Indian Journal of Surgery
https://doi.org/10.1007/s12262-023-04003-8

ORIGINAL ARTICLE

Laparoscopic Sacrocolpopexy Versus Transvaginal Mesh Pelvic Floor Reconstruction Surgery for Treatment of Pelvic Organ Prolapse

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Received: 24 August 2023 / Accepted: 21 December 2023

Abstract

The study aims to compare the objective and subjective outcomes of laparoscopic sacrocolpopexy (LSC) and transvaginal mesh (TVM) surgery. A retrospective study of 62 women with pelvic organ prolapse stage III and IV among patients who underwent LSC ($N=30$) and TVM ($N=32$). The pelvic floor quality of life questionnaires (PFDI-20, PFIQ-7, PISQ-12) and the pelvic organ prolapse quantification (POP-Q) were used to assess the subjective and objective outcomes, respectively. The intraoperative details and long-term surgery complications were assessed as well. The patients were reviewed after the operation for a gynecological examination, treatment, and functional outcomes evaluation. Compared to preoperative POP-Q measurement, except for PB and TVL, the postoperative objective outcomes improved significantly for the two groups ($P<0.05$). The postoperative mean for PB increased significantly in the TVM group than in the LSC group, 2.75 ± 0.49 Vs 2.45 ± 0.68, ($P=0.04$), and the postoperative mean for point C was more improved in LSC than in the TVM group, (-5.68 ± 2.76 Vs -5.59 ± 2.07), respectively. The PFDI-20 questionnaire shows that the post-operative subjective outcomes were significantly improved compared to preoperative status in LSC and TVM ($P<0.05$), except CRADI-8 questionnaire for LSC ($P=0.4$). The PFIQ-7 improved significantly in TVM ($P<0.05$), except CRAIQ-7 ($P=0.5$). However, there were no statistically significant in the LSC group ($P>0.05$). Patients who went for the LSC procedure had a longer operation time and greater blood loss than TVM. The TVM surgery offered a higher patient satisfaction for colorectal-anal symptoms than LSC. The patients who underwent LSC had a more extended operating time and greater blood loss, while those who underwent TVM had a higher rate of dyspareunia.

Keywords Laparoscopic sacrocolpopexy · Pelvic organ prolapse · Transvaginal mesh

Introduction

Due to connective tissue fragility, pelvic organ prolapse is an unusual falling of the pelvic organs from their normal position into the vagina or beyond, which aggravates while getting older [1]. In view, the fact that this disease can deteriorate the patient's life quality made it a veritable public health issue. Transvaginal mesh repair has shown satisfactory success in the anatomic outcome [2]. Nevertheless, the use of mesh vaginally is debated due to mesh-related complications; resulting in the US FDA's (American Food and Drug Administration) warnings [3], which stated that only selected patients after counseling need vaginal mesh by trained surgeons [4].

The standard procedure for treating vault prolapse, with a low risk of recurrence and dyspareunia, is abdominal sacrocolpopexy (ASC), according to a meta-analysis of clinical studies, PubMed, MEDLINE, and PubMed [5] and mesh erosion, but holds a long operative time and a long recovery time [6]. These shortcomings are often offset by laparoscopic and robotic-assisted sacrocolpopexy (LSC) procedures. Also, the laparoscopic technique is less invasive and gives a clearer view by magnification than ASC [7]. LSC seems more advantageous in terms of blood loss, post-operating pain, and inpatient days compared to ASC, furthermore, decreasing in operating time and cost than the robotic-assisted sacrocolpopexy [8]. On the other hand, the transvaginal mesh is easily performed by shortening operation time than LSC and ASC [9].

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Published online: 08 January 2024

According to a 2011 randomized trial, LSC performs better during surgery to address vault prolapse than TVM [10]. The utilization of lightweight mesh has shown similar results for both approaches [11]. However, with a higher recurrence rate in the anterior vaginal site for LSC when compared to TVM. Also, TVM had a high recurrence rate in vault prolapse [12]. The debate remains about the choice between the surgery types. The goal of the present research is to evaluate and contrast the treatment outcomes related to laparoscopic sacrocolpopexy (LSC) and transvaginal mesh (TVM) therapy techniques for prolapse of the pelvic organ and compare the therapeutic efficacy of LSC and TVM using Case Series Analysis following Case Report (CARE) guidelines.

Materials and Methods

Participants

This study was a retrospective study based on sixty-two participants who had stage III and IV pelvic organ prolapse (including those without vaginal hysterectomy) underwent LSC ($N=30$) and TVM ($N=32$) surgery in our hospital between April 2019 to May 2022. The follow-up reports for these patients were collected from medical records with the permission of the Institutional Ethical Review Board (No. ZCMU/2019/31/SRT03). All the surgeries have been conducted by two gynecologists. Based on the available statistics from a previous study reporting 85% and 87% objective success rates after LSC and TVM, respectively, the sample size necessary to identify a 5% substantial variance in success rates with an 80% power (alpha = 0.05) was 30 per group in this study of 62 patients.

Inclusion and Exclusion Criteria

The study included patients who had complete follow-up data and had pelvic organ prolapse stage III or IV according to the pelvic organ prolapse quantification (POP-Q) method. Patients requiring vaginal colporrhaphy without mesh, women who had a history of smoking, and patients with recurrent prolapse were excluded from the present research.

Patients Evaluation

Every participant underwent a thorough clinical examination, with a focus on the pelvic exam to detect prolapse. Additionally, they completed the PFDI-20, PFIQ-7, and PISQ-12 short-form pelvic floor quality of life questionnaires for subjective evaluation. UDI-6, CRADI-8 and POPDI-6 make up the PFDI-20. The UIQ-7, CRAIQ-7, and POPIQ-7 are three additional scales included in the PFIQ-7. When subjects complained of urinary problems or had urine leakage during the prolapse evaluation, a urodynamic test was then performed on them**.** Within 14 days after surgery, we performed a follow-up using the POP-Q system for objective outcomes evaluation. To rule out any bulges, mesh exposure, and urine incontinence indicated by the cough test, we performed a pelvic examination. The short-form PFDI-20, PFIQ-7, and PISQ-12 pelvic floor quality of life questionnaires were used to evaluate the subjective results.

Surgical Intervention

Under the general anesthesia induction, we applied skin disinfection; a patient is positioned in the recumbent position with their legs flexed and held up by stirrups. They are then draped in sterile material and given a urinary catheter. Four trocars were initially inserted: one 10 mm at the umbilicus, two parallel 5 mm trocars on the right, and one left at the third of the umbilical-spinous line. The final trocar was positioned 4 cm above the left lateral 5 mm trocar. When required, we also conducted hysterectomies. At the base of the prolapse, we used scissors to cut open the rectovaginal and vesicovaginal spaces (Fig. 1a and b). Therefore, after locating the L5-S1, right ureter, and iliac vein, the promontory dissection began with the incision of the paravertebral peritoneum and the retroperitoneum fat. The anterior longitudinal ligament was therefore made visible. Additionally, the peritoneum was sliced longer medially at the sacral promontory. To do this, we employed a Y-shaped mesh (monofilament, macroporous polypropylene mesh, GYNECARE of the USA and Budd Company of Germany). Then, using two columns of six interrupted sutures, we stitched the mesh's arms at the front and posterior compartments (Fig. 1c and d). The mesh was adjusted tension-free, and a running suture helped the peritoneum close (Fig. 1g and h). Lastly, we fastened the tail of the mesh to the anterior sacral longitudinal ligament using a non-absorbable suture (Fig. 1f). Following 3 months, individuals could begin having sex, and they were advised to use vaginal estrogen cream for at least 6 months following surgery.

Transvaginal Mesh (TVM)

Anterior Pelvic Reconstruction

To perform anterior pelvic reconstruction, the patient is supported by stirrups while lying supine. Following disinfection, sterile wrap, and insertion of a urinary catheter into the bladder, the anterior cervical lip was pulled forward to expose the bulging anterior vaginal wall, under general anesthesia. Using physiological saline, we conducted an anterior longitudinal colpotomy that was guided by a hydro dissection. (Fig. 2a and b) through vesicovaginal fascia to secure the bladder. The bladder was pushed

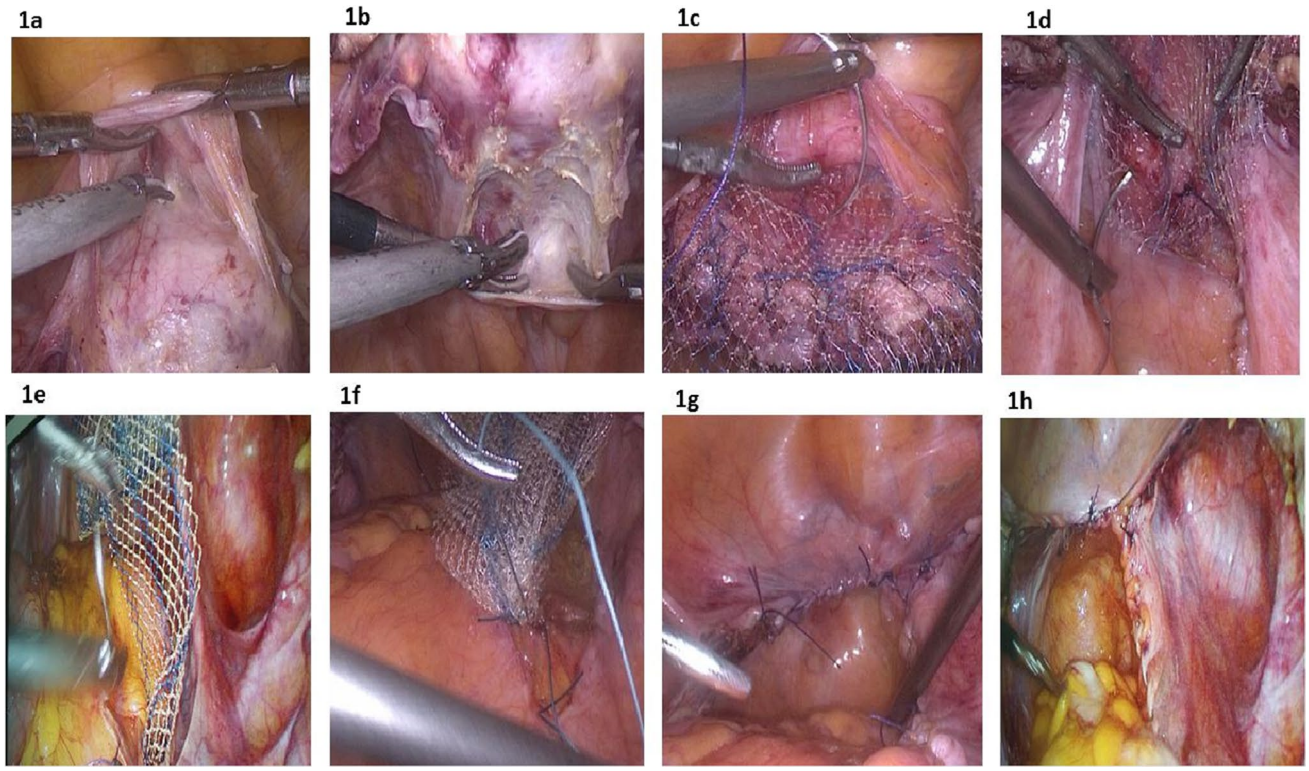

Fig. 1 Illustration of laparoscopic sacrocolpopexy in a 61-year-old, para 2, having stage III apical prolapse and stage III anterior vaginal wall prolapse. POP-Q stage III posterior vaginal wall prolapse. Opening of the vesicovaginal space (Fig. 1a), the opening of the rectovaginal space (Fig. 1b), insertion of the mesh at the anterior compartment (Fig. 1c), the posterior compartment is where the mesh is inserted. (Fig. 1d), suturing of the mesh at the sacral promontory after hysterectomy (Fig. 1e and f). Peritonization of the mesh after mesh insertion (Fig. 1 g and h)

away from the vaginal mucosal membrane before superficial cutaneous incisions (double incisions, each 4 mm). The initial cuts were made at the intersection of the inferior pubic rami and public body on each side and the horizontal line binding the urethral orifice. While the second incisions were at 1 cm sidelong and 2 cm beneath the primary cuts. We introduced a precut monofilament polypropylene mesh made of four twigs (Avaulta Solo, Bard Covington, USA). The trocar passed through the cutaneous entry points to reach the pubovesical space. To secure the bladder, the fingers were inserted into the vagina. On the first incisions, the trocar pointed through the obturator membrane piercing the vagina from the front of the finger and bringing out the distal arm of the graft (Fig. 2c). The trocar was used to introduce the proximal arms of the mesh on the arcus tendinous fascia pelvis (ATFP) on the second incisions, 1 cm from the ischial spine for either side before exiting on the cutaneous incisions (Fig. 2d). The mesh was then adjusted without tension and fixed by a continuous suture with absorbable 2/0 Vicryl. Also, we performed an anterior colporrhaphy (Fig. 2e). Finally, we applied a dressing on the surface incisions (Fig. 2f).

Posterior Pelvic Reconstruction

During posterior pelvic reconstruction, the woman is set in the same position as the one used in the anterior pelvic floor reconstruction. First, we implemented a separation of the rectovaginal space after vaginal mucosa infiltration with normal saline. To expose the vagina, the posterior lip of the cervix was pulled upward with Allis pliers. The vaginal posterior mucosa was dissected longitudinally. The avascular region was then exposed by performing a continuous dissection from the rectovaginal space to the ischial spine and sacrospinous ligaments with the use of a vaginal retractor. Two incisions were applied on the skin under the anus 3 cm underneath and 3 cm lateral. To access the rectovaginal area and bring out the hands of the mesh on the skin incisions beneath the anus, the trocar must cross the

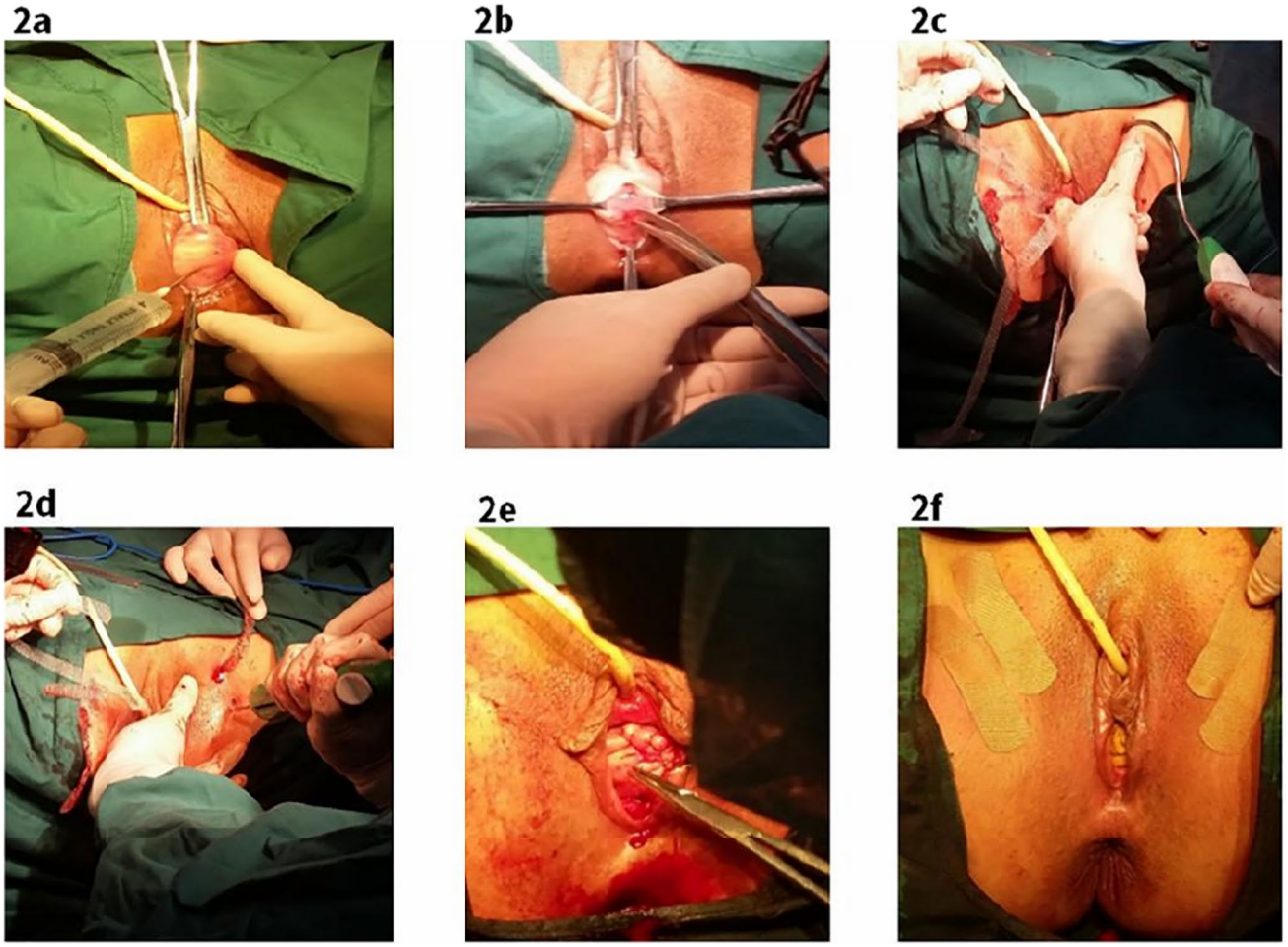

Fig. 2 Illustration of steps of anterior transvaginal mesh in a 56-year-old, para 2, with stage III POP-Q anterior vaginal wall prolapse. To provide access to the exterior urogenital organs, the patient is placed in a lithotomy posture. Hydrodissection with normal saline of the anterior vaginal mucosa (Fig. 2a), anterior colpotomy and vesicovaginal dissection with scissors (Fig. 2b), insertion of the precut mesh Avaulta Solo, Bard Covington USA with the trocar for the lower arms (Fig. 2c) and proximal hand of the graft (Fig. 2d), closure of the vaginal mucosa (Fig. 2e), end of the surgery and wound dressing (Fig. 2f)

sacrospinous ligament at a distance of 2 cm from the ischial spine. After adjustment, the surplus of the mesh was cut off, and we completed a posterior colporrhaphy. Finally, we completed a perineorrhaphy when there was an associated perineal laceration. To avoid vaginal atrophy and mesh-related complications, all participants after surgery were recommended to use estrogen cream for 6 months or more and were advised to attend the hospital for a schedule of follow-ups within 1 year (1, 3, 6 months), then every year. Additionally, where necessary, we conducted a concurrent trans obturator tape (TOT) on patients with incontinence.

Statistics Analysis

The ideal metric for presenting data is the mean, standard deviation, median (range), and percentage. The Wilcoxon rank test was used to compare pre- and post-operative results, and the Mann–Whitney test was utilized to compare results across groups. Nevertheless, if the distribution was normal, simply the Student *t*-test was applied. Then, for categorical data, we employed the chi-square. The odds ratio and associated 95% CI were examined using the binary logistic regression. The $P < 0.05$ threshold was utilized to determine statistical significance when using IBM SPSS statistics version 21.

Results

Patients Baseline Characteristics

The baseline features of the patient across LSC and TVM are shown in Table 1. The TVM group's participants were older than the LSC category ($P = 0.001$). However, there

Table 1 The baseline features of the patient across LSC and TVM

	LSC (30)		TVM (32)		
Demographics	Value	Range	Value	Range	*P* value
Age (year)	53.74 ± 8.52	(39–73)	59.93 ± 7.14	(45–80)	0.001[a]
Gravidity	2.77 ± 1.4	(1–7)	3.09 ± 1.47	(1–6)	0.3[b]
BMI	24.7 ± 2.47	(19.4–28.7)	24.8 ± 3.65	(19.5–35.4)	0.6[a]
Parity	1	(1–5)	1	(1–5)	0.6[b]
Contraception	13.3	(4/30)	3.1	(1/32)	0.3[b]
Perineal laceration during vaginal delivery	10	(3/30)	3.1	(1/32)	0.5[d]
Chronic pulmonary disease	0	(0/30)	3.1	(1/32)	> 0.99[f]
Constipation	6.7	(2/30)	0	(0/32)	0.2[e]
Menopause	60	(18/30)	68.8	(22/32)	0.6[d]
Employment					
Retired	56.7	(17/30)	56.3	(18/32)	0.1[b]
Home duties	16.7	(5/30)	34.4	(11/32)	
Bureaucrat	16	(5/30)	9.4	(3/32)	
Farmer	10	(3/30)	0	(0/32)	
Literacy (secondary school)	100	(30/30)	96.9	(31/32)	> 0.99[e]
Marital status (married)	100	(30/30)	100	(32/32)	
Associated diagnostics					
Leiomyoma	30	(9/30)	34.4	(11/32)	0.9[d]
Diabetes	3.3	(1/30)	6.3	(2/32)	> 0.99[d]
Hypertension	20	(6/30)	18	(6/32)	> 0.99[d]
Previous operations					
Appendicectomy	13.3	(4/30)	12.5	(4/32)	> 0.99[d]
Hysterectomy	13.3	(4/30)	6.3	(2/32)	0.6[c]
Hemorrhoidectomy	3.3	(1/30)	0	(0/32)	0.4[d]
[a]Student *t*-test					
[b]Mann–Whitney *U*-test					
[c]Pearson chi-square					
[d]Continuity correlation					
[e]Fisher exact					
	LSC		TVM		*P* value
	N		*N*		
Urodynamic result					
QMax (ml/s)	30	18(0.7–50)	22	18(3–50)	0.7[b]
Pdet Max (cmH2O)	30	71(1–152)	22	103(27–229)	> 0.99[b]
Bladder capacity(ml)	30	384 ± 123	22	486 ± 103	0.2[a]
VLPP(cmH2O)	12	97(49–214)	15	93(62–178)	0.7[b]
PVR(cm)	30	31(5–135)	22	65(5–200)	0.05[b]
Urodynamic diagnosis					
USI	57%	(17/30)	55%	(12/22)	0.8[f]
Urine retention	27%	(8/30)	46%	(10/22)	0.1[f]
LUTO	33%	(10/30)	43%	(11/22)	0.1[f]
Overactive bladder	7%	(2/30)	18%	(4/22)	0.3[d]
Bladder a contractile	10%	(3/30)	4.50%	(1/22)	0.8[d]
Bladder hypersensitive	17%	(2/30)	27%	(7/22)	0.2[d]

Table 1 (continued)

Demographics	LSC (30)		TVM (32)		
	Value	Range	Value	Range	*P* value

LUTO lower urine tract obstruction, *USI* urodynamic stress incontinence, *Qmax* maximum flow rate, *Pdet Max* maximum detrusor pressure, *VLPP* Valsalva leak point pressure, *PVR* post-voiding residual

[a]Student *t*-test

[b]Mann Whitney *U*

[c]Wilcoxon signed-ranks test

[d]Continuity correlation

[e]Fisher exact test

[f]Person chi-square

were no substantial differences in parity, gravidity, BMI, chronic constipation, chronic coughing, employment, previous surgery, sexual life, educational level, marital status, and associated diseases between the two kinds of surgery.

Multifocal Urodynamic Analysis Before Surgery

Preoperative maximal detrusor pressure and maximum flow rate were not significantly different. Comparing the two groups, Valsalva leak point pressures, post-voiding residuals, and urodynamic diagnoses (Table 1) provide the specifics.

Comparison of Objective Outcomes

Table 2 shows the objective outcomes comparison of POP-Q scores. First, before-after surgery for LSC and TVM. Then, before surgery between LSC and TVM. Last, after surgery between LSC and TVM. The objective outcomes improved significantly postoperatively compared with pre-operative status in LSC and TVM groups, ($P < 0.05$). However, no significant improvements were detected for PB and TVL after surgery compared with preoperative status in both groups. The preoperative mean for point C was greater in the LSC group (2.83 SD2.58 versus 0.53 SD3.88) compared with TVM ($P = 0.01$). Similarly, the postoperative mean for point C improved more in the LSC group compared with TVM (− 5.68 SD2.76 versus − 5.59 SD2.07). However, $P = 0.09$ does not indicate statistical significance. When compared to LSC, the TVM category's postoperative mean for PB was superior ($P = 0.04$).

Comparison of Subjective Outcomes

Table 2 shows the comparison of subjective outcomes between treatments. First, before-after surgery for LSC and TVM. Then, before surgery between LSC and TVM. Last, after surgery between LSC and TVM. The total scores of the PFDI-20 questionnaire were significantly better preoperatively for both LSC and TVM ($P < 0.05$). However, the total scores of CRADI-8 were not statistically different before and after LSC ($P = 0.40$). The PFIQ-7 score improved significantly postoperatively in TVM ($P < 0.05$), excluding CRAIQ-7 ($P = 0.50$). The PFIQ-7 score was improved but remained statistically insignificant for the LSC group. Moreover, PISQ-12, PFDI-20, and PFIQ-7 scores were improved postoperatively for both surgeries; however, no statistical differences were observed among the two categories pre- and post-operatively ($P > 0.05$).

Comparison of LSC, TVM's Intraoperative Information, and Postoperative Complications

Table 3 depicts the perioperative details. Their description is as follows: First, the operation time started from the skinning knife to the skin suture. Second, the blood loss was evaluated by the anesthetist. Third, the vesical catheterization is set as the day's indwelling catheter. Fourth, inpatient days are the number of nights stayed in the hospital and the postoperative complications such as mesh extrusion and dyspareunia. In 20 SD12 months mean follow-up, the median (min–max) operation time was 177 min [50–350] and 77 min [15–220] for LSC and TVM, respectively. LSC surgery's time was extended than TVM ($P < 0.001$). The median (min–max) estimated bleeding was 50 ml [20–150] versus 50 ml [5–200] for LSC and TVM, respectively, ($P = 0.02$). Additionally, the percentage of hysterectomy was superior in the LSC group than in TVM ($P = 0.005$). The postoperative results showed that the difficulty of sexual intercourse in the TVM group was greater than that in the LSC group [14.8% (4/27) versus 7.1% (2/28), ($P = 0.6$)]. However, surgery complications were not dissimilar postoperatively among the two groups. Importantly, pelvic pain, granuloma, and vaginal infection were the only incident in the TVM group.

Discussion

The finding of this investigation regarding the comparison of the treatment outcomes demonstrated that LSC and TVM have a similar success rate, consistent with the

Table 2 Objective outcomes were assessed with POP-Q after LSC and TVM. Subjective results comparing patients who underwent LSC or TVM surgery using the PFDI-20, PFIQ-7, and PISQ-12 scores

	LSC ($N=30$)			TVM ($N=32$)				
POP-Q	Preop	Postop	*P* value[b]	Preop	Postop	*P* value[b]	*P* between pre-groups[c]	*P* between post-groups[c]
Aa	0.43 ± 1.94	− 2.40 ± 1.3	< 0.001[a]	1.00 ± 1.65	2.6 ± 0.56	< 0.001	0.1	0.8
Bb	2.98 ± 1.97	− 2.54 ± 0.56	< 0.001	2.92 ± 1.97	− 2.53 ± 0.57	< 0.001	0.8	0.8
C	2.83 ± 2.59	− 5.68 ± 2.76	< 0.001	0.53 ± 3.88	− 5.59 ± 2.07	< 0.001	0.01	0.09
Ap	− 1.73 ± 1.85	− 2.60 ± 2.13	0.01	− 1.61 ± 1.6	− 2.78 ± 0.49	< 0.001	0.5	0.8
Bp	− 0.37 ± 2.54	− 2.50 ± 1.96	0.001	− 0.67 ± 2.4	− 2.69 ± 0.59	< 0.001	0.7	0.7
GH	4.47 ± 1.04	3.75 ± 1.13	0.001	4.13 ± 0.98	3.45 ± 0.68	0.001	0.2	0.3
PB	2.46 ± 1.41	2.45 ± 0.68	0.9	2.56 ± 0.76	2.75 ± 0.49	0.2	0.9	0.04
TVL	6.40 ± 0.62	6.52 ± 0.91	0.8	6.34 ± 0.70	6.44 ± 0.67	0.5	0.7	0.9

Preop preoperative, *Postop* postoperative, *P between pre-groups P* value between preoperative groups, *P between post-group P* value between postoperative groups

[a]Student *t*-test

[b]Wilcoxon signed-rank test

[c]Mann–Whitney test

	LSC ($N=30$)			TVM ($N=32$)				
	Preop	Postop	*P* value[b]	Preop	Postop	*P* value[b]	*P* between pre-groups[c]	*P* between post-groups[c]
PFDI-20	72.43 ± 45.96	41.18 ± 36.30	< 0.001[a]	84.59 ± 64.10	47.18 ± 57.64	< 0.001	0.7	0.7
POPDI-6	35.97 ± 25.48	13.88 ± 13.59	< 0.001	34.63 ± 25.29	15.36 ± 33.50	< 0.001	0.7	0.3
UDI-6	26.25 ± 21.25	18.89 ± 16.37	0.01	36.77 ± 36.49	23.71 ± 23.47	0.02	0.4	0.8
CRADI-8	10.20 ± 11.74	8.85 ± 8.01	0.4	13.18 ± 16.88	8.10 ± 11.82	0.03	0.7	0.7
PFIQ-7	29.20 ± 42.32	16.19 ± 33.62	0.2	28.55 ± 53.19	12.19 ± 28.75	0.03	0.8	0.5
UIQ-7	15.23 ± 27.80	5.23 ± 17.25	0.1	9.22 ± 19.96	2.37 ± 7.25	0.01	0.8	0.6
CRAIQ-7	4.44 ± 10.46	3.96 ± 12.88	0.6	7.28 ± 18.00	5.95 ± 16.35	0.5	0.7	0.7
POPIQ-7	9.52 ± 16.77	6.98 ± 17.32	0.3	11.15 ± 20.03	3.86 ± 12.28	0.006	0.4	0.4
PISQ-12	14.70 ± 4.85	13.81 ± 4.16	0.1	14.04 ± 4.34	13.41 ± 3.85	0.3	0.5	0.9

Preop preoperative, *Postop* postoperative, *P between pre-groups P* value between preoperative groups, *P between post groups P* value between postoperative groups. *PFDI-20* pelvic floor distress inventory, *POPDI-6* pelvic organ prolapses distress inventory, *UDI-6* urinary destress inventory, *CRADI-8* colo-rectal destress inventory, *POPIQ-7* pelvic organ prolapses impact questionnaire, *UIQ-7* Urinary impact questionnaire, *CRAIQ-7* Colo-rectal-anal impact questionnaire, *POPIQ-7* pelvic organ prolapses impact questionnaire, *PISQ-12* pelvic organ prolapse urinary incontinence sexually questionnaire

[a]Student *t*-test

[b]Wilcoxon signed-ranked test

[c]Mann–Whitney test

POP-Q points Aa, Ba, C, Ap, & Bp -1 (POP-Q stage 0 or stage 1) were used to define the success rate. ($P=0{,}624$; $OR=1.487$; 95% $CI=0.304$–7.277) The overall success rate for the LSC category was 86.7% (26/30) and 90.6% (29/32) for TVM

preceding results [13]. There was a significant advancement in objective outcomes post-operatively compared with pre-operative status in both LSC and TVM. Also, preceding studies demonstrated that objective outcomes were improved following LSC and TVM procedures [14]. In this study, however, there were no significant improvements for PB and TVL after operation compared with preoperative status in both groups. In comparison to the LSC category, the postoperative mean for PB was higher in the TVM category. Point C in the earlier experiments was significantly higher in the LSC category than in the TVM category [15]. In the current research, however, point C improved but not significantly; the reason could be explained by the preoperative mean for point C which was greater in LSC than it was in the TVM group. Moreover, the concomitantly increased number of hysterectomies performed in LSC outcome. In the literature, the treatment success proportion of LSC ranges between 75 and 100% [16–20], and for TVM between 75 and 100% [21–23]. Thus, our objective success rates of 86.7% for LSC and 90.6% for TVM show proper adherence to the standard surgical protocol. The recurrence rate for LSC and TVM was 13.3% (4/30) and 9.4% (3/32), respectively, consistent with the previous reports [24]. In our study, in the LSC group over the four relapses, two patients had a recurrence in all compartments. One of the patients did not follow the follow-up plan due to a severe

Table 3 Comparative information on the intraoperative process and postoperative issues among patients who had LSC and TVM procedures

	LSC ($N=30$)	TVM ($N=32$)	
	Value [min, max]	Value [min, max]	*P* value
Intraoperative details			
Median operative time (min)	177 [50–350]	77 [15–220]	<0.001[b]
Median blood loss (ml)	50 [20–150]	50 [5–200]	0.02[b]
Median catheterization (day)	1 [1, 2]	1 [1–4]	0.2[b]
Median in-patient stay (day)	6 [4–9]	5 [3–10]	0.1[b]
Concomitant surgery			
TOT	57 (17/30)	41(13/32)	0.1[e]
Hysterectomy	92.3 (24/26)	60 (18/30)	0.005[e]
Postoperative complications			
Mesh extrusion	10 (3/30)	6.3 (2/32)	0.9[d]
Dyspareunia	7.1 (2/28)	14.8 (4/27)	0.6[d]
Vaginal infection	0 (0/30)	6.3 (2/32)	0.4[e]
Pelvic pain	3.3(1/30)	9.4 (3/32)	0.6[d]
Granulation tissue	0 (0/30)	3.1 (1/32)	>0.99[d]
De novo incontinence	16.7(5/30)	12.5(4/32)	0.9[d]
De novo urgency	6.7(2/30)	15.6(5/32)	0.4[d]
De novo OAB	6.7(2/30)	13.8(4/32)	0.6[d]
Relapse	13.5(4/30)	9.4(3/32)	0.9[d]

OAB overactive bladder, *TOT* transobturator tape

[a]Student *t*-test

[b]Mann–Whitney *U* test

[c]Wilcoxon signed-rank test

[d]Continuity correlation

[e]Fisher's exact test

cough after surgery. Thus, she experienced a recurrence. The third participant of the LSC group recurred only in the anterior compartment, and the last recurred in the posterior compartment. In the TVM group, of the three patients who had a recurrence, each of them had relapses only in one compartment, either anterior, posterior, or central.

All three domains of PFDI-20 were statistically significant after TVM surgery. Importantly, the patients who reported colorectal-anal distress symptoms as per the assessment with the CRADI-8 questionnaire were not satisfied significantly after the LSC procedure. Also, another study has revealed that bowel function was not significantly improved after LSC surgery [25, 26]. The pelvic floor impact scores assessed with the PFIQ-7 questionnaire were improved significantly postoperatively in TVM, except for CRAIQ-7. Controversy, in the LSC group the PFIQ-7 was not statically significant. The postoperative means for the PFDI-20 and PFIQ-7 questionnaires, nevertheless, did not statistically vary between the two categories. These findings back up the ones that have already been reported. [27]. Likewise, a randomized trial conducted in 2011 did not find any distinction among the groups in bowel and bladder symptoms [28]. The sexual life did not enhance significantly, based on the PISQ-12. These results are following the preceding investigations [29]. A prospective study conducted in 2011 reported that bowel and sexual symptoms were not improved significantly after the operation in the category of LSC [30].

In the current research, patients who underwent the LSC procedure experimented with a longer surgery time and had a greater amount of bleeding than TVM. Furthermore, compared to the TVM category, the LSC category had a greater percentage of hysterectomies. The surgery's complications among the groups were not different. In the present study, we did not observe mesh erosion, which is in similarity to the previous studies [31]. However, the proportions of mesh extrusion remained at 6.3% in the TVM category and 10% (3/30) in the LSC category. This rate of mesh extrusion is close to the previous studies [32]. We treated mesh extrusion and dyspareunia conservatively and successfully with vaginal topic estrogen. Mesh extrusion and the rate of dyspareunia were not different across the groups in our research. which supports previous findings [33]. The greater frequency of concurrent hysterectomies might be the cause of the increased bleeding and mesh extrusion in LSC [34]. Our high success rate in the transvaginal mesh is related to the strategy that we used to avoid complications as reported previously [35].

The fact that two experienced gynecologists carried out every procedure makes the current study strong. Also, this study utilized standard and reliable questionnaires to gather data. The non-randomization, limited sample size, and different follow-up periods ranging from 6 to 42 months are only a few of the study's drawbacks. Also, the study did not include postoperative information on the urodynamic study. It is advised that randomized trials with sizable sample numbers and extensive follow-up be conducted.

Conclusions

In 20 ± 12 months of mean follow-up, LSC and TVM had a similar objective success rate. LSC and TVM are effective for the treatment of POP. LSC is suitable for apical compartment repair, whereas TVM is suitable for perineal body reconstruction. Patients who underwent LSC had a more extended time of operation and a greater amount of bleeding, while those who underwent TVM had a greater percentage of dyspareunia.

Data Availability The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics Approval This study was a retrospective study and hence Institutional Review Board (IRB) of The First Affiliated Hospital of Zhejiang Chinese Medical University (Zhejiang Provincial Hospital of Chinese Medicine), Hangzhou, Zhejiang, China provided permission (No. ZCMU/2019/31/SRT03) to collect the patient's details from the medical record room. Under the ethical approval, institutional IRB agreed and permitted that patient consent was not required for a retrospective study.

Conflict of Interest All authors hereby provide the following disclosures in accordance with the ICMJE uniform disclosure form:
Payment/services info: This study was supported by the Basic Public Welfare Research Program Project of Zhejiang Province (NO: LGF19H040012).
Financial relationships: Every author has acknowledged that they have no financial ties to any companies that could be interested in the submitted work, either now or within the last three years.
Other relationships: The submitted work has not been impacted by any outside relationships or activities, according to all authors.

References

1. Yasutoshi Y, Tomoka O, Shiho O et al (2023) Pelvic reconstruction in abdominal trachelectomy and bilateral salpingo-oophorectomy for occult uterine endometrial cancer found in specimens removed in the context of laparoscopic sacrocolpopexy. Hinyokika Kiyo 69(4):117–120
2. Saeed A, Jawaher A (2023) Al Baalharith Maha, Outcomes of pregnancy and recurrence of pelvic organ prolapse after laparoscopic sacrocolpopexy with uterine preservation: a retrospective case-series study. Cureus 15:e37874
3. Hirotaka S, Shota O, Hirokazu A et al (2023) Medium-term risk of recurrent pelvic organ prolapse within 2-year follow-up after laparoscopic sacrocolpopexy. Gynecol Minim Invasive Ther 12:38–43
4. Burak K, Barış M, Ceyda K et al (2023) McCall culdoplasty vs. vaginally assisted laparoscopic sacrocolpopexy in the treatment of advanced uterine prolapse: a randomized controlled study. Taiwan J Obstet Gynecol 62(2):325–329
5. Bernard N, Zdenek R, Wael A et al (2023) Impact of laparoscopic sacrocolpopexy (LSC) on sexual function in women with advanced stages of pelvic organ prolapse (POP): A five-year prospective study[J]. Eur J Obstet Gynecol Reprod Biol 284:12–15
6. El Haraki AS, Shepherd Jonathan P, Candace PA et al (2023) Financial analysis of minimally invasive sacrocolpopexy compared with native tissue vaginal repair with concomitant hysterectomy. Int Urogynecol J 34(5):1121–1126
7. Ann-Sophie P, Laura C, Stefaan P et al (2023) Long-term data on graft-related complications after sacrocolpopexy with lightweight compared with heavier-weight Mesh. Obstet Gynecol 141(1):189–198
8. Yaman D, Markus S, Joscha S et al (2023) Three-dimensional vs two-dimensional endoscopic approach in urogynecology: a retrospective cohort study of laparoscopic sacrocolpopexy. J Obstet Gynaecol Res 49(3):1028–1035
9. Gurayah Aaron A, Mason Matthew M, Grewal Meghan R et al (2023) Racial and socioeconomic disparities in cost and postoperative complications following sacrocolpopexy in a US National Inpatient Database. World J Urol 41(1):189–196
10. Tuo D, Wang Su, Xuezao L et al (2022) Medium- to long-term outcomes of vaginally assisted laparoscopic sacrocolpopexy in the treatment of stage III-IV pelvic organ prolapse. BMC Womens Health 22(1):503
11. Yin CJC, Hung YC, Wa GW (2023) Clinical outcomes and complications of laparoscopic sacrocolpopexy with versus without concomitant hysterectomy for pelvic organ prolapse in Hong Kong Chinese patients after median follow-up of 7 years. Int Urogynecol J 34(1):271–278
12. Winget Veronica L, Gabra Martina G, Addis Ilana B et al (2022) Laparoscopic pectopexy for patients with intraabdominal adhesions, lumbar spinal procedures, and other contraindications to sacrocolpopexy: a case series[J]. AJOG Glob Rep 2(2):100034
13. Woodburn Katherine L, Bradley Sarah E, Ward Sarah A et al (2023) Assessing the impact of vaginal hysterectomy with vaginal mesh attachment on outcomes and complications during minimally invasive sacrocolpopexy. J Minim Invasive Gynecol 30(1):25–31
14 Daisuke S, Akira O, Hideo Y (2023) Postoperative adverse events and re-treatment among patients who have undergone laparoscopic and robotic sacrocolpopexy for pelvic organ prolapse in Japan. Int J Gynaecol Obstet 161(1):114–119
15 Rathigashini R, Wanniarachchi WADP, De Silva A et al (2022) (2022) Recurrent vaginal vault dehiscence and evisceration following total laparoscopic hysterectomy, successfully repaired with polypropylene mesh and sacrocolpopexy[J]. J Surg Case Rep 9:rjac453
16. Hirotaka S, Shota O, Hirokazu A et al (2022) Medium-term outcomes 2 years after laparoscopic sacrocolpopexy: a retrospective cohort study in Japan[J]. J Obstet Gynaecol 42:3336–3341
17 Bousouni E, Sarlos D (2023) Lateral extension and attachment of mesh to the lateral vagina during laparoscopic sacrocolpopexy: a modified technique aimed at lowering recurrences in the anterior vaginal compartment surgical video. Int Urogynecol J 34(1):305–308
18. Nabila N, Dina B, Florian-Rodriguez Marian E et al (2022) Comparing minimally invasive sacrocolpopexy with vaginal

uterosacral ligament suspension: a multicenter retrospective cohort study through the fellows' pelvic research network. Urogynecology 28(10):687–694
19. Kim Edward K, Hong Christopher X, Harvie HS (2022) Trends in same-day discharge rate after minimally invasive sacrocolpopexy and propensity score-matched analysis of postoperative complication rates using the National Surgical Quality Improvement Program Database[J]. Female Pelvic Med Reconstr Surg 28(3):e22–e28
20. Chang Olivia H, Shepherd Jonathan P, Brad SM et al (2022) Surgical correction of the genital hiatus at the time of sacrocolpopexy-are concurrent posterior repairs cost-effective. Female Pelvic Med Reconstr Surg 28(5):325–331
21. Valeria T, Chiara T, Federico R et al (2022) Laparoscopic sacrocolpopexy versus pelvic organ prolapse suspension for surgical management of pelvic organ prolapse: a retrospective study. J Obstet Gynaecol 42:2075–2081
22. Andiman Sarah E, Bui Anthony H, Charles AW et al (2022) Surgical complications and hospital costs in robot-assisted versus conventional laparoscopic hysterectomy with concurrent sacrocolpopexy: analysis of the Nationwide Readmissions Database. Female Pelvic Med Reconstr Surg 28(5):142–148
23. Ohad G, Zdenek R, Ehud G et al (2022) Effect of age on complications rate and surgical outcomes in women undergoing laparoscopic sacrohysteropexy and sacrocolpopexy. J Minim Invasive Gynecol 29(6):753–758
24. Simone A, Ivo F, Janine F et al (2022) Impact of sacrocolpopexy for the management of pelvic organ prolapse on voiding dysfunction and uroflowmetry parameters: a prospective cohort study. Arch Gynecol Obstet 306:1373–1380
25. Kai D, Lior T, Paige K et al (2022) Supracervical hysterectomy is protective against mesh complications after minimally invasive abdominal sacrocolpopexy: a population-based cohort study of 12,189 patients. J Urol 207(3):669–676
26. Andrea J, Hussein W, Annliz M et al (2021) Comparison of trendelenburg angles in vaginal, laparoscopic, and robotic uterovaginal apical prolapse repairs. J Minim Invasive Gynecol 28(11):1868–1875
27. Shashank S, Shuchita G, Manu G et al (2021) Medium-term anatomical and functional results of isolated laparoscopic sacrocolpopexy for female pelvic organ prolapse during the early learning curve. J Obstet Gynaecol India 71(1):91–94
28. Chia-Lun C, Chun-Hua C, Shang-Jen C (2022) Comparing the outcomes and effectiveness of robotic-assisted sacrocolpopexy and laparoscopic sacrocolpopexy in the treatment of pelvic organ prolapse. Int Urogynecol J 33:297–308
29. Oluwateniola B, Tsung M, Deepanjana D et al (2022) Perioperative outcomes of laparoscopic sacrocolpopexy with and without hysterectomy: a secondary analysis of the National Surgical Quality Improvement Program Database. Int Urogynecol J 33:1889–1895
30. AjaoMobolaji O, Xiangmei Gu, Neeraj K et al (2021) Peri- and postoperative outcomes of outpatient vs inpatient laparoscopic apical prolapse repair[J]. J Minim Invasive Gynecol 28(8):1508–1513
31. Daniela U, Oliver P, Vesna B-R et al (2021) The Austrian Sacrocolpopexy Registry: surgical techniques, perioperative safety, and complications. J Minim Invasive Gynecol 28(4):909–912
32 Valeria T, Stefania R, Chiara T et al (2021) Comparison of absorbable and permanent sutures for laparoscopic sacrocervicopexy: a randomized controlled trial. Acta Obstet Gynecol Scand 100:347–352
33. Kumiko K, Yasukuni Y, Masahiro N et al (2020) "Central Road" cystoscopic finding: the road to worsened incontinence following laparoscopic sacrocolpopexy. IJU Case Rep 3(5):204–206
34. Michael Heit, Carpenter Janet S, Chen Chen X et al (2021) Operationalizing postdischarge recovery from laparoscopic sacrocolpopexy for the preoperative consultative visit. Female Pelvic Med Reconstr Surg 27(7):427–431
35. Chang Olivia H, Ferrando CA (2021) Occult uterine malignancy at the time of sacrocolpopexy in the context of the safety communication on power morcellation by the FDA. J Minim Invasive Gynecol 28(4):788–793