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ORIGINAL ARTICLE

Comparison of laparoscopic lateral suspension and high uterosacral ligament suspension for apical prolapse: a retrospective clinical study

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Abstract

Background The aim of this retrospective clinical study is to assess clinical outcomes and patient satisfaction between laparoscopic lateral suspension (LLS) with mesh and laparoscopic high uterosacral ligament suspension (LHUS) for apical prolapse with or without anterior prolapse.

Methods Patients who underwent LLS with mesh or LHUS from 2019 to 2023 at the Second West China Hospital of Sichuan University were enrolled in this retrospective study. The objective outcomes were evaluated on the basis of the anatomical success rate according to the Pelvic Organ Prolapse Quantification System (POP-Q). The subjective outcomes were assessed using the Pelvic Floor Distress Inventory (PFDI-20) questionnaire, Pelvic Floor Impact Questionnaire (PFIQ-7), Patient Global Impression of Improvement (PGI-I) scores, and complications rate. Complications were defined according to the Clavien–Dindo scale. The outcomes of the postoperative 3, 6, and 12 months were analyzed retrospectively.

Results The objective and subjective outcomes indicated improvements in both groups. There was no statistically significant difference between the two groups in the change of subjective outcomes. The short-term objective and subjective outcomes for both techniques were found to be comparable. The anatomical success rate for apical and anterior prolapse was 93.85% in the LHUS group and 93.44% in the LLS group at a median follow-up of 12 months. LLS demonstrated a superior effect on the degree of postoperative point Ba (the distance from the most protruding point to the hymen on the anterior vaginal wall) improvement compared with LHUS.

Conclusions LHUS and LLS are both effective, safe surgical techniques for the treatment of apical prolapse, with or without concomitant anterior prolapse, exhibiting low complication rates and high short-term anatomical cure rates. LLS demonstrated certain advantages over LHUS in terms of anterior prolapse improvement and symptom relief.

Keywords High uterosacral ligament suspension · Laparoscopic lateral suspension · Pelvic organ prolapse

Introduction

Pelvic organ prolapse (POP) is a common condition in elderly women worldwide. Although it is not life-threatening, it significantly impacts a patient's quality of life, especially in patients with advanced POP. There is a spectrum of surgical techniques addressing moderate to severe POP treatment, encompassing native tissue repair and mesh repair surgeries. While sacrocolpopexy is considered as the conventional gold standard for apical prolapse [1], it is challenging to perform in patients with obesity. This procedure necessitates dissection of the sacral promontory which may cause life-threatening vascular injury in the sacral area. In this context, laparoscopic lateral suspension (LLS) with mesh emerges as a viable alternative for the treatment of apical prolapse. Isenlik et al. [2] reported comparable short-term objective and subjective outcomes between LLS and laparoscopic sacrocolpopexy (LSC). It is indicated that laparoscopic high uterosacral ligament suspension (LHUS) yielded favorable midterm curative effects similar to LSC, according to Guan et al.'s retrospective study [3].

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In this retrospective clinical study, we conducted a comparative analysis between patients who underwent LLS with mesh and LHUS. Our study focused on evaluating clinical outcomes.

Materials and methods

This retrospective study was conducted at our hospital between 2019 and 2023. The study was approved by the Medical Ethics Committee of Second West China Hospital of Sichuan University (registration number: 2022-207; date: October 25, 2022). All procedures performed in this study were in accordance with the ethical standards of the institutional research committee.

The patients with stage II or higher stage apical prolapse with or without anterior prolapse on the Pelvic Organ Prolapse Quantification System (POP-Q) examination who opted for either LLS or LHUS and consented to participate were enrolled in this study. Demographic and clinical data such as age, body mass index (BMI), obstetrics history, menstrual status, comorbidity, urinary incontinence, complications, blood loss, Pelvic Organ Prolapse Quantification (POP-Q), pelvic floor questionnaires scores before and after surgery, and other relevant clinical data were systematically collected. The Patient Global Impression of Improvement (PGI-I) questionnaire was used for evaluating patient satisfaction. PGI-I scores of 1 ("very much better"), 2 ("better"), and 3 ("a little better") were categorized as improved, while scores of 4 ("no change"), 5 ("a little worse"), 6 ("much worse"), and 7 ("very much worse") were considered unimproved. De-novo anterior, apical, and posterior compartment defect were defined as point Ba (distance from the most protruding point to the hymen on the anterior vaginal wall) ≥ 0, C (distance from cervix to the hymen) ≥ 0, or Bp (distance from the most protruding point to the hymen on the posterior vaginal wall) ≥ 0 according to the POP-Q postoperatively. De-novo urinary incontinence (UI) was evaluated at 3 months of follow-up. The outcome was classified as positive if the patient exhibited no evidence of UI preoperatively and reported UI complaints during follow-up.

All patients were under general anesthesia in lithotomy with steep Trendelenburg position during the surgery. As our routine clinical steps, the surgical area was disinfected, and a urinary catheter was placed. Hysterectomy, salpingo-oophorectomy, or salpingectomy was first performed, if needed. LLS was following the procedure described by Dubuisson [4]. LHUS procedure proceeded as follows. Initially, the uterosacral ligament and ureter were identified. The peritoneum between the cervix and the left ureter was incised along the uterosacral ligament reaching to the left margin of the rectum. Subsequently, the uterosacral ligament was kept away from the ureter and put under tension. Starting from the midportion, the ligament was spirally sutured to the vaginal stump or the posterior lip of cervix using non-absorbable suture. Repeated steps was performed in the contralateral ligament. Concomitant cystoscopy was then performed. All surgical procedures were performed by three senior urogynecologists. Postoperative evaluations were scheduled at 1 month, 3 months, 6 months, 12 months, and then annually thereafter to monitor patient progress and outcomes over time.

Statistical Package for the Social Sciences (SPSS, version 27.0, developed by IBM Corp, USA) was utilized for statistical analysis. Differences between groups were evaluated for statistical significances using *t*-test, Pearson's chi-squared test, Fisher's exact test, continutity correction chi-squared test or Mann–Whitney *U* test, depending on the data distribution.

Results

Between 2019 and 2023, a total of 126 patients were included. 61 patients underwent LLS, and 65 patients underwent LHUS. The demographic characteristics and baseline parameters of the participants are presented in Table 1. No statistically significant disparities were observed between the two groups regarding age, body mass index (BMI), parity, prevalence of hypertension or cardiopathy, diabetes mellitus, other comorbidities, previous total or subtotal hysterectomy, previous POP or stress urinary incontinence (SUI) surgery, and preoperative urinary incontinence (UI). There was a significant difference in preoperative Ba between the two groups.

The median follow-up duration was 12 months, with no significant difference between the two groups. Perioperative characteristics and postoperative outcomes of the patients are presented in Table 2. There was no significant difference in operative time, blood loss, intraoperative complication, or the days of hospital stay. A total of 47 patients (72.31%) in the LHUS group underwent concomitant procedures and 53 (86.89%) of those in the LLS group ($p = 0.04$). In total, 42 patients (64.62%) underwent concomitant posterior colporrhaphy in the LHUS group, while 53 patients (86.89%) underwent concomitant posterior colporrhaphy in the LLS group ($p = 0.00$). Within the LLS group, one patient (1.64%) experienced intraoperative bladder injury necessitating urinary catheterization for 7 days without any other complications. This patient underwent subtotal hysterectomy owing to uterine myoma. Vaginal cuff mesh exposure was observed in five patients (8.2%) among the LLS group, with one of them undergoing mesh excision in the outpatient department, while the remaining patients were managed conservatively with localized estriol application. Encouragingly, no mesh exposure were identified at their latest follow-up. The

Table 1 Baseline characteristics

Characteristics	LHUS, $n=65$	LLS, $n=61$	p-Value
Age (years)	53.06 (34–79)	55.54 (35–77)	0.07
BMI (kg/m^2)	24.14 (17.78–31.11)	23.91 (19.20–29.67)	0.64
BMI ≥ 30	2 (3.08)	0	0.50
Parity	1.38 (1–5)	1.67 ± 0.91(1–5)	0.07
Primiparous,	44 (67.69)	34 (55.74)	0.17
Multiparous (≥ 2 deliveries)	21 (32.31)	27 (44.26)	
Menopause	29 (44.62)	38 (62.30)	0.05
COPD	0	0	–
Diabetes	5 (7.69)	3 (4.92)	0.79
Hypertension or cardiopathy	15 (23.08)	16 (26.23)	0.68
Previous total or subtotal hysterectomy	0	2 (3.28)	0.23
Previous POP surgery	3 (4.62)	2 (3.29)	0.92
Previous UI surgery	0	1 (1.64)	0.48
Preoperative UI	11 (16.92)	13 (21.31)	0.53
SUI	11 (16.92)	9 (14.75)	0.74
UUI	0	3	0.22
MUI	0	1	0.48
Preoperative Ba	−0.5 (−2 to 3)	1 (−3 to 5)	< 0.00
Preoperative C	2 (−6 to 5.5)	2 (−4 to 7)	0.75
Preoperative Bp	−1 (−3 to 4)	−1 (−2.5 to 2)	0.21

Results are presented as n (%), median (range), or mean ± SD

LHUS, laparoscopic high uterosacral ligament suspension; LLS, laparoscopic lateral suspension; BMI, body mass index; COPD, chronic obstructive pulmonary disease; POP, pelvic organ prolapsed; UI, urinary incontinence; SUI, stress urinary incontinence; UUI, urge urinary incontinence; MUI, mixed urinary incontinence

anatomical success rate was 93.85% in the LHUS group, compared with 93.44% in the LLS group ($p=1.00$). No patients with recurrence needed a second POP operation.

The postoperative evaluation revealed significant improvements in point Aa (distance from the 3cm away the external urethra orifice to the hymen on the anterior vaginal wall), Ba, C, Ap (distance from the 3cm away the hymen on the posterior vaginal wall to the hymen), and Bp in both groups (Table 3). A significant difference was observed in the degree of postoperative improvement in point Ba between the two groups. In terms of de novo posterior POP, the LHUS group exhibited a prevalence of 3.08%, while the LLS group demonstrated a slightly lower incidence at 1.64%, with no significant difference (Table 2).

The subjective outcomes (PFDI-20, PFIQ-7 questionnaire scores) improved significantly in the LLS group at 3- and 6—Month follow-ups. Importantly, there was no significant difference between the two groups in the degree of improvement (Table 4). Additionally, within the LHUS group, a significant difference in PFDI-7 questionnaire scores at 6 months post-operation compared with pre-operation was observed ($p=0.01$). Patient satisfaction, as assessed by PGI-I scores, was notably high in both groups (Table 5). Moreover, there was no significant difference in PGI-I scores between the two groups ($p>0.05$). This suggests that both surgical techniques yielded similarly satisfactory outcomes in terms of patient-reported satisfaction.

Discussion

Sacrocolpopexy (SC) has been widely considered as the standard mesh repair surgery for apical prolapse. HUS is a valid technique using native tissue for apical prolapse with a good curative effect [5–10]. In some clinical studies, the curative effects and patient satisfaction of HUS are similar to that of sacrocolpopexy (SC) in the treatment of apical prolapse [3, 11, 12]. LLS is indicated for treatment of apical prolapse and was first demonstrated by Dubiusson et al. It is considered as an alternative technique for patients with contraindications of SC, avoiding promontory dissection. Compared with LHUS and LLS, LSC has greater technical requirements.

To the best of our knowledge, there are a few studies focusing on comparing LHUS with LLS in terms of clinical outcomes. In this study, we compared LHUS with LLS in terms of objective and subjective outcomes and evaluated the efficacy and safety of these techniques for the treatment of apical prolapse. Our study showed that both LHUS and LLS were effective surgical techniques for apical prolapse

Table 2 Perioperative characteristics and postoperative outcomes

Characteristics	LHUS, $n=65$	LLS, $n=61$	p-Value
Operative time (mins)	228.74 ± 49.25	237.87 ± 69.95	0.88
Estimated blood loss (ml)	57.49 ± 44.73	56.23 ± 102.59	0.08
Intraoperative complication	0	1 (1.64)	0.48
Bladder injury	0	1 (1.64)	0.48
Rectum injury	0	0	–
Other	0	0	–
Blood transfusion	0	1 (1.64)	0.48
Conversion to laparotomy	0	0	–
Concomitant procedures	47 (72.31)	53 (86.89)	0.04
Cervical amputation	22 (33.85)	12 (19.67)	0.07
Posterior colporrhaphy	42 (64.62)	53 (86.89)	0.00
Perineal repair	36 (55.38)	53 (86.89)	0.00
McCall's culdoplasty,	4 (6.15)	1 (1.64)	0.40
Hysterectomy	41 (63.08)	39 (63.93)	0.92
Hospital stay (days)	7.30 ± 2.26	7.69 ± 2.54	0.46
Mesh erosion	–	0	–
Mesh exposure	–	5 (8.20)	–
Anatomical success rate	61 (93.85)	57 (93.44)	1.00
Apical	65 (100)	61 (100)	–
Anterior	61 (93.85)	57 (93.44)	1.00
Re-operation for POP	0	0	–
De-novo posterior POP	2 (3.08)	1 (1.64)	1.00
De-novo UI	6 (9.23)	4 (6.56)	0.82
SUI	6 (9.23)	4 (6.56)	0.82
UUI	0	0	–
MUI	0	0	–

Results are presented as n (%), median (range), or mean ± SD

LHUS, laparoscopic high uterosacral ligament suspension; LLS, laparoscopic lateral suspension

with or without anterior prolapse. The subjective cure rates for apical and anterior prolapse were 100% and 93.85% in the LHUS group and 100% and 93.44% in the LLS group at a median follow-up of 12 months. Mereu et al. evaluated the subjective outcomes of LLS in 125 patients with apical and anterior prolapse, and the anatomic success rate was 94.9% for apical POP and 94.2% for anterior POP at 2 years of follow-up [13]. There was no patient requiring the secondary POP surgery for recurrence during the follow-up. PFDI-20 and PFIQ-7 scores significantly improved after surgery only in the LLS group (Table 4). LLS possessed certain advantages in symptom improvement, as Mereu et al. reported [13].

In our study, no complications were observed in the LHUS group. In the LLS group, however, one patient experienced bladder injury intraoperatively, and another required blood transfusion therapy owing to excessive intraoperative bleeding. Additionally, the mesh exposure rate of the LLS group was 8.2% (1 out of 61 patients), all of which were managed in the outpatient department and did not require hospitalization for further treatment. Overall, both techniques demonstrated low complication rates and can be considered safe treatment options for apical prolapse with or without concurrent anterior prolapse.

Regarding postoperative de novo posterior POP and UI, there was no significant difference between the two groups. De-novo posterior prolapse was observed in two (3.08%) patients in the LHUS group and one (1.64%) patient in the LLS group, which were lower than reported in some previous reports [2, 8, 13, 14]. The lower incidence of de novo posterior prolapse after surgery in our study may be attributed to differences in surgical approach, follow-up duration, and concomitant procedures. In the LLS group, despite the short median follow-up of 12 months, no patients required posterior compartment repair, a result that compares favorably with other studies. In several recent randomized controlled trials, it has been reported that the LLS procedure yields results comparable to those of the LSC procedure in terms of posterior POP at the 1-year follow-up [2, 15, 16]. Dallenbach et al. [17] reported that one patient (1.85%) had posterior compartment beyond hymen within the first postoperative year, and two (3.70%) had posterior compartment beyond hymen at a mean follow-up of 33.6 months. Although their study primarily focused on robotically assisted LLS, their findings are nonetheless relevant and contribute to a broader understanding of postoperative posterior prolapse in the LLS procedure. Similarly, in a prospective cohort study conducted by Chatziioannidou et al. [18], one patient (1.30%) developed posterior compartment prolapse beyond hymen during a mean follow-up duration of 3.4 years. In the prospective case series by Russo et al. [19], it was demonstrated that most mild high rectoceles are effectively treated with lateral suspension of the apex, with a 6% incidence of de novo posterior defect observed in the absence of posterior mesh. In the review by Campagna et al. [20], the recurrence rate of posterior prolapse in patients who underwent LLS ranges from 0% to 20%, whereas the success rate of posterior compartment varies between 75% and 85%. In summary, the incidence of de novo posterior prolapse following the LLS procedure is low at short-term follow-up; however, the incidence at long-term follow-up remains indeterminate.

LLS procedure is currently indicated for the treatment of anterior and apical prolapse, rather than posterior prolapse, a stance with which we concur. Although the LLS procedure shows promising short-term clinical outcomes, the risk of postoperative posterior prolapse at long-term follow-up still remains a persistent concern. There is a lingering hypothesis that, when administered to patients without high rectocele, the lateral suspension of the apex may promote the later development of an enterocele or the descent of the upper

Table 3 Comparison between pre- and post-operative 3-, 6-, and 12-month POP-Q measurements

	LHUS			LLS			Difference		
	Preoperative	Postoperative	*P*	Preoperative	Postoperative	*P*	ΔLHUS	ΔLLS	*P*
Pre- and post-operative 3 months									
Aa	−1 (−2 to 1)	−2 (−2.5 to −1)	0.00	−0.5 (−3 to 2)	−2 (−2.5 to −0.5)	0.00	1 (−0.5 to 3)	1 (−1 to 3.5)	0.16
Ba	−0.5 (−2 to 3)	−2 (−2.5 to −1)	0.00	1 (−3 to 3)	−2 (−2.5 to 1)	0.00	1.5 (−0.5 to 5.5)	2.5 (−1 to 4.5)	0.00
C	2 (−6 to 5)	−6 (−9 to −4.5)	0.00	2 (−4 to 7)	−6 (−8 to −1.5)	0.00	8 (0–13)	8 (1–13)	0.90
Ap	−1 (−3 to 0.5)	−2 (−3 to −1)	0.00	−1 (−2.5 to 2)	−2 (−2.5 to −0.5)	0.00	1 (−1 to 3)	1 (−0.5 to 4)	0.29
Bp	−1 (−3 to 4)	−2 (−3 to −1)	0.00	−1 (−2.5 to 2)	−2 (−2.5 to −0.5)	0.00	1 (−1 to 6)	1.25 (−0.5 to 4)	0.21
Pre- and post-operative 6 months									
Aa	−1 (−2 to 1)	−2 (−3 to −0.5)	0.00	−0.5 (−3 to 1.5)	−2 (−2.5 to −0.5)	0.00	1 (−0.5 to 2.5)	1.5 (−1 to 3)	0.05
Ba	−0.5 (−2 to 3)	−2 (−3 to −0.5)	0.00	1 (−3 to 5)	−2 (−2.5 to −0.5)	0.00	1 (−0.5 to 5)	3 (−1 to 6.5)	0.00
C	2 (−6 to 5)	−6 (−8 to −4.5)	0.00	2 (−4 to 5)	−6 (−7 to 0)	0.00	8 (0–12)	8 (1–12)	0.80
Ap	−1 (−3 to 0.5)	−2 (−3 to −1)	0.00	−1 (−2 to 2)	−2 (−3 to −1)	0.00	1 (−1.5 to 3.5)	1 (−1 to 4.5)	0.02
Bp	−1 (−3 to 4)	−2 (−3 to −1)	0.00	−1 (−2 to 2)	−2 (−3 to −1)	0.00	1 (−1.5 to 6)	1 (−1 to 4.5)	0.02
Pre- and post-operative 12 months									
Aa	−1 (−2 to 1)	−2 (−3 to −1)	0.00	−0.5 (−1.5 to 1.5)	−2 (−2.5 to −0.5)	0.00	0.75 (−1 to 3)	1.5 (0–3)	0.05
Ba	−0.75 (−2 to 3)	−2 (−3 to 0)	0.00	1.5 (−1.5 to 4)	−2 (−2.5 to −0.5)	0.00	1 (−1 to 5)	3 (0.5–6.5)	0.00
C	2 (−5 to 5)	−5.75 (−7 to −3)	0.00	2.25 (−4 to 5)	−6 (−7 to −4.5)	0.00	8 (0–11)	8 (1.5–12)	0.34
Ap	−1.5 (−3 to 0.5)	−2 (−2.5 to 1)	0.01	−1 (−2 to 2)	−2.25 (−3 to −0.5)	0.00	0.5 (−3 to 3)	1.5 (−0.5 to 4.5)	0.02
Bp	−1.5 (−3 to 4)	−2 (−2.5 to 3)	0.01	−1 (−2 to 2)	−2.25 (−3 to −0.5)	0.00	0.5 (−5 to 6)	1.5 (−0.5 to 4.5)	0.02

Table 4 Comparison between pre- and post-operative 3-, 6-, and 12-month PFDI-20 and PFIQ-7 scores

	LHUS			LLS			Difference		
	Preoperative	Postoperative	*P*	Preoperative	Postoperative	*P*	ΔLHUS	ΔLLS	*P*
Pre- and post-operative 3 months									
PFDI-20	45.52 ± 27.87	49.82 ± 39.92	0.69	51.47 ± 33.36	29.03 ± 34.30	0.00	-4.29 ± 51.61	22.43 ± 41.21	0.18
PFIQ-7	48.09 ± 48.57	23.60 ± 37.56	0.08	38.79 ± 38.20	17.24 ± 31.19	0.00	24.49 ± 63.02	21.55 ± 46.09	0.86
Pre- and post-operative 6 months									
PFDI-20	47.28 ± 28.21	39.30 ± 33.64	0.26	55.04 ± 33.56	34.35 ± 43.14	0.00	7.98 ± 31.70	20.70 ± 43.94	0.09
PFIQ-7	47.15 ± 48.32	14.29 ± 27.06	0.01	37.52 ± 35.80	24.22 ± 50.35	0.046	32.86 ± 54.46	13.30 ± 60.42	0.49
Pre- and post-operative 12 months									
PFDI-20	47.86 ± 28.51	36.17 ± 31.40	0.28	56.33 ± 35.05	39.93 ± 48.22	0.11	11.69 ± 39.97	19.40 ± 53.86	0.64
PFIQ-7	47.94 ± 55.30	15.25 ± 28.52	0.08	40.59 ± 39.43	19.13 ± 57.72	0.01	32.69 ± 67.32	21.46 ± 66.12	0.72

part of the rectum [21–23]. Some researchers have proposed that the LLS procedure, by tensioning of the round ligament plicated forwads and creating a substantial posterior space, may pose disadvantages for the posterior compartment. Furthermore, subsequent study revealed that the posterior transversal prosthesis in the LLS procedure did not provide any additional benefits [4], prompting some surgeons to implant only the anterior mesh [13, 15, 19, 24]. Recent evidence indicates that for addressing issues in the posterior compartment, a straightforward posterior colporrhaphy remains the most effective approach [25]. Additionally, the Cochrane review suggests that the posterior compartment is most effectively managed through vaginal approaches, typically without the use of a prosthesis, with simple posterior colporrhaphy being the preferred technique [26]. In this context, it can be inferred that in the presence of apical prolapse with concomitant posterior defect, LLS procedure with concomitant posterior colporrhaphy may represent the optimal approach, or alternatively, the LSC procedure may be a more appropriate treatment. A majority of patients in the reviewed studies underwent concomitant posterior colporrhaphy, and they were predominantly diagnosed with apical or anterior prolapse. It remains unclear whether concomitant posterior colporrhaphy contributes to the lower rate of de novo posterior POP observed in the LLS group. Our study suggests that the incidence of de novo posterior POP is low following the LLS procedure with concomitant posterior colporrhaphy in a short-term follow-up duration. Pulatoglu et al.

Table 5 Comparison of postoperative 3-, 6-, and 12-month PGI-I scores between LHUS and LLS

Postoperative 3 months			
Scores	LHUS, $n=24$	LLS, $n=43$	p-Value
1—Very much better, n (%)	14 (58.33)	25 (58.14)	0.99
2—Better, n (%)	7 (29.17)	14 (32.56)	0.77
3—A little better, n (%)	3 (12.50)	1 (2.33)	0.25
4—No change, n (%)	0	1 (2.33)	1.00
5—A little worse, n (%)	0	2 (4.65)	0.53
6—Much worse, n (%)	0	0	–
7—Very much worse, n (%)	0	0	–
Postoperative 6 months			
Scores	LHUS, $n=21$	LLS, $n=36$	p-Value
1—Very much better, n (%)	9 (42.86)	17 (47.22)	0.75
2—Better, n (%)	10 (47.62)	14 (38.89)	0.52
3—A little better, n (%)	1 (4.76)	4 (11.11)	0.74
4—No change, n (%)	1 (4.76)	1 (2.78)	1.00
5—A little worse, n (%)	0	0	–
6—Much worse, n (%)	0	0	–
7—Very much worse, n (%)	0	0	–
Postoperative 12 months			
Scores	LHUS, $n=15$	LLS, $n=26$	p-Value
1—Very much better, n (%)	7 (46.67)	16 (61.54)	0.36
2—Better, n (%)	6 (40.00)	6 (23.08)	0.43
3—A little better, n (%)	2 (13.33)	3 (11.54)	1.00
4—No change, n (%)	0	1 (3.85)	1.00
5—A little worse, n (%)	0	0	–
6—Much worse, n (%)	0	0	–
7—Very much worse, n (%)	0	0	–

[27] reported that the vaginal axis remained near-normal in patients who underwent LLS. This finding suggests that the LLS procedure may have minimal impact on the alignment of the vaginal axis, maintaining its anatomical integrity postoperatively. However, the study was limited by its small sample size, with only 21 cases., which may affect the generalizability of the findings. Furthermore, there was insufficient evidence to suggest that the LLS procedure increased the risk of postoperative posterior prolapse at a long-term follow-up. This issue warrants further investigation, including additional multicenter randomized controlled trials, to reach more definitive conclusions.

According to PGI-I scores, the LLS group exhibited the highest patient satisfaction at the 12-month follow-up, while the LHUS group demonstrated peak patient satisfaction at 3 months. It is unclear whether the patient satisfaction is related to other postoperative complications such as chronic pelvic pain or lower urinary tract symptoms. Frigerio et al. suggested that LLS involves a certain risk of chronic pelvic pain [28]. Therefore, further research is necessary in the incidence of postoperative chronic pelvic pain, lower urinary tract symptoms, and other symptoms.

This study has several limitations. First, it employed a retrospective, single-center design with a short-term follow-up. Additionally, the two groups differed in preoperative anterior POP stage owing to the reality of the patient's surgical treatment selection for POP. This disparity made it challenging to objectively evaluate the comparative effectiveness of the two surgical techniques for anterior POP in this study. Clinical data on middle-term and long-term follow up remains limited. Furthermore, all participants were of East Asian ethnicity, which limits the generalizability of the findings. Lastly, the study did not exclude patients who underwent concomitant posterior colporrhaphy, and potential impact on posterior compartment was not thoroughly evaluated. Therefore, large-scale, multicenter randomized controlled trials are still required to further evaluate the effectiveness of the two surgical techniques.

Conclusions

LHUS and LLS are both effective, safe surgical techniques for the treatment of apical prolapse, with or without concomitant anterior prolapse, exhibiting low complication rates and high short-term anatomical cure rates. The short-term objective and subjective outcomes for both techniques were found to be comparable. LLS demonstrated certain advantages over LHUS in terms of anterior prolapse improvement and symptom relief. These findings suggest that LLS may be a preferable option for patients with concurrent anterior compartment prolapse or those seeking improved symptom management in the short term. Nonetheless, further studies with larger sample sizes and longer follow-up periods are warranted to validate and expand upon these findings.

Author contributions Ya Yu carried out data collection and management, data analysis, and manuscript writing/editing. Yueyue Chen carried out project development, administrative support, and manuscript writing/editing. Ling Mei carried out data analysis and manuscript writing/editing. Tao Cui carried out manuscript writing/editing. Dongmei Wei carried out manuscript writing/editing. Xiaoyu Niu carried out project development, administrative support, manuscript writing/editing.

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Data availability No datasets were generated or analyzed during the current study.

Declarations

Conflict of interest The authors have no conflicts of interest to declare that are relevant to the content of this article.

Ethical approval This retrospective study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Medical Ethics Committee of Second West China Hospital of Sichuan University (registration number: 2022-207; date: October 25, 2022).

Consent to participate Informed consent was obtained from all individual participants included in the study.

Consent to publish The data in this study is anonymous, and the requirement of consent to publish was therefore waived.

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