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# Bilateral Sacrospinous Hysteropexy Versus Bilateral Sacrospinous Ligament Fixation With Vaginal Hysterectomy for Apical Uterovaginal Prolapse

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**Purpose:** The aim of this retrospective study was to compare the anatomical and functional outcomes between bilateral sacrospinous hysteropexy (BSHP) and bilateral sacrospinous ligament fixation with vaginal hysterectomy (BSLF/VH) in women with apical-predominant uterovaginal prolapse.

**Methods:** Clinical data from patients with symptomatic Pelvic Organ Prolapse-Quantification (POP-Q) stage 2 or higher uterovaginal prolapse who underwent either BSHP (48 patients) or BSLF/VH (69 patients) between January 2014 and December 2018 were reviewed retrospectively. The primary outcome was the subjective satisfaction rate evaluated by Patient Global Impression of Improvement, and the secondary outcomes included objective anatomical success rates, impact on disease-specific quality of life evaluated by the Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire-12, Pelvic Floor Distress Inventory-Short Form 20, and Pelvic Floor Impact Questionnaire 7, and surgical complications.

**Results:** After a median follow-up of 35 months (range, 25–58 months), all patients in both groups demonstrated significant postoperative improvements in anatomical and functional outcomes ($P < 0.001$). There were no significant differences in postoperative subjective and objective results, sexual satisfaction outcomes, or disease-specific quality of life between the BSHP and BSLF/VH groups, and similar incidence rates of intraoperative and postoperative complications were also recorded.

**Conclusions:** The uterus-sparing BSHP procedure yielded noninferior anatomical and functional outcomes compared to the BSLF/VH procedure and could be adopted as an alternative to conventional hysterectomy-based native-tissue repair modalities for symptomatic apical-predominant uterovaginal prolapse.

**Keywords:** Pelvic organ prolapse; Sacrospinous hysteropexy; Sacrospinous hysteropexy; Native-tissue repair

- **Research Ethics:** This study was approved by the ethics committee of Third Affiliated Hospital of Soochow University (2019-012).
- **Conflict of Interest:** No potential conflict of interest relevant to this article was reported.

## INTRODUCTION

Pelvic organ prolapse (POP) is a common uterovaginal disease that has an increasing prevalence owing to rising obesity rates and population aging [1,2] and adversely affects urinary, bowel, and sexual function, impairing women's quality of life (QoL) [3,4].

Various transvaginal procedures to treat symptomatic POP have been performed. Although it was initially performed to curie vaginal vault prolapse after hysterectomy [5], vaginal sa-

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crospinous ligament fixation (SSLF) has been regarded as the most common vaginal native-tissue repair procedure, with subjective and objective success rates ranging from 67% to 93% and 84% to 99%, respectively [6]. Native-tissue sacrospinous hysteropexy has also been widely applied for apical-predominant uterovaginal prolapse, and this technique is regarded as highly successful (evidence-based medicine [EBM] level 1a, grade A) and safe for uterus preservation (EBM level 2a, grade B) [2]. A recent randomized controlled trial (the LAVA trial) and literature reviews revealed that unilateral sacrospinous hysteropexy was associated with satisfactory anatomic, functional, and sexual outcomes with low postoperative morbidity and a favorable cost-effectiveness profile [3,4,7].

Existing randomized controlled trials and studies comparing bilateral sacrospinous hysteropexy (BSHP) and bilateral sacrospinous ligament fixation with vaginal hysterectomy (BSLF/VH) are lacking. Therefore, to clarify whether concomitant uterus preservation or vaginal hysterectomy during bilateral SSLF has distinct clinical efficacy for treating patients characterized by apical-predominant uterovaginal prolapse, we conducted this retrospective analysis to compare the subjective and objective clinical outcomes, impact on disease-specific QoL as evaluated by multiple validated questionnaires, and surgical complications between the 2 procedures.

## MATERIALS AND METHODS

The present retrospective study included women with apical-predominant prolapse who underwent either BSLF/VH or BSHP between January 2014 and December 2018 (Fig. 1). The inclusion criteria were symptomatic POP stage 2 or higher according to the Pelvic Organ Prolapse-Quantification (POP-Q) system, no abnormal uterine bleeding or cervical intraepithelial neoplasia, and willingness to participate in postoperative follow-up for at least 24 months. The exclusion criteria were uterine malignancies. Our study was approved by the ethics committee of Third Affiliated Hospital of Soochow University (2019-012), and the patients signed informed consent documents. Concomitant colporrhaphy, perineoplasty, and trachelectomy were performed for anterior or posterior compartment prolapse and cervix elongation (≥2 cm), as well as anti-incontinence surgery such as tension-free trans-obturator vaginal tape for patients with symptomatic stress urinary incontinence (SUI).

The Patient Global Impression of Improvement (PGI-I) contains 7 items ranging from a score of 1, revealing "significant improvement" to a score of 7 indicating "much worse" compared with the preoperative condition. Subjective satisfaction in the present study was defined as "significant improvement" (a score of 1) and "improvement" (a score of 2) on the PGI-I scale. Higher scores on the Pelvic Floor Distress Inventory-Short Form 20 (PFDI-20) and Pelvic Floor Impact Questionnaire 7 (PFIQ-7) questionnaires indicate more severe impairment of postoperative QoL, whereas a higher score on the Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire 12 (PISQ-12) questionnaire indicates better improvement of postopera-

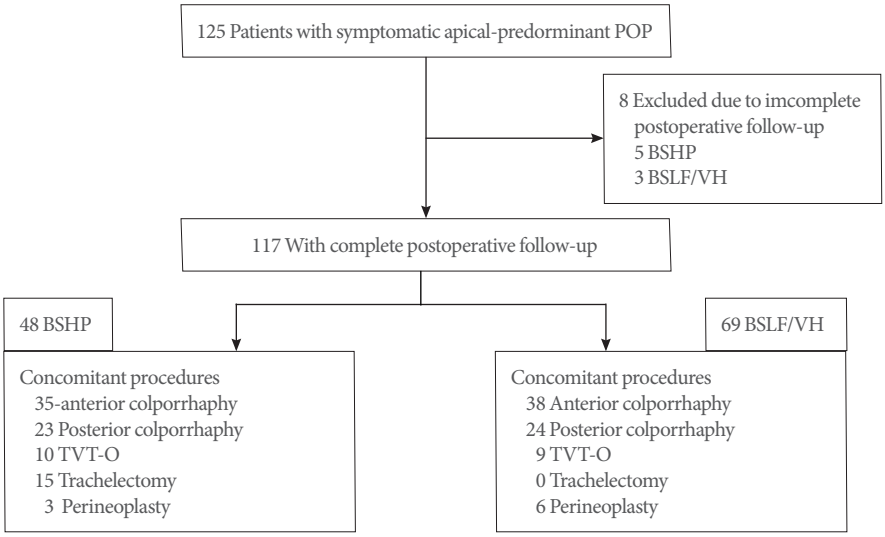


**Fig. 1.** Study flow chart. POP, pelvic organ prolapse; BSHP, bilateral sacrospinous hysteropexy; BSLF/VH, bilateral sacrospinous ligament fixation with vaginal hysterectomy; TVT-O, tension-free transobturator vaginal tape.

tive sexual QoL. Objective anatomical success was defined as prolapse of less than stage 2 in all compartments as quantified by the POP-Q system, without any bothersome vaginal bulging symptoms, no reoperation, and no pessary use for recurrence. The primary outcome was the subjective satisfaction rate evaluated by the PGI-I, and the secondary outcomes included the objective anatomical success rate, impact on QoL as evaluated by the PISQ-12, PFDI-20, and PFIQ-7 questionnaires, and surgical complications classified by the Clavien-Dindo severity system, including 5 degrees of severity ranging from a slight deviation from the normal postoperative course (grade I) to death (grade V). Postoperative follow-up was routinely scheduled at intervals of 1, 3, 6, and 12 months and annually thereafter. All patients completed the self-administered PISQ-12, PFDI-20, PFIQ-7, and PGI-I questionnaires at the last follow-up. Among the 125 enrolled patients, 5 in the BSHP group and 3 in the BSLF/VH group were lost to follow-up (Fig. 1).

### Surgical Procedures

Both procedures were performed through a posterior vaginal approach. The midline posterior vaginal wall was incised deeply to the rectovaginal fascia. The ischial spine was identified using Breisky-Navratil retractors and the sacrospinous ligaments were palpated. Two permanent nonabsorbable monofilament 1-0 sutures, with the help of a Capio suture capturing device (Boston Scientific, Marlborough, MA, USA), were anchored through the middle portion of the sacrospinous ligaments at least 2–3 cm medial to each side of the ischial spine. For BSHP, the posterior cervix was exposed by blunt dissection, and the sutures mentioned above were finally placed through the posterior aspect of the cervix; the sutures were then tightened properly to restore the anatomical position of the uterus. The prolapsed uterus could be raised up to the sacrospinous ligament level. In BSLF/VH, initial vaginal hysterectomy and peritoneal closure were performed according to the standard procedure; 2 sutures were pierced through the vaginal vault without passing through the vaginal epithelium and tied over the vaginal mucosa, placing the vaginal cuff into direct contact with the sacrospinous ligaments. The posterior vaginal incision was finally closed with a 2-0 polyglactin absorbable suture, with a transanal examination performed to ensure that the vaginal apex or cervix was finally attached to the bilateral sacrospinous ligaments.

### Statistical Analysis

IBM SPSS Statistics ver. 22.0 (IBM Co., Armonk, NY, USA) was used for statistical analysis. Continuous variables for demographic data, perioperative details, POP-Q scores, and questionnaire scores were analyzed using either the Student t-test for parametric data or the Wilcoxon signed-rank test for nonparametric data, as well as the chi-square or Fisher exact test for categorical variables. A P-value of $<0.05$ was considered statistically significant.

## RESULTS

In total, 117 patients with apical-predominant uterovaginal prolapse were included in the present retrospective study, among whom 48 and 69 underwent BSHP and BSLF/VH, respectively, with a median follow-up duration of 35 months (range, 25–58 months). As shown in Table 1, there were significant differences in some baseline clinical parameters in terms of mean age, prevalence of menopause status, and the numbers of

**Table 1.** Baseline demographic and clinical parameter of the study population

| Variable | BSHP (n=48) | BSLF/VH (n=69) | P-value |
|---|---|---|---|
| Age (yr) | 45.52±7.23 | 56.93±8.71 | 0.001 |
| Vaginal parity | 1.73±1.09 | 1.98±1.00 | 0.290 |
| Body mass index (kg/m$^2$) | 24.54±4.26 | 23.37±4.61 | 0.530 |
| Menopause | 9 (18.8) | 45 (65.2) | <0.001 |
| Active sex intercourse | 40 (83.3) | 31 (44.9) | <0.001 |
| Arterial hypertension | 7 (14.6) | 23 (33.3) | 0.031 |
| Diabetes mellitus | 5 (10.4) | 12 (17.4) | 0.425 |
| Constipation | 12 (25.0) | 19 (27.53) | 0.833 |
| Stress urinary incontinence | 10 (20.8) | 15 (21.7) | 1.000 |
| Frequent urinary infections | 9 (18.8) | 8 (11.6) | 0.298 |
| Dysuria | 7 (14.6) | 6 (8.7) | 0.377 |
| Previous pelvic surgery | 6 (12.5) | 11 (15.9) | 0.791 |
| Preoperative POP-Q stage[a] of apical prolapse | | | |
| Stage 2 | 12 (25.0) | 21 (30.4) | 0.540 |
| Stage 3 | 28 (58.3) | 34 (49.3) | 0.353 |
| Stage 4 | 8 (16.7) | 14 (20.3) | 0.642 |

Values are presented as mean±standard deviation or number (%).
BSHP, bilateral sacrospinous hysteropexy; BSLF/VH, bilateral sacrospinous ligament fixation with vaginal hysterectomy; POP-Q, Pelvic Organ Prolapse-Quantification.
[a]POP-Q stage 2, most distal apical prolapse between 1 cm above and beyond hymen; stage 3, most distal apical prolapse >1 cm beyond hymen but no further than 2 cm less than total vaginal length; stage 4, total prolapse.

**Table 2.** Comparison of perioperative parameters and concurrent urogenital surgeries between the 2 groups

| Perioperative parameter | BSHP (n = 48) | BSLF/VH (n = 69) | P-value | Mean difference[a] | 95% CI |
|---|---|---|---|---|---|
| Operative time (min) | 62.91 ± 25.63 | 110.45 ± 31.72 | < 0.001 | -47.54 ± 18.61 | -74.64 to -28.26 |
| Estimated blood loss (mL) | 73.61 ± 35.05 | 138.77 ± 50.26 | < 0.001 | -65.16 ± 24.35 | -85.25 to -45.36 |
| Catheterization time (day) | 2.54 ± 0.52 | 3.73 ± 0.35 | 0.027 | -1.19 ± 0.21 | -2.33 to -0.04 |
| Postoperative hospital stay (day) | 3.42 ± 1.16 | 5.56 ± 0.89 | < 0.01 | -2.14 ± 0.45 | -4.25 to -0.03 |
| Concurrent urogenital surgeries | | | | | |
| Anterior colporrhaphy | 35 (72.9) | 38 (55.1) | 0.055 | - | - |
| Posterior colporrhaphy | 23 (47.9) | 24 (34.8) | 0.182 | - | - |
| TVT-O for concomitant SUI | 10 (20.8) | 9 (13.0) | 0.312 | - | - |
| Trachelectomy[b] | 15 (31.3) | 0 (0) | < 0.001 | - | - |
| Perineoplasty | 3 (6.3) | 6 (8.7) | 0.892 | - | - |

Values are presented as mean ± standard deviation or number (%).
BSHP, bilateral sacrospinous hysteropexy; BSLF/VH, bilateral sacrospinous ligament fixation with vaginal hysterectomy; CI, confidence interval; TVT-O, tension-free transobturator vaginal tape; SUI, stress urinary incontinence.
[a]The postoperative mean difference between BSHP and BSLF/VH groups. [b]For those with cervical length more than 2 cm within BSHP group.

**Table 3.** Perioperative POP-Q comparison between the BSHP and BSLF/VH groups during follow-up (median, 35 months; range, 25–58 months)

| POP-Q | BSHP (n = 48) | | P-value | BSLF/VH (n = 69) | | P-value | P-value[a] | Mean difference[b] | 95% CI |
|---|---|---|---|---|---|---|---|---|---|
| | Pre | Post | | Pre | Post | | | | |
| Aa | -1.03 ± 1.49 | -2.64 ± 0.61 | < 0.001 | -1.12 ± 1.55 | -2.75 ± 0.47 | < 0.001 | 0.38 | 0.11 ± 0.36 | -0.14 to 0.36 |
| Ba | -0.92 ± 1.14 | -2.83 ± 0.55 | < 0.001 | -0.96 ± 1.33 | -2.92 ± 0.39 | < 0.001 | 0.41 | 0.09 ± 0.29 | -0.12 to 0.31 |
| Ap | -1.98 ± 1.48 | -2.62 ± 0.49 | < 0.001 | -2.21 ± 1.51 | -2.75 ± 0.36 | < 0.001 | 0.94 | 0.13 ± 0.39 | -0.16 to 0.42 |
| Bp | -2.10 ± 1.57 | -2.81 ± 0.62 | < 0.001 | -2.05 ± 1.61 | -2.96 ± 0.58 | < 0.001 | 0.27 | 0.15 ± 0.27 | -0.13 to 0.43 |
| C | 1.64 ± 1.25 | -4.09 ± 1.16 | < 0.001 | 1.81 ± 1.32 | -4.38 ± 0.98 | < 0.001 | 0.33 | 0.29 ± 0.95 | -0.25 to 0.82 |
| TVL | 7.05 ± 0.91 | 6.92 ± 0.46 | 0.23 | 6.67 ± 0.83 | 6.75 ± 0.57 | 0.19 | 0.21 | 0.17 ± 0.51 | -0.09 to 0.45 |
| D | -4.03 ± 2.52 | -5.10 ± 1.72 | 0.004 | -3.63 ± 2.89 | - | - | - | - | - |

Values are presented as mean ± standard deviation.
POP-Q, Pelvic Organ Prolapse-Quantification; BSHP, bilateral sacrospinous hysteropexy; BSLF/VH, bilateral sacrospinous ligament fixation with vaginal hysterectomy; CI, confidence interval.
Point Aa is at the midline of anterior vaginal wall. Point Ba refers to the most superior location of the front vaginal wall. Point Ap is located midline of posterior vaginal wall 3 cm proximal to hymen. Point Bp is the uppermost point of the posterior vaginal wall. Point C is the lowest edge of the cervix or the vaginal cuff (i.e., hysterectomy scar). TVL refers to 'total vaginal length' measured from hymen to the most distal point. Point D is the topmost point of the posterior vaginal wall.
[a]Postoperative intergroup comparison between BSHP and BSLF/VH groups. [b]Postoperative mean difference between BSHP and BSLF/VH groups.

patients with active sexual intercourse and hypertension as a comorbidity, indicating that young and sexually active women tended to prefer uterine preservation and chose BSHP rather than BSLF/VH procedure.

The main perioperative parameters such as operative time (P < 0.001), estimated blood loss (P < 0.001), catheterization time (P = 0.027), and postoperative hospital stay (P < 0.01) in the BSHP group were significantly shorter or had lower values than in the BSLF/VH group (Table 2). No significant differences involving concurrent procedures were found, except for trachelectomy within the BSHP group (P < 0.001). A previous study revealed that the severity of cervical elongation was closely related to the degree of apical uterine prolapse [8]; therefore, considering that cervical elongation may develop due to asymmetrical posterior traction [9], concomitant trachelectomy was performed in patients with a cervical length more than 2 cm within the BSHP group to decrease the postoperative incidence rate of cervical elongation.

**Table 4.** Disease-specific quality of life outcomes

| Variable | BSHP (n=48) | | P-value | BSLF/VH (n=69) | | P-value | P-value[b] | Mean difference[c] | 95% CI |
|---|---|---|---|---|---|---|---|---|---|
| | Pre | Post | | Pre | Post | | | | |
| PISQ-12[a] | 29.53±8.12 | 38.65±6.83 | <0.001 | 30.26±9.49 | 36.84±5.62 | <0.001 | 0.417 | 1.81±1.32 | 0.05 to 3.58 |
| PFDI-20 | 13.84±8.25 | 2.10±2.94 | <0.001 | 14.39±7.85 | 1.95±3.28 | <0.001 | 0.752 | 0.15±0.51 | -0.06 to 0.37 |
| PFIQ-7 | 9.58±4.95 | 1.34±2.52 | <0.001 | 9.79±5.20 | 1.23±2.91 | <0.001 | 0.961 | 0.11±0.46 | -0.02 to 0.24 |
| PGI-I | - | 1.65±1.02 | - | - | 1.53±0.79 | - | 0.835 | 0.12±0.55 | -0.05 to 0.30 |

Values are presented as mean±standard deviation.
BSHP, bilateral sacrospinous hysteropexy; BSLF/VH, bilateral sacrospinous ligament fixation with vaginal hysterectomy; CI, confidence interval; PISQ-12, pelvic organ prolapse/urinary incontinence sexual questionnaire-12; PFDI-20, pelvic floor distress inventory-short form 20; PFIQ-7, pelvic floor impact questionnaire 7; PGI-I, Patient Global Impression of Improvement.
[a]PISQ-12 score was based on the patients with active sexual activity (45 and 60 patients from the BSHP and BSLF/VH group respectively). [b]Postoperative intergroup comparison between BSHP and BSLF/VH groups. [c]Postoperative mean difference between BSHP and BSLF/VH groups.

**Table 5.** Subjective satisfaction & objective anatomical success rates and recurrence rates

| Variable | BSHP (n=48) | BSLF/VH (n=69) | P-value |
|---|---|---|---|
| Subjective satisfaction rate[a] | 45 (93.8) | 67 (97.1) | 0.677 |
| Objective anatomical success rate[b] | 42 (87.5) | 63 (91.3) | 0.721 |
| Recurrent prolapse ≥ POP-Q stage 2 | | | |
| Apical compartment recurrence[c] | 2 (4.2) | 1 (1.5) | 0.749 |
| Anterior compartment recurrence | 3 (6.3) | 2 (2.9) | 0.677 |
| Posterior compartment recurrence | 0 (0) | 0 (0) | - |
| Symptomatic recurrent prolapse | 2 (4.2) | 2 (2.9) | 1.000 |
| Reoperation for recurrent prolapse | 1 (2.1) | 0 (0) | 0.410 |

Values are presented as mean±standard deviation or number (%).
BSHP, bilateral sacrospinous hysteropexy; BSLF/VH, bilateral sacrospinous ligament fixation with vaginal hysterectomy; POP-Q, Pelvic Organ Prolapse-Quantification; PGI-I, Patient Global Impression of Improvement.
[a]Subjective satisfaction defined as questionnaire score ≤2 on the PGI-I scale. [b]Objective success defined as less than POP-Q stage 2 prolapse at all vaginal sites. [c]Recurrent uterine prolapse of BSHP group vs. recurrent vaginal vault prolapse of BSLF/VH group.

As shown in Table 3, the postoperative scores of the Aa, Ba, C, Bp, and Ap sites within both the BSHP and BSLF/VH cohorts significantly improved (P<0.001), and no significant differences were found between multiple postoperative scores of POP-Q locations (Aa, Ba, C, Bp, and Ap) in both cohorts. The total vaginal length also remained unchanged postoperatively.

Significant improvements in POP symptom severity, quality of daily life, and sexual satisfaction scores were revealed in both cohorts (Table 4). Furthermore, compared to the BSLF/VH cohort, sexual satisfaction scores (PISQ-12) in the BSHP cohort seemed higher, but without a significant difference (P=0.417). It was noteworthy that the scores of PISQ-12 for evaluating sexual QoL came from patients who actively engaged in sexual intercourse, preoperatively and postoperatively, within both the BSHP (n=45) and BSLF/VH (n=60) cohorts.

There were no significant differences in the postoperative subjective satisfaction rate (P=0.677) and objective anatomical success rate (P=0.721) between both surgical procedures, as shown in Table 5. Among cases of recurrent prolapse equal to or more than stage 2, although the postoperative recurrence rate involving the anterior, apical, and posterior compartments and the reoperation rate for recurrence in the BSHP cohort were slightly higher, no significantly statistical differences were found. One patient with symptomatic recurrent prolapse in the BSHP cohort underwent vaginal hysterectomy with anterior and posterior colporrhaphy 3 years after the previous surgery and recovered well during subsequent follow-up, and another patient refused a secondary operation and chose conservative treatment with a pessary after being carefully counseled regarding potential risk.

As shown in Table 6, there were a few intraoperative complications in both cohorts, with 2 cases of massive hemorrhage and colon or rectum injury in the BSHP group and 3 cases of massive hemorrhage in the BSLF/VH group. No significant between-group difference was noted. There were also no significant intergroup differences in terms of postoperative complications of grade I or grade II, according to the Clavien-Dindo classification (P>0.05). In the present study, postoperative urinary retention was defined as post-void residual urine volume exceeding 100 mL, with 6 cases in the BSHP group and 3 cases in the BSLF/VH group. All cases of urinary retention were as-

**Table 6.** Intraoperative and postoperative complications

| Perioperative outcome | BSHP (n=48) | BSLF/VH (n=69) | P-value |
|---|---|---|---|
| Intraoperative complications | | | |
| Massive hemorrage | 2 (4.2) | 3 (4.3) | 1.000 |
| Rectum or colon injury | 2 (4.2) | 0 (0) | 0.166 |
| Bladder injury | 0 (0) | 0 (0) | - |
| Postoperative complications (Clavien-Dindo classification) | | | |
| Grade I | | | |
| Postoperative transient urinary retention | 6 (12.5) | 3 (4.4) | 0.202 |
| *De novo* dyspareunia | 5 (10.4) | 2 (2.90) | 0.197 |
| Buttock or hypogastrium pain | 8 (16.7) | 13 (18.8) | 0.811 |
| Dysuria & micturition pain | 4 (8.3) | 3 (4.4) | 0.619 |
| Grade II | | | |
| Overactive bladder syndrome | 2 (4.2) | 5 (7.3) | 0.768 |
| *De novo* urinary incontinence | 5 (10.4) | 4 (5.8) | 0.569 |
| Urogenital tract infection | 3 (6.3) | 2 (2.9) | 0.677 |
| Grade III | | | |
| Progression of preoperative SUI | 0 (0) | 0 (0) | - |

Values are presented as number (%).
BSHP, bilateral sacrospinous hysteropexy; BSLF/VH, bilateral sacrospinous ligament fixation with vaginal hysterectomy; SUI, stress urinary incontinence.

ymptomatic and subsequently resolved spontaneously. The other grade I complications, such as *de novo* dyspareunia, buttock or hypogastrium pain, and dysuria were slight and never became aggravated during routine follow-up visits, without additional medical or surgical interventions. The grade II complications mainly consisted of overactive bladder syndrome (OAB) along with urinary frequency or urinary urgency, *de novo* urinary incontinence, and uterovaginal tract infection. Patients complaining of OAB and *de novo* urinary incontinence in both groups noticed apparent improvement after taking solifenacin orally, whereas patients with uterovaginal tract infections were treated with routine oral or intravenous antibiotic therapy. In both groups, no cases involving postoperative SUI progression were recorded.

## DISCUSSION

The present retrospective cohort study was performed to evaluate the effectiveness and feasibility of the uterus-sparing BSHP procedure in terms of operative data, complications, efficacy, and patient satisfaction in women with apical-predominant uterovaginal prolapse when compared to the BSLF/VH procedure.

The issue of uterine preservation during pelvic reconstructive surgery has recently received increasing public attention [10, 11]. A survey study conducted by Korbly et al. [12] revealed a growing trend of preferences for uterovaginal prolapse procedures with uterine preservation among women with POP. A recent systematic literature review and observational cohort study have indicated that unilateral sacrospinous hysteropexy possessed comparable short-term objective prolapse outcomes [13] and long-term postoperative sexual function, subjective, and objective success outcomes compared with SSLF with concomitant hysterectomy [14,15]. The SAVE U multicenter randomized controlled trial [4] also revealed significantly less apical compartment recurrence and comparable overall anatomical, sexual, and functional outcomes and QoL after unilateral sacrospinous hysteropexy versus conventional vaginal hysterectomy with uterosacral suspension.

Compared to the BSLF/VH cohort, the BSHP cohort in our study revealed better perioperative outcomes than other uterine-preserving prolapse operations [13], with shorter operating times, less estimated blood loss, and shorter postoperative catheterization times and hospital stays, indicating that patients who undergo BSHP may experience a rapid postoperative recovery and return to normal activities much earlier, while undertaking much less risk of additional intraoperative anesthetization, excessive blood transfusion, and postoperative urinary retention.

The effect of uterine preservation upon postoperative sexual function after POP surgery remains a matter of debate; a prospective cohort study involving colposacropexy with and without hysterectomy demonstrated that the uterus-sparing procedure was associated with better sexual functional outcomes, which was attributed to the negative impact of concomitant hysterectomy on sexual function due to specific physical and psychological issues, namely vaginal shortening, damage to nerve endings, lack of uterine contractions, altered perceptions of orgasm, and a loss of sense of self-esteem or femininity [16], while another retrospective study conducted by Lo et al. [14] revealed that there were no significant differences in sexual function evaluated by the PISQ-12 questionnaire between unilateral sacrospinous hysteropexy with and without concomitant hysterectomy. Theoretically, conventional unilateral sacrospinous repair might lead to vaginal deviation or narrowing and

postoperative sexual dysfunction, and both BSHP and BSLF/VH could restore the anatomical symmetry of the vaginal axis, maintain vaginal length and width, and improve sexual function effectively. Our present BSHP cohort reported slightly higher sexual satisfaction scores than the BSLF/VH cohort, indicating the positive role of uterine preservation in sexual function. Furthermore, based on the scores of validated PFIQ-7, PFDI-20, and PGI-I questionnaires, there were no statistically significant intergroup differences with regard to POP symptom severity scores or QoL scores between the 2 cohorts, revealing that BSHP was also noninferior to BSLF/VH for alleviating postoperative discomfort and improving subjective relief associated with prolapse-specific symptoms.

Due to the very heterogeneous definitions of subjective outcomes and validated questionnaires applied in previous studies, subjective satisfaction rates for BSHP and BSLF/VH as evaluated by the PGI-I questionnaire have remained relatively less studied and documented. David-Montefiore et al. [17] reported that the subjective cure rate for bilateral SSLF with concomitant hysterectomy was 93%. In another retrospective cohort study [15], the subjective success rate of patients who underwent unilateral vaginal sacrohysteropexy with or without uterine preservation evaluated by the PGI-I was 89.0% and 88.0%, respectively, after a mean follow-up of 13.3 years (range, 8.5–22.6 years).

The objective anatomical success rate (quantitatively evaluated as POP-Q stage ≤1) of the BSHP group showed no statistically significant difference (87.5% vs. 91.3%, P=0.721) compared to the BSLF/VH group, which seemed comparable to the objective anatomic results from a previous single-center observational study [18] involving bilateral minimal tension sacrospinous fixation with or without concomitant hysterectomy (94.5%), and much higher than the overall objective cure rates of unilateral sacrospinous hysteropexy with concomitant anterior and posterior cervical fixation (82.9%) or posterior cervical fixation alone (74.3%) from another retrospective study [19].

Conventional unilateral SSLF has been reported to yield a high recurrence rate of anterior compartment prolapse, ranging from 5.8% to 21.3% [6]; this high rate is attributed to the dorsal-caudal vaginal deviation and exposure of the anterior compartment, which is vulnerable to intraabdominal pressure. A previous literature review focusing on unilateral and bilateral SSLF concluded that the recurrence rates for the anterior, apical, and posterior compartments were 18.3%, 5.3%, and 2.4%, respectively [20], while another recent literature review involving sacrospinous hysteropexy reported that the recurrence rate was 34.9% for the anterior compartment, 8.5% for the apical compartment, and 6.4% for the posterior compartment, respectively [3]. In the present study, the recurrence rates in both the BSHP and BSLF/VH cohorts were much lower, as a bilateral procedure with native-tissue repair was performed via the posterior vaginal approach, and sutures were finally placed on each side of the posterior cervix or vaginal fornices. Compared to a unilateral procedure, bilateral SSLF with or without hysterectomy not only provided a more symmetrical vaginal cavity, but also resolved the dorsal-caudal deviation of the vaginal axis, hence theoretically guaranteeing durable apical and midline support for the apical-predominant uterine descensus.

Intraoperative complications are rare but sometimes serious; a previous study reported that massive hemorrhage, intestine or colon injury, and bladder or ureter damage occurred with global incidence rates of 5.2%, 0.4%, and 0.7%, respectively [18]. The incidence rate of rectal or colon injury in the BSHP group (2 cases, 4.17%) was higher than the average risk rate (range, 0.6%–0.8%) [6], which is attributed to the more extensive dissection for intraperitoneal adhesion due to previous gynecological or cesarean operations. Postoperative complications were evaluated according to the Clavien-Dindo classification, and only slight complications were recorded. As an exclusive postoperative complication following SSLF, the incidence rate of buttock or hypogastrium pain in the present study was higher than in a previous study (6.1% to 13.7%) [7], although all cases resolved spontaneously without medical intervention. The anatomic mechanism of buttock or hypogastrium pain could potentially be attributed to iatrogenic injury of both the levator ani nerve and pudendal nerve [21].

The issue of uterine preservation during POP surgery always presents a treatment dilemma for its role in potential prolapse recurrence, the risk of uterine malignancies, and increased operative morbidity associated with a subsequent surgical intervention. During the preoperative assessment and postoperative annual follow-up, routine cervical surveillance and uterine ultrasound screening are highly recommended for patients choosing uterine preservation. During the overall follow-up period in the present study, no cases of gynecological malignancy were diagnosed.

The strengths of the present study include its long-term follow-up, the application of POP-Q staging, and the use of multiple validated questionnaires. All procedures were performed by the same urogynecology surgeon to minimize potential bias including the surgeon's preferences, patient selection, and surgical

experience. There are also some obvious limitations, such as the nature of a retrospective cohort study without randomization, which was inevitably affected by selection bias, given that the fact that younger, premenopausal, and sexually active patients were more likely to choose the BSHP procedure. Such situations were inherent aspects of the preoperative counseling and decision-making process, as the appropriate surgical modality should be patient-centered and individualized, taking into consideration their expectation of improvement of quality of sexual life and the maintenance of femininity and sense of self-esteem associated with uterine preservation.

To our knowledge, this article is the first study comparing anatomical and functional outcomes between vaginal BSHP and BSLF/VH procedures. Nonetheless, further long-term feasibility and effectiveness should be rigorously evaluated to arrive at convincing evidence-based conclusions.

Our present study proved that the BSHP procedure yielded comparable subjective and objective outcomes, disease-specific QoL, and incidence rates of complications, while also possessing advantages over BSLF/VH in terms of less intraoperative anesthetization and estimated blood loss, shorter postoperative urinary retention and hospital stay. Therefore, BSHP is an effective and safe technique addressing symptomatic apical-predominant uterine descensus, especially for premenopausal patients who prefer uterine preservation.

### AUTHOR CONTRIBUTION STATEMENT

Conceptualization: *KW*
Data curation: *LS, ZH*
Methodology: *KW*
Project administration: *YX*
Writing - original draft: *KW*
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