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Original Article

Comparison of postoperative recovery and complications: laparoscopic sacrocolpopexy versus transvaginal sacrospinous ligament suspension

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Abstract: Objective: The goal of this study was to determine whether functional recovery and complication rates differed between laparoscopic sacrocolpopexy (LSC) and transvaginal sacrospinous ligament suspension (TSS) in patients with moderate-to-severe uterine prolapse and vaginal wall prolapse. Methods: We conducted a retrospective cohort study of 321 patients who underwent surgery between April 2021 and February 2023. Participants were divided into an LSC group (n=163) and a TSS group (n=158). Since pelvic organ prolapse may occur following childbirth, complication and recurrence rates were compared between groups. Factors associated with recurrence were analyzed using logistic regression. Results: Compared to LSC, TSS had shorter operation time, less blood loss, and faster return of flatus. Both groups improved in pelvic organ prolapse quantification scores, pelvic floor distress inventory-20, and pelvic organ prolapse/urinary incontinence sexual questionnaire-12, with greater improvement in the LSC group. TSS was associated with higher rates of urinary incontinence and recurrence (5.52% vs. 13.29%). Multivariate analysis showed TSS, prior pelvic surgery, and combined compartment prolapse were risk factors for recurrence, while age <60 and body mass index <24 kg/m^2 were protective. Conclusion: In patients with moderate-to-severe uterine and vaginal wall prolapse who are medically fit, LSC provides superior pelvic floor anatomical restoration, quality of life improvement, and recurrence control compared to TSS. For patients who cannot tolerate laparoscopic surgery, TSS remains a safe alternative, with both procedures demonstrating comparable overall safety.

Keywords: Uterine prolapse, laparoscopic sacrocolpopexy, transvaginal sacrospinous ligament suspension, postoperative complications, treatment outcome, recurrence

Introduction

Moderate-to-severe uterine prolapse combined with vaginal wall prolapse represents a significant pelvic floor disorder. This condition manifests predominantly as central compartment prolapse and occurs most frequently in middle-aged and elderly women. Established risk factors include multiple childbirths, chronic constipation, and other conditions that generate sustained increases in intra-abdominal pressure [1]. The disorder severely disrupts body functions and significantly impacts quality of life. Patients often have complaints involving urinary and defecatory issues, sexual dysfunction, and symptoms including vaginal bleeding and pain [2]. As age progresses, the incidence of uterine prolapse increases; studies have shown that as many as 40% of women over 50 may demonstrate some degree of uterine descent [3]. For severe cases involving concurrent vaginal wall prolapse, surgery is the treatment option to restore normal pelvic anatomy and function. Laparoscopic sacrocolpopexy (LSC) and transvaginal sacrospinous ligament suspension (TSS) are now recognized methods to use for moderate-to-severe uterine prolapse with vaginal wall involvement [4-6]. The shift

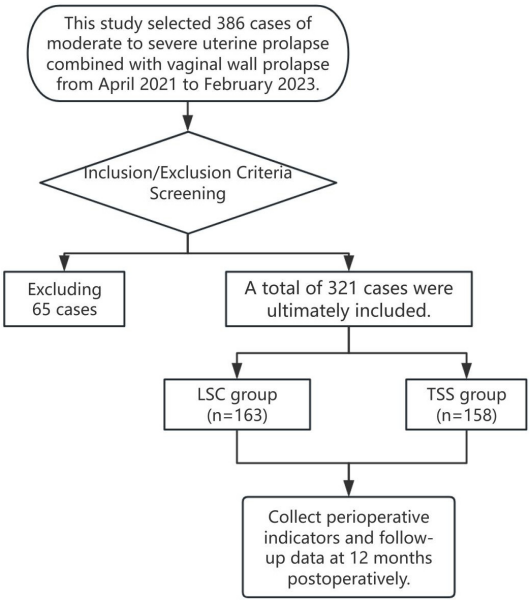

Figure 1. Patient selection flowchart. Note: LSC: laparoscopic sacrocolpopexy; TSS: transvaginal sacrospinous ligament suspension.

toward these procedures reflects a broader trend favoring minimally invasive techniques over traditional open or transvaginal approaches. LSC is a minimally invasive technique that involves the laparoscopic fixation of the vaginal apex to the sacrum, facilitating a quicker patient recovery [7]. Mesh-augmented repair for pelvic organ prolapse effectively corrects both uterine prolapse and vaginal wall bulging, boasting a high long-term success rate and low postoperative morbidity, which has established it as a current gold-standard technique. The TSS procedure that uses a transvaginal approach for sacrospinous ligament fixation may technically less demanding than LSC and is associated with less trauma and quicker postoperative recovery. Nonetheless, TSS is limited by factors such as a restricted surgical field, high technical proficiency requirements, and risks including vaginal scarring [8]. Consequently, while TSS is still a commonly used option, mainly for patients who are unsuitable for laparoscopic surgery, its limitations must be considered. Despite the efficacy of both LSC and TSS, there is a relative scarcity of robust comparative studies examining postoperative functional recovery and complication profiles. According to some evidence, LSC may allow for a faster recovery, fewer constipation-related complications, lower rates of urinary incontinence, and a reduced risk of prolapse recurrence [9]. In contrast, TSS is technically simpler, and correlates with a shorter postoperative recovery and hospital stay, which makes it potentially suitable for a subset of patients.

Given the lack of comparisons in the literature, this study sought to compare systematically the postoperative functional recovery and complication rates between LSC and TSS for the treatment of moderate-to-severe uterine prolapse with vaginal wall prolapse.

Patients and methods

Study design and participants

This retrospective study analyzed clinical data from 321 patients with moderate-to-severe uterine prolapse combined with vaginal wall prolapse, who were admitted to Xi'an People's Hospital and The First People's Hospital of Xianyang from April 2021 to February 2023. According to the surgical procedure performed, patients were divided into two groups: the LSC group (n=163) and the TSS group (n=158). The sample calculation was performed using PASS 15.0 software, based on previously reported recurrence rates for LSC (5%) and TSS (13%) [10], with α=0.05 and β=0.2. The calculation yielded a minimum requirement of 142 cases per group. Our cohort size therefore meets this requirement. The Ethics Committee of The First People's Hospital of Xianyang approved this study. A flowchart of patient selection is presented in **Figure 1**.

Surgical selection criteria

The choice between LSC and TSS was based on a comprehensive preoperative evaluation. Key considerations included the patient's general physical condition, anesthetic tolerance, comorbidities, pelvic anatomic complexity, and surgeon experience. LSC was preferentially recommended for patients with good cardiopulmonary function (American Society of Anesthesiologists grade I-II), the ability to tolerate general anesthesia and pneumoperitoneum, and those requiring strong apical support or presenting with combined anterior-posterior vaginal wall prolapse. TSS was selected for patients with advanced age, multiple comorbidities or higher anesthetic risk (American Society of Anesthesiologists grade III), contraindications to laparoscopy, or anticipated difficulty tolerating prolonged operative time. In addition, sur-

geon expertise and patient preference after informed counseling also played a role in the final decision-making process.

Inclusion and exclusion criteria

Inclusion criteria: 1. Diagnosis of stage II or higher pelvic organ prolapse based on the International Pelvic Organ Prolapse Quantification (POP-Q) system; 2. Definite surgical indications and completion of the corresponding surgical treatment; 3. Availability of complete clinical data and a postoperative follow-up duration of at least 12 months.

Exclusion criteria: 1. Coexistence of malignant tumors, severe cardiovascular or cerebrovascular diseases, or hepatic/renal dysfunction; 2. Significant cognitive impairment or inability to cooperate with questionnaire-based assessment; 3. Severe neuromuscular disorders affecting the pelvic floor prior to surgery; 4. Incomplete perioperative data or loss to follow-up during the study period.

Collection of clinical data

Baseline data: Data including patient age, body mass index (BMI), number of pregnancies, menopausal status, history of pelvic surgery, history of vaginal delivery, and type of vaginal wall prolapse (anterior wall, posterior wall, or combined anterior-posterior walls) were collected through the medical record system. Differences in baseline characteristics were compared between the two groups.

Perioperative indicators: Perioperative data such as operation time, intraoperative blood loss, time to first postoperative flatus, and length of hospital stay were collected from surgical and anesthesia records.

Indicators of pelvic floor anatomical recovery: Pelvic floor anatomical recovery was assessed using the POP-Q system, which provides an objective and standardized description of pelvic support [11]. The POPQ system measures defined points on the vaginal wall: points Aa and Ba on the anterior vaginal wall; point C at the cervix or vaginal cuff, and point D at the posterior fornix (if the cervix is present); and points Ap and Bp on the posterior vaginal wall.

Quality of life assessment: The quality of life of patients was assessed before and 12 months after surgery using the Pelvic Floor Distress Inventory-20 (PFDI-20) and the Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire-12 (PISQ-12) scales. All questionnaires were completed independently by the patients under the guidance of the researcher, and scores were calculated as per standard scoring. The PFDI-20 is reliable in assessing pelvic floor disorders (Cronbach's α=0.82-0.91; intraclass correlation coefficient =0.78-0.85) [12], and the PISQ-12 has similarly good reliability (Cronbach's α=0.76-0.83; intraclass correlation coefficient =0.72-0.80) [13] for estimating postoperative sexual quality of life.

Postoperative complications: Postoperative complications were monitored and recorded, including incision infection, bleeding, urinary retention, urinary incontinence, constipation, and dyspareunia. The overall complication rates were computed based on data extracted from the medical and nursing records of patients, as well as follow-up data collected after discharge.

Postoperative recurrence: The assessment of prolapse recurrence was carried out during postoperative outpatient re-examinations and via telephone follow-ups. Recurrence was defined as the reappearance of prolapse at the anterior wall, posterior wall, or vaginal apex, or a POP-Q stage of II or higher. We documented the precise location of recurrence and determined the total recurrence rate. All patients completed a minimum follow-up period of 12 months.

Analysis of risk factors for recurrence: The patients were classified as recurrence and non-recurrence based on their postoperative condition. The treatment method, age, BMI, parity, menopausal status, history of pelvic surgery, mode of delivery, and type of vaginal wall prolapse were the clinical data collected for analysis. Using univariate and multivariate logistic regression analyses, we identified independent factors associated with recurrence.

Evaluation of predictive value: To evaluate their predictive value for postoperative recurrence, receiver operating characteristic curves were constructed for the independent factors that were statistically significant in the multivariate analysis. Next, we determined the predictive ability of each factor by calculating the area under the curve.

Statistical analysis

Statistical analyses were performed using SPSS version 26.0. Data that had a normal distribution are expressed as mean ± standard deviation and were compared across groups using the independent-samples t-test. The results pertaining to categorical variables were presented as numbers and percentages, and intergroup comparisons were performed with the chi-square (χ^2) test. Multivariate logistic regression analysis was employed to identify independent factors associated with recurrence, reported as odds ratios (OR) with 95% confidence intervals. Receiver operating characteristic curve analysis was used to assess the predictive performance of significant independent factors. A *P*-value less than 0.05 was considered significant for all tests.

Results

Comparison of baseline data

The baseline data of both patient groups did not differ significantly with regards to age, BMI, number of pregnancies, menopausal status, history of pelvic surgery, history of vaginal delivery, or type of vaginal wall prolapse (all P>0.05). Details are presented in **Table 1**.

Comparison of perioperative indicators

The TSS group had a shorter operation time, lower intraoperative blood loss, and earlier return of flatus compared to the LSC group (all P<0.05). Details are shown in **Figure 2**.

Comparison of POP-Q component scores before and after surgery

In the LSC group, the preoperative Aa point was (2.04±0.45) cm, and the postoperative Aa point was (-2.48±0.40) cm; in the TSS group, the preoperative Aa point was (1.95±0.57) cm, and the postoperative Aa point was (-2.22±0.48) cm. The postoperative difference in Aa point between the groups was significant (t=5.279, P<0.001). The changes in Ba, C, D, Ap, and Bp points showed the same trend. Details are shown in **Table 2**.

Comparison of quality of life before and after surgery

Preoperatively, the PFDI-20 score in the LSC group was (86.5±12.3) and the PISQ-12 score was (28.4±5.2), while the PFDI-20 score in the TSS group was (87.2±11.8) and the PISQ-12 score was (27.9±5.5) (all P>0.05). Postoperatively, the LSC group demonstrated significantly lower PFDI-20 scores (32.1±8.5) and higher PISQ-12 scores (45.6±6.1) compared to the TSS group (45.8±9.2 and 38.2±5.8, respectively) (all P<0.05). Details are shown in **Figure 3**.

Comparison of postoperative complications

After analyzing the complications in both groups, we observed that only urinary incontinence had a statistically significant difference. The LSC group experienced lower incidence of urinary incontinence compared to the TSS group (P<0.05). Rates of incision infection, postoperative bleeding, urinary retention, constipation, dyspareunia, and overall complications were not significantly different (all P>0.05). Details are shown in **Table 3**.

Comparison of postoperative recurrence

Site-specific recurrence rates (anterior, posterior, and apical vaginal wall prolapse) were not significantly different between the two groups (all P>0.05). The difference in overall recurrence rate between the LSC and TSS groups was found to be significant, with the LSC group exhibiting a lower recurrence rate than the TSS group (P<0.05). Details are shown in **Table 4**.

Univariate analysis of postoperative recurrence

Univariate analysis of the recurrence and non-recurrence groups demonstrated significant differences in treatment method, age, BMI, history of pelvic surgery and type of vaginal wall prolapse (all P<0.05). On the other hand, no significant intergroup differences were found in the number of pregnancies, menopause status, or history of vaginal delivery (all P>0.05). Detailed results are provided in **Table 5**.

Multivariate analysis of postoperative recurrence

Multivariate logistic regression was performed on factors that showed significant differences in univariate analysis. The independent risk factors for recurrence after repair of an anterior posterior wall prolapse include TSS procedure and a history of pelvic surgery. Furthermore, presence of vaginal wall prolapse can also

Table 1. Comparison of baseline data between the LSC and TSS groups

Characteristic	LSC group (n=163)	TSS group (n=158)	χ^2	P
Age (years)			0.459	0.498
<60	58 (35.58)	62 (39.24)		
≥60	105 (64.42)	96 (60.76)		
Body Mass Index (kg/m^2)			0.175	0.676
<24	126 (77.30)	119 (75.32)		
≥24	37 (22.70)	39 (24.68)		
Number of Pregnancies			0.335	0.551
0-1	45 (27.61)	39 (24.68)		
>1	118 (72.38)	119 (75.32)		
Menopause Status			0.311	0.577
Yes	107 (65.74)	99 (62.66)		
No	56 (34.36)	59 (37.34)		
History of Pelvic Surgery			0.628	0.428
Yes	39 (23.93)	32 (20.25)		
No	124 (76.07)	126 (79.75)		
History of Vaginal Delivery			1.464	0.226
Yes	102 (62.58)	109 (68.99)		
No	61 (37.42)	49 (31.01)		
Vaginal Wall Prolapse Type			0.272	0.873
Anterior	83 (50.92)	76 (48.10)		
Posterior	14 (8.59)	15 (9.49)		
Combined Anterior & Posterior	66 (40.49)	67 (42.41)		
ASA Classification			1.135	0.567
I	45 (27.61)	38 (24.05)		
II	98 (60.12)	104 (65.82)		
III	20 (12.27)	16 (10.13)		
POP-Q Stage (Most Severe)			0.347	0.841
II	52 (31.90)	55 (34.81)		
III	98 (60.12)	90 (56.96)		
IV	13 (7.98)	13 (8.23)		
Comorbidities				
Hypertension	39 (23.93)	32 (20.25)	0.628	0.428
Diabetes	21 (12.88)	17 (10.76)	0.347	0.556

Note: Data are presented as n (proportion). ASA: American Society of Anesthesiologists, POP-Q: pelvic organ prolapse quantification, LSC: laparoscopic sacrocolpopexy, TSS: transvaginal sacrospinous ligament suspension.

increase this risk. However, the risk factors were not associated with pelvic organ prolapse. On the contrary, independent protective factors were age <60 years (OR: 0.301, P=0.040) and body mass index <24 kg/m^2 (OR: 0.128, P<0.001). The results are visualized in **Figure 4**.

Discussion

The current study provides a comparative analysis of LSC and TSS for treating moderate-to-severe uterine prolapse with vaginal wall prolapse. Our findings indicate that while TSS offers advantages in shorter operative time and faster early recovery, LSC demonstrates superiority in achieving more optimal anatomical restoration, greater improvement in quality of life, and lower long-term recurrence rates. These findings suggest that for patients who are medically fit for laparoscopic surgery, LSC may offer a more durable repair with enhanced functional outcomes. In contrast, TSS retains advantages in perioperative indicators like op-

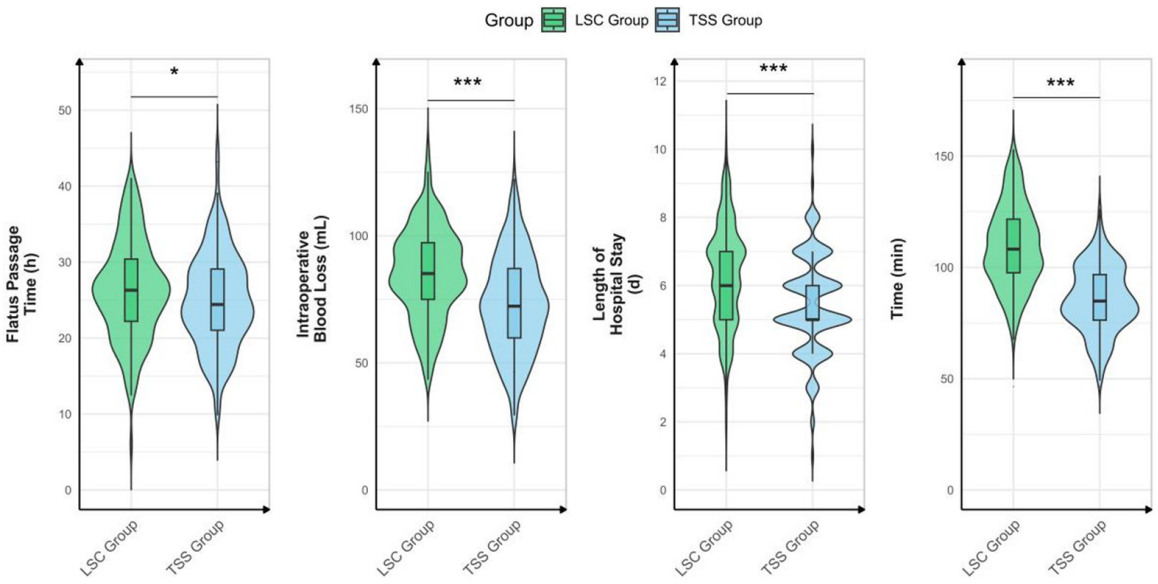

Figure 2. Comparison of perioperative indicators. Note: *P<0.05, ***P<0.001 vs. LSC group. LSC: laparoscopic sacrocolpopexy, TSS: transvaginal sacrospinous ligament suspension.

Table 2. Comparison of POP-Q component scores before and after surgery

POP-Q point	Time point	LSC group (n=163)	TSS group (n=158)	t	P
Aa (cm)	Preoperation	2.04±0.45	1.95±0.57	1.611	0.108
	Postoperation	-2.48±0.40	-2.22±0.48	5.279	<0.001
Ba (cm)	Preoperation	3.85±0.71	3.90±0.80	0.545	0.586
	Postoperation	-2.64±0.53	-2.07±0.59	9.207	<0.001
C (cm)	Preoperation	4.85±1.02	5.04±1.28	1.412	0.159
	Postoperation	-7.18±0.69	-6.23±0.78	11.579	<0.001
D (cm)	Preoperation	2.78±0.92	2.84±0.85	0.570	0.569
	Postoperation	-6.51±0.71	-5.64±0.75	10.692	<0.001
Ap (cm)	Preoperation	1.96±0.56	1.85±0.68	1.684	0.093
	Postoperation	-2.51±0.41	-2.10±0.48	8.440	<0.001
Bp (cm)	Preoperation	3.43±0.85	3.52±0.90	0.855	0.393
	Postoperation	-2.60±0.54	-2.04±0.65	8.433	<0.001

Note: Data are presented as mean ± standard deviation. POP-Q stage: pelvic organ prolapse quantification stage, LSC: laparoscopic sacrocolpopexy, TSS: transvaginal sacrospinous ligament suspension.

erative time and blood loss. These findings offer valuable evidence to inform surgical decision-making for this patient population.

Superior anatomic outcomes, evidenced by significantly better postoperative POP-Q measurements at all points in the LSC group, likely form the foundation for its functional benefits. The central, physiologic suspension to the sacrum in LSC appears to provide more comprehensive support to all vaginal compartments compared to the unilateral, posterolateral fixation in TSS. This is particularly reflected in the greater improvement of anterior compartment points (Aa, Ba) in our LSC cohort, addressing a known limitation of TSS. The variation in outcomes arises from the different surgical principles underlying each method. LSC involves direct suspension of the vaginal apex to the sacral promontory, aiming to restore a central, ligament-like support closely aligned with the physiological vaginal axis [14, 15]. Conversely, TSS attaches the apex to the unilateral sacrospinous ligament, which can result in a pronounced posterior and lateral deviation of the vaginal axis. This displacement may compromise support for the anterior compartment, explaining the comparatively smaller improvement in anterior points observed in the TSS group [16]. As a result, the greater anatomical and symmetric apical support achieved with LSC is the basis for its superior restorative results [17].

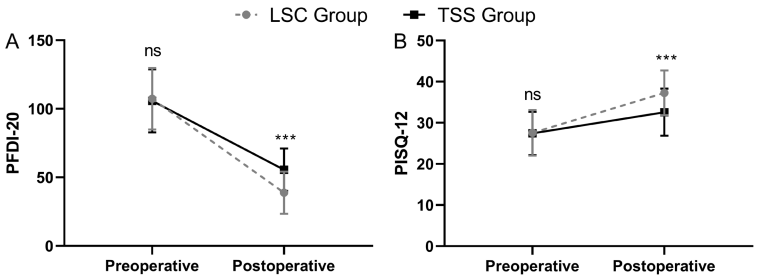

Figure 3. Comparison of quality of life before and after surgery. A. Changes in PFDI-20 before and after treatment. B. Changes in PISQ-12 before and after treatment. Note: LSC: laparoscopic sacrocolpopexy, TSS: transvaginal sacrospinous ligament suspension; PFDI-20: pelvic floor distress inventory-20; PISQ-12: pelvic organ prolapse/urinary incontinence sexual questionnaire-12; ns indicates no significant difference; *** indicates P<0.001 compared to the LSC group.

Table 3. Comparison of postoperative complications

Complication	LSC group (n=163)	TSS group (n=158)	χ^2	P
Incision Infection	2 (1.23)	3 (1.90)	0.236	0.627
Postoperative Bleeding	2 (1.23)	2 (1.27)	1.173	0.279
Urinary Incontinence	3 (1.84)	10 (6.33)	4.160	0.041
Urinary Retention	5 (3.07)	6 (3.80)	0.129	0.719
Constipation	5 (3.07)	4 (2.53)	0.084	0.771
Dyspareunia	1 (0.61)	4 (2.53)	1.925	0.165
Total Complications	19 (11.66)	29 (18.35)	2.830	0.093

Note: Data are presented as n (%). LSC: laparoscopic sacrocolpopexy, TSS: transvaginal sacrospinous ligament suspension.

Table 4. Comparison of postoperative recurrence

Recurrence Type	LSC group (n=163)	TSS group (n=158)	χ^2	P
Anterior vaginal wall prolapse	5 (3.07)	10 (6.33)	1.916	0.166
Posterior vaginal wall prolapse	3 (1.84)	7 (4.43)	1.783	0.182
Apical recurrence	1 (0.61)	4 (2.53)	1.925	0.165
Overall recurrence rate	9 (5.52)	21 (13.29)	5.717	0.017

Note: Data are presented as n (%). LSC: laparoscopic sacrocolpopexy, TSS: transvaginal sacrospinous ligament suspension.

The superior anatomic restoration achieved with LSC translated into significantly greater improvements in patient-reported quality of life, as measured by PFDI-20 and PISQ-12 scores. The pronounced reduction in PFDI-20 scores suggests that LSC is more effective in alleviating a broad range of pelvic floor symptoms. Notably, the higher incidence of postoperative urinary incontinence in the TSS group aligns with concerns about bladder neck and urethral distortion due to the altered vaginal axis, which may partially explain the lesser improvement in urinary and bowel symptoms in this group. The marked reduction in PFDI-20 scores implies that LSC is more effective in relieving symptoms related to lower urinary tract symptoms, bowel function, and pelvic pressure. This is attributed to the restoration of the vaginal axis, which helps maintain the bladder neck and urethra in their normal anatomic positions postoperatively, thereby further reducing complications like voiding dysfunction or stress incontinence [18]. The LSC group had more favorable PISQ-12 scores. Previous research shows that TSS may impair sexual function due to a shortened vagina, axial deviation, and introital stenosis [19]. In contrast, LSC is associated with better vaginal depth and compliance. The improvement in functional outcomes in this context is likely attributable to its anatomic advantages [20]. Overall, our findings support the notion that optimal anatomical reconstruction is an essential prerequisite for functional recovery.

The analysis of complications revealed similar overall incidence rates in both groups, although postoperative urinary incontinence was significantly more common in the TSS group, consistent with previous literature [21]. The alteration of vaginal axis change caused by the TSS technique likely accounts for this difference. The resulting posterior and lateral traction can distort the urethro-vesical angle and increase urethral outlet resistance [22]. Potential injury to pelvic autonomic nerves during surgery may be an additional factor. On the contrary, LSC restores the vaginal axis to a more physiological position while minimizing distortion of the bladder neck and the ure-

Table 5. Univariate analysis of factors associated with postoperative recurrence

Factor	Recurrence (n=30)	No recurrence (n=291)	χ^2	P
Treatment Method			5.717	0.017
LSC	9 (30.00)	154 (52.92)		
TSS	21 (70.00)	137 (47.08)		
Age (years)			8.177	0.004
<60	4 (13.33)	116 (39.86)		
≥60	26 (86.67)	175 (60.14)		
Body Mass Index (kg/m^2)			19.930	<0.001
<24	13 (43.33)	232 (79.73)		
≥24	17 (56.67)	59 (20.27)		
Number of Pregnancies			0.879	0.348
0-1	10 (33.33)	74 (25.43)		
>1	20 (66.67)	217 (74.57)		
Menopausal Status			0.010	0.920
Yes	19 (63.33)	187 (64.26)		
No	11 (36.67)	104 (35.74)		
History of Pelvic Surgery			27.570	<0.001
Yes	18 (60.00)	53 (18.21)		
No	12 (40.00)	238 (81.79)		
History of Vaginal Delivery			2.259	0.137
Yes	16 (53.33)	195 (67.01)		
No	14 (46.67)	96 (32.99)		
Vaginal Wall Prolapse Type			5.637	0.024
Anterior	9 (30.00)	150 (51.55)		
Posterior	3 (10.00)	26 (8.93)		
Combined Anterior & Posterior	18 (60.00)	115 (39.52)		

Note: Data are presented as n (%). LSC: laparoscopic sacrocolpopexy, TSS: transvaginal sacrospinous ligament suspension.

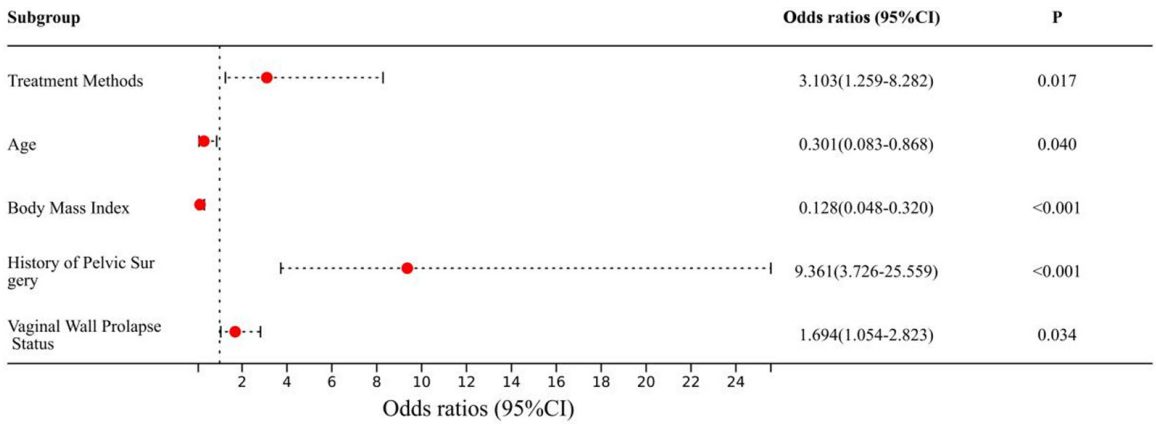

Figure 4. Forest plot of multivariate logistic regression analysis. Reference categories: Procedure: LSC, Age: ≥60 years, BMI: ≥24 kg/m^2, History of pelvic surgery: No, Type of vaginal wall prolapse: Anterior wall prolapse. Note: LSC: laparoscopic sacrocolpopexy, BMI: body mass index, CI, confidence interval.

thra. These results suggest that LSC may be a safer option for patients with a history of voiding dysfunction. When TSS is performed, careful postoperative monitoring and proactive bladder management are strongly recommended.

The recurrence rate following surgery is the most common measure of long-term outcome. The overall recurrence rate for LSC was significantly lower than for TSS according to our results. The reason for the superior durability is mainly attributed to differences in fixation points. LSC secures the graft to the anterior longitudinal ligament of the sacrum, which provides robust mechanical strength and delivers durable apical support capable of effectively resisting chronic increases in intra-abdominal pressure [23]. As a result of a unilateral fixation to the weaker sacrospinous ligament, TSS is more susceptible to long-term complications such as suture elongation or ligament attenuation over time [24, 25]. Therefore, LSC is favored in young patients or those with severe prolapse, in which the primary goal is to maximize long-term anatomic durability.

Multivariate analysis identified the TSS, a history of pelvic surgery, and the presence of combined anterior-posterior wall prolapse as independent predictors of recurrence. Among these, a history of pelvic surgery showed the strongest link to recurrence (OR=9.361). This may be due to factors such as postoperative adhesions, compromised tissue perfusion, and altered anatomical planes, which can limit surgical dissection and impair healing [26]. The failure to address all compromised sites in surgery increases the risk of recurrence, which indicates more generalized pelvic floor dysfunction involving both anterior and posterior compartments. In contrast, patient age under 60 years and a BMI below 24 kg/m^2 were identified as protective factors, likely due to better tissue quality in younger, non-obese individuals. These findings support improved preoperative risk stratification. Patients with previous pelvic surgery or complicated prolapse may derive greater benefit from the strong apical support provided by LSC, though they should be counseled extensively regarding their inherently higher recurrence risk [27, 28].

This study has several limitations that should be acknowledged. First, its retrospective, non-randomized design is susceptible to selection bias. The allocation to LSC or TSS was not randomized and was influenced by several factors, including surgeon preference and experience, as well as patient-related characteristics such as age, comorbidities, anesthetic risk, severity of prolapse and patient choice. For instance, older or higher-risk patients may have been more frequently directed toward the less invasive TSS procedure, but these patients may be more prone to recurrence because of poorer tissue quality. Despite no significant differences in baseline characteristics, residual confounding related to these non-random assignments may persist. Moreover, this investigation was conducted at a single center with a limited sample size. Followup was limited to 12 months, which is insufficient to assess the true long-term durability of the surgeries. To achieve a higher level of evidence, larger, prospective, multicenter randomized controlled trials with extended follow-up are needed.

It can be concluded that, for patients with moderate-to-severe uterine prolapse and vaginal wall prolapse who are medically suitable for treatment, LSC is more effective than TSS in achieving pelvic floor anatomical restoration, improving quality of life, and reducing recurrence. TSS remains a safe alternative for patients who are not candidates for laparoscopic surgery, with both procedures demonstrating comparable safety profiles.

Disclosure of conflict of interest

None.

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