episiotomy or second-degree tears. *Cochrane Database Syst Rev*. 2012;11:CD000947.
18. Patrick DL, Martin ML, Bushnell DM, Yalcin I, Wagner TH, Buesching DP. Quality of life of women with urinary incontinence: further development of the incontinence quality of life instrument (I-QOL). *Urology*. 1999;53:71–76.
19. Chao WT, Liu CH, Yang ST, Chen YJ, Wang PH, Horng HC. Efficacy of minimally invasive pectopexy with concomitant I-stop-mini sling for women with pelvic organ prolapse and overt stress urinary incontinence: a retrospective cohort study. *Int J Gynaecol Obstet*. 2023 Mar 27. [Epub ahead of print].
20. Salman S, Kumbasar S, Yeniocak AS. Uterine preserving technique in the treatment of pelvic organ prolapse: laparoscopic pectopexy. *J Obstet Gynaecol Res*. 2022;48:850–856.
21. Szymczak P, Wydra DG. Evisceration of the small intestine through the vagina as a rare complication after laparoscopic pectopexy. *Ginekol Pol*. 2021;92:673–674.
22. Possavino F, Preti M, Carone R, et al. Psychometric validation of the Italian version of the I-QoL questionnaire: clinical and urodynamic findings. *Int Urogynecol J*. 2013;24:2125–2130.
23. Barber MD, Walters MD, Bump RC. Short forms of two condition-specific quality-of-life questionnaires for women with pelvic floor disorders (PFDI-20 and PFIQ-7). *Am J Obstet Gynecol*. 2005;193:103–113.
24. Utomo E, Blok BF, Steensma AB, Korfage IJ. Validation of the Pelvic Floor Distress Inventory (PFDI-20) and Pelvic Floor Impact Questionnaire (PFIQ-7) in a Dutch population. *Int Urogynecol J*. 2014;25:531–544.
25. Schurch B, Denys P, Kozma CM, Reese PR, Slaton T, Barron R. Reliability and validity of the Incontinence Quality of Life Questionnaire in patients with neurogenic urinary incontinence. *Arch Phys Med Rehabil*. 2007;88:646–652.
26. Yalcin I, Patrick DL, Summers K, Kinchen K, Bump RC. Minimal clinically important differences in Incontinence Quality-of-Life scores in stress urinary incontinence. *Urology*. 2006;67:1304–1308.

eTable 1

Surgical characteristics and intra-/postoperative complications with robotic-assisted surgery

Variables	Sacrocolpopexy (n = 42)	Pectopexy (n = 16)	Difference/Odds Ratio(95%CI)	P value
Uterus preservation	0	0	-	-
Operating time (mins)	187.9 ± 35.8	207.8 ± 45.3	20.0 (−2.7, 42.7)	0.084b
Hospital stay (days)	10.6 ± 1.6	11.3 ± 1.3	−0.6 (−0.2, 1.5)	0.130b
Blood loss (ml)	42.9 ± 10.4	48.8 ± 5.0	5.9 (1.8, 10.0)	0.006b
Intraoperative complications	0	0	-	-
Postoperative 7-day complications	4 (9.5)	1 (6.3)	0.6 (0.1, 6.1)	1.000a
PE/DVT	1 (2.4)	0	-	1.000a
Urinary system infection	3 (7.1)	1 (6.3)	0.9 (0.1, 9.0)	1.000a
Mesh exposure	0	0	-	-
Hypostatic pneumonia	0	0	-	-
Occult stress urinary incontinence	4 (9.5)	0	-	0.567a

Abbreviations: PE: Pulmonary embolism; DVT: deep vein thrombosis.
a. Fisher exact test; b. Mann-Whitney U test.

eTable 2

Operating time comparation between sacrocolpopexy and pectopexy group in the whole population and sub-population stratified by concomitant hysterectomy

	All patients (n = 203)				Without concomitant hysterectomy				Concomitant hysterectomy			
Variables	Sacrocolpopexy (n = 101)	Pectopexy (n = 102)	Difference (95%CI)	P	Sacrocolpopexy (n = 61)	Pectopexy (n = 95)	Difference (95%CI)	P	Sacrocolpopexy (n = 40)	Pectopexy (n = 7)	Difference (95%CI)	P
Concomitant hysterectomy	40 (39.6)	7 (7.1)	-	<0.001	-	-	-	-	-	-	-	-
Operating time (mins)	187.7 ± 33.9	174.2 ± 35.0	−13.5 (−23.0, −3.9)	0.006	191.3 ± 39.3	173.6 ± 34.5	−17.7 (−29.6, −5.9)	0.004	182.1 ± 22.8	182.9 ± 43.0	0.7 (−39.1, 40.6)	0.966

eTable 3

Pre- and postoperative 1-day pelvic organ prolapse quantification (POP-Q)

	Sacrocolpopexy (n = 101)			Pectopexy (n = 102)		
POP-Q point	Preoperative	Postoperative 1 day	P value	Preoperative	Postoperative 1 day	P value
Aa	2.5 ± 0.8	−3 ± 0	<0.001	2.4 ± 0.8	−3 ± 0	<0.001
Ba	3.3 ± 1.3	−3 ± 0	<0.001	3.3 ± 1.2	−3 ± 0	<0.001
C	2.0 ± 2.1	−6.8 ± 0.3	<0.001	1.5 ± 2.0	−6.7 ± 0.4	<0.001
Ap	0.1 ± 1.8	−3 ± 0	<0.001	−0.4 ± 1.8	−3 ± 0	<0.001
Bp	0.7 ± 2.6	−3 ± 0	<0.001	0.6 ± 2.7	−3 ± 0	<0.001
TVL	6.8 ± 0.4	6.9 ± 0.4	0.048	6.9 ± 0.5	6.8 ± 0.4	0.742

Abbreviations: TVL: total vaginal length.

eTable 4

Clinical follow-up outcomes at month 12 with robotic-assisted surgery

Clinical findings	Sacrocolpopexy (n = 42)	Pectopexy (n = 16)	Odds Ratio (95%CI)	P value
Recurrence pelvic organ prolapse	0	0	-	-
Recurrence urinary symptoms	4 (9.5)	2 (12.5)	1.4 (0.2, 8.2)	0.664[a]
De novo urinary symptoms	2 (4.8)	2 (12.5)	2.9 (0.4, 22.2)	0.303[a]
De novo constipation	2 (4.8)	0	-	1.000[a]

[a] Fisher exact test.

eTable 5

Changes of PFDI-20 and I-QOL score Pre- and post-operation

Variables	Sacrocolpopexy (n = 101)	Pectopexy (n = 102)	Difference (95% CI)	P value
PFDI-20				
Baseline	56.0 ± 37.7	83.3 ± 44.2	-	<0.001
Change at month 3	−44.9 ± 37.9	−74.1 ± 43.9	−29.2 (−37.3, −21.1)	<0.001
Change at month 6	−47.8 ± 37.8	−75.2 ± 42.8	−27.3 (−35.4, −19.2)	<0.001
Change at month 12	−51.6 ± 38.5	−75.8 ± 42.6	−25.1 (−33.4, −16.8)	<0.001
I-QOL				
Baseline	81.2 ± 11.5	72.5 ± 14.4	-	<0.001
Change at month 3	12.8 ± 14.4	20.5 ± 14.5	7.7 (4.6, 10.8)	<0.001
Change at month 6	14.5 ± 13.9	22.0 ± 13.9	7.5 (4.4, 10.6)	<0.001
Change at month 12	16.6 ± 16.6	22.6 ± 13.9	7.6 (4.4, 10.8)	<0.001

Abbreviations: PFDI-20, Pelvic Floor Distress Inventory Questionnaire; I-QOL, Incontinence Quality Of life.
A Mixed-effects model with repeated-measures adjusted for age, diabetes mellitus, uterine surgery history, robotic-assisted surgery and baseline scores was used.