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Outcomes and recurrence rates of four surgical techniques for treating vaginal vault prolapse

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ABSTRACT

Aims: This study aimed to compare the surgical outcomes of four distinct techniques for vaginal vault prolapse (VVP) after hysterectomy to identify the optimal approach.

Methods: This retrospective study was conducted using the data of patients who underwent VVP between 2010 and 2022 and had a history of hysterectomy. The surgical techniques evaluated were laparotomic sacrocolpopexy (LPSC), laparoscopic sacrocolpopexy (LSSC), sacrospinous ligamentopexy (SSLP), and laparoscopic lateral suspension (LLS). The study outcomes were the surgical duration, VVP recurrence, and adverse outcomes.

Results: The study included 77 women (age, mean±standard deviation: 58.96±9.96 years). LPSC, LSSC, SSLP, and LLS were detected in 27 (35%), 10 (13%), 31 (40.3%), and 9 (11.7%) cases, respectively. The duration of the surgery was significantly different among the groups (SSLP group: 115.96±51.29 min, LPSC group: 143.51±31.46 min, LLS group: 168.33±53.20 min, and LSSC group: 197.50±62.46 min, p=0.012). The recurrence rate of VVP was 11.11% in the LPSC group, 12.9% in the SSLP group, 11.11% in the LLS group, and 0.0% in the LSSC group (p=0.838). The rates of adverse outcomes in the early and late periods did not differ across the four groups, with p values of 0.274 and 0.556 (LPSC group: 18.52% and 18.52%, LSSC group: 20.0% and 20.0%, SSLP group: 6.46% and 22.58%, and LLS group: 0.0% and 22.22%).

Conclusions: Surgical techniques for VVP, including LPSC, LSSC, SSLP, and LLS, showed comparable outcomes and recurrence rates, except for the duration of surgery, which was the lowest in the SSLP group and longest in the LSSC group.

Introduction

Hysterectomy is one of the most common surgeries in gynecology (1). Pelvic organ prolapse (POP), such as vaginal vault prolapse (VVP), can be observed after hysterectomy (2) and causes serious morbidity in older women (2,3). Although post-hysterectomy VVP rates of 0.14% have been reported (3), this rate can rise to 11.6% in hysterectomy performed due to POP (4). The lifetime risk of surgery due to POP is 13% in the United States (5), and for many women, POP surgeries may lead

to voiding, defecation, and sexual dysfunction (5,6). However, surgery for VVP can improve the quality of life of patients (5,6).

Surgery for VVP, a subtype of POP surgery, is complex and requires experience (5,6). Various approaches for VVP surgery, including abdominal, vaginal, laparoscopic, and robotic, along with techniques such as sacrospinous fixation, colpocleisis, lateral suspension, and sacrocolpopexy, have been used to restore normal anatomy (7). Despite these efforts, ongoing studies and technological advancements continue to identify the optimal surgical technique for VVP. Four distinct techniques for VVP surgery, including laparotomic sacrocolpopexy (LPSC), laparoscopic sacrocolpopexy (LSSC), sacrospinous ligamentopexy (SSLP), and laparoscopic lateral suspension (LLS), are the preferred methods (5-8). Notably, a gap exists in the current literature, since no studies have compared the outcomes of these four techniques in VVP surgery. Hence, this retrospective study addressed this gap by comparing the surgical duration, recurrence rates, and adverse outcomes of four techniques.

Methods

Study population

This retrospective cross-sectional study evaluated women with symptomatic VVP who underwent surgery using four distinct techniques between 2010 and 2022. We collected data from the registry of the Urogynecology Clinic at the University of Health Sciences Türkiye, Etlik Zübeyde Hanım Obstetrics and Gynecology Training and Research Hospital. The exclusion criteria were other surgical techniques for VVP, concomitant hysterectomy, recurrent VVP, missing data, and missing postoperative follow-up information. The Local Ethics Committee of the University of Health Sciences Türkiye, Etlik Zübeyde Hanım Obstetrics and Gynecology Training and Research Hospital approved the study protocol (date: 21.04.2022, number: 05/42).

Our clinic does not have a definite protocol regarding which technique will be used for each patient. Nonetheless, techniques such as SSLP and LPSC were previously preferred by surgeons, whereas with the development of technology, LSSC and LLS have been increasingly preferred by surgeons and patients. All surgeries in the current study were performed by surgeons at the Urogynecology Clinic of the University of Health Sciences Türkiye, Etlik Zübeyde Hanım Obstetrics and Gynecology Training and Research Hospital.

Data collection

Age, body mass index (BMI), obstetric and demographic characteristics, history of previous surgeries, evaluation of pelvic compartments using the Pelvic Organ Prolapse Quantification (POP-Q) system, duration of the surgery, intraoperative complications, preoperative and postoperative hemoglobulin values, postoperative early or late complications, length of hospital stay (LOS), postoperative follow-up time, and recurrence of cuff prolapse were collected using the patient files. POP-Q is performed according to the American College of Obstetricians and Gynecologists guidelines for all patients in our clinic guidelines (5) and is recorded in the patient's file. When the apex of the vagina was evaluated using the POP-Q system, cuff prolapses at stage 2 and above that occurred in the postoperative period were considered as recurrence (5,8). Due to the retrospective study design, recurrence rates were determined from the hospital's registration system using data entered after gynecological examinations.

The primary outcomes were differences in age, BMI, obstetric and demographic characteristics, stage of the POP-Q, duration of the surgery, and LOS among the four groups. The secondary outcomes were differences in the recurrence rates of VVP and adverse surgical outcomes (intraoperative complications, de novo pelvic pain, de novo urinary incontinence, and cystocele/rectocele) among the four groups.

Statistical Analysis

All statistical analyses were performed using Statistical Package for the Social Sciences (version 17; SPSS Inc., Chicago, IL, USA). Histograms, probability plots, and the Kolmogorov-Smirnov test were used to check the normal distribution. Normally distributed variables were expressed as mean±standard deviation (SD), skewed variables as median (interquartile range), and categorical variables as number and percentage. The chi-square test or Fisher's exact test was used to compare categorical variables across the four groups. Parametric variables were analyzed using one-way ANOVA, and non-parametric variables were analyzed using the Kruskal-Wallis test. The Bonferroni test was used for post-hoc analyses for variables significantly different across the groups. A $p<0.05$ was considered statistically significant.

Results

A total of 154 patients were evaluated, and 77 were included in the study (age, mean±SD: 58.96±9.96 years). LPSC, LSSC, SSLP, and LLS were detected in 27 (35%), 10 (13%), 31 (40.3%), and 9 (11.7%) patients, respectively. As shown in Table 1, a statistically significant difference was observed in the mean age and BMI of the four groups (p=0.003 and 0.011, respectively). Post hoc analysis revealed a significant difference in mean age between the SSLP (63.68±9.94 years) group and the LSSC (52.80±7.37 years) and LPSC (56.96±9.45 years) groups (p=0.011 and 0.044, respectively). However, the mean ages of the patients in the SSLP (63.68±9.94 years) and LLS (55.56±7.76 years) groups were similar in the post hoc analysis (p=0.140). The mean BMI was different only between the LSSC (25.13±2.69 kg/m^2) and the SSLP (30.68±4.44 kg/m^2) groups in

the post hoc analysis (p=0.009). The gravidity and parity were similar between all four groups (p>0.05), and all patients had a history of vaginal delivery (Table 1). The preoperative stages of POP-Q between the groups did not reach statistical significance (p>0.05) (Table 2).

Thirty-three (42.85%) cases of hysterectomy via the vaginal approach and 44 (57.15%) cases of hysterectomy via the abdominal approach were identified (Table 1), and there was no significant difference in the type of hysterectomy between the four groups (p>0.05). Additionally, the time from the previous hysterectomy was similar between the four groups (p=0.351). The duration of surgery was significantly different across the four groups (p=0.012); the shortest duration was identified in the SSLP group at 115.96±51.29 min, followed by LPSC at 143.51±31.46 min, LLS at 168.33±53.20 min, and LSSC at 197.50±62.46 min. There was a significant difference in the duration of surgery between the SSLP group and the LSSC and LLS groups (p<0.001 and 0.027, respectively); and no difference was noted between the SSLP and LPSC groups (p=0.178). Additionally, the duration of surgery was similar between the LPSC group and the SSLP and LLS groups (p=0.178 and 1.000, respectively); whereas there was a significant difference between the LPSC and LSSC groups (p=0.017). Intraoperative complications were observed in only one patient who underwent LSSC, as a bladder injury that was repaired laparoscopically in this patient.

The difference in LOS between the four groups did not reach statistical significance (p>0.05) (Table 1). However, the longest postoperative follow-up duration was observed in the LPSC group (78.19±50.23 months), whereas the shortest period was observed in the LLS group (36.56±7.81 months); the difference in the follow-up duration was significantly different only between these two groups (p=0.017). Adverse outcomes in the early and late postoperative stages did not differ between the four groups

Table 1. Demographic, obstetric, and surgical characteristics of the groups

	LPSC n=27	LSSC n=10	SSLP n=31	LLS n=9	p value
Age, years, mean±SD	56.96±9.45	52.80±7.37	63.68±9.94	55.56±7.76	**0.003**[a]
Gravidity, n, mean±SD	3.95±1.98	3.40±0.96	4.74±2.12	4.00±1.58	0.205[a]
Parity, n, mean±SD	3.10±1.33	2.50±0.70	3.74±1.67	3.11±1.61	0.108[a]
BMI, kg/m^2, mean±SD	28.24±3.75	25.13±2.69	30.68±4.44	29.67±8.30	**0.011**[a]
Time since the previous hysterectomy, years, mean±SD	10.92±6.76	7.88±7.64	11.46±7.94	7.00±6.25	0.351[a]
Type of previous hysterectomy, % (n)					
Abdominal approaches, 57.14 (44)	40.7 (11)	40.0 (4)	41.9 (13)	55.6 (5)	0.884[b]
Vaginal approaches, 42.86 (33)	59.3 (16)	60.0 (6)	58.1 (18)	44.4 (4)	
Preoperative Hb, g/dL, mean±SD,	13.23±1.27	13.71±1.05	13.01±1.04	13.08±1.16	0.432[a]
Postoperative Hb, g/dL, mean±SD,	11.12±1.21	11.34±1.08	10.69±1.95	11.09±0.62	0.392[a]
Delta Hb, g/dL, mean±SD	1.91±0.76	2.35±1.86	2.37±0.87	1.99±0.84	0.592[a]
Duration of surgery, minutes, mean±SD	143.51±31.46	197.50±62.46	115.96±51.29	168.33±53.20	**0.012**[a]
Length of hospital stay, days, mean±SD	3.01±2.04	3.30±3.09	2.45±0.88	2.11±0.33	0.307[a]
Postoperative follow-up period, months, mean±SD	78.19±50.23	56.06±18.40	56.70±38.22	36.56±7.81	**0.012**[a]

The results are significant at p<0.05, [a]: One-way ANOVA test, [b]: Fisher's exact test.
BMI: Body mass index, n: Number, Hb: Haemoglobin, LLS: Laparoscopic lateral suspension, LPSC: Laparotomic sacrocolpopexy, LSSC: Laparoscopic sacrocolpopexy, SSLP: Sacrospinous ligamentopexy, SD: Standard deviation

Table 2. Evaluation of pelvic compartments across the groups with quantification of the Pelvic Organ Prolapse Quantification system

	LPSC n=27	LSSC n=10	SSLP n=31	LLS n=9	p value
Apical compartment, stage, median (IQR)	4 (1)	4 (1)	4 (1)	3 (1)	0.603
Anterior compartment, stage, median (IQR)	1 (3)	2 (4)	0 (4)	3 (3)	0.659
Posterior compartment, stage, median (IQR)	0 (1)	0 (0)	0 (2)	0 (2)	0.155

The results are significant at the level of 0.05. Kruskal-Wallis H test.
IQR: Interquartile range, LLS: Laparoscopic lateral suspension, LPSC: Laparotomic sacrocolpopexy, LSSC: Laparoscopic sacrocolpopexy, n: Number, SSLP: sacrospinous ligamentopexy

(p=0.274 and 0.974, respectively) (Table 3). Considering the early postoperative findings, surgical site infection (n=3 LPSC group; n=1 SSLP group), fever of unknown origin (n=2 each in the LPSC and SSLP groups), nephrostomy due to ureteral injury (n=1 LSSC group), postoperative pulmonary dysfunction (n=1 LSSC group), and postoperative acute coronary syndrome (n=1 LPSC group) were identified.

Late postoperative findings included urinary incontinence, cystocele/rectocele, pelvic pain, and VVP recurrence. Recurrent VVP was detected in 8 (10.38%) cases in all patients, of whom 3 (37.5%) belonged to the LPSC group, 4 (50.0%) to the SSLP group, and 1 (12.5%) to the LLS group. No recurrence of VVP was observed in the LSSC group (Table 3). The difference in recurrence rates between the groups was non-significance (p=0.838). Six percent of the patients had de novo urinary incontinence (urge and stress), 6.5% had cystocele/rectocele, 1.3% had pelvic pain, and 10.4% had recurrent VVP. The difference in the incidence of late postoperative outcomes across the four groups did not reach statistical significance (p>0.05) (Table 3). Mesh erosion, sexual dysfunction, and new dyspareunia were not observed in any of the patients.

Discussion

Conservative treatment modalities, such as pelvic floor physiotherapy and pessaries, are available as first-line treatment for POP; however, reconstructive or obliterative surgeries for VVP are planned when conservative treatments fail or the prolapse is severe (5). In the current study, the outcomes of four surgical techniques for VVP were evaluated retrospectively. Overall, the four surgical techniques had similar surgical outcomes, with the only difference being the duration of the surgery.

Various techniques are used for VVP surgery; nonetheless, newer approaches are being developed using contemporary technology. Sacrocolpopexy is the gold standard treatment for VVP (9). It was reported to be superior to SSLP; however, the duration of the surgery and recovery time are longer than those of SSLP (10). Similarly, SSLP was found to be the shortest and easiest technique in our study. Nonetheless, LOS and postoperative outcomes were similar between the four groups examined in our analysis. In a meta-analysis evaluating POP surgery, vaginal suture suspension to various pelvic ligaments was found to be inferior when evaluated as outcomes of apical failure from abdominal sacrocolpopexy (any route) with synthetic mesh; however, anterior and posterior failures, awareness of recurrence, reoperation, intraoperative bladder and ureter injuries, and postoperative lower urinary tract symptoms were similar in both surgery types (11). The only case in our study cohort who underwent bladder injury and nephrostomy due to ureteral injury belonged to the LSSC group; no urinary tract injury was observed in any of the other cases. Long-term surgical outcomes were similar between the sacrocolpopexy (laparotomic and laparoscopic) and SSLP groups in the current study.

Table 3. Postoperative adverse outcomes across four groups

	Total cases n=77	LPSC n=27	LSSC n=10	SSLP n=31	LLS n=9	p value
Early postoperative outcomes, n (%)						
No	68 (88.31)	22 (81.48)	8 (80.0)	29 (93.54)	9 (100)	0.274
Yes	9 (11.69)	5 (18.52)	2 (20.0)	2 (6.46)	0 (0.0)	
Type of early postoperative outcomes, n (%)						
Surgical site infection	4 (5.19)	3 (11.11)	0 (0.0)	1 (3.22)	0 (0.0)	0.272
Fever of unknown origin	2 (2.59)	1 (3.70)	0 (0.0)	1 (3.22)	0 (0.0)	
Nephrostomy due to ureteral injury	1 (1.29)	0 (0.0)	1 (10.0)	0 (0.0)	0 (0.0)	
Postoperative pulmonary dysfunction	1 (1.29)	0 (0.0)	1 (10.0)	0 (0.0)	0 (0.0)	
Postoperative acute coronary syndrome	1 (1.29)	1 (3.70)	0 (0.0)	0 (0.0)	0 (0.0)	
Late postoperative outcomes, n (%)						
No	61 (79.22)	22 (81.48)	8 (80.0)	24 (77.41)	2 (22.22)	0.566
Yes	16 (20.08)	5 (18.52)	2 (20.0)	7 (22.58)	2 (22.22)	
Types of late postoperative outcomes, n (%)						
De novo urinary incontinence	2 (2.59)	1 (3.70)	0 (0.0)	1 (3.22)	0 (0.0)	0.443
De novo cystocele/rectocele	5 (6.49)	0 (0.0)	2 (20.0)	2 (6.46)	1 (11.11)	
De novo pelvic pain	1 (1.29)	1 (3.70)	0 (0.0)	0 (0.0)	0 (0.0)	
Recurrence of vaginal vault prolapse	8 (10.38)	3 (11.11)	0 (0.0)	4 (12.90)	1 (11.11)	

The results are significant at p<0.05.
LLS: Laparoscopic lateral suspension, LPSC: Laparotomic sacrocolpopexy, LSSC: Laparoscopic sacrocolpopexy, n: Number, SSLP: Sacrospinous ligamentopexy

Minimally invasive approaches, such as laparoscopic or robotic approaches, are preferred to LPSC surgery when a trained surgical team and appropriate equipment are available, and similar outcomes have been reported after POP surgery in both the short and medium-term (10-12). No difference has been reported between laparotomic and laparoscopic approaches for sacrocolpopexy in the context of its therapeutic effect on apical vaginal prolapse and incidence of recurrence has been reported (11-13). However, LSSC is considered superior to LPSC in terms of the quantity of blood loss, LOS, and risk of ileus (12,13). In our study, although the LOS was similar between patients who underwent LSSC and LPSC, surgical site infection, de novo urinary incontinence, pelvic pain, and VVP recurrence were predominant in the LPSC group, whereas urinary tract injury and *de novo* cyctorectocele were observed in the LSSC group. Recurrence of cystocele and mesh-related complications were reported to occur more frequently in the LSSC group than in the LPSC group (14).

Although sacrocolpopexy is the preferred laparoscopic technique for the treatment of POP, its duration is longer and the learning curve is steep (15). In the current study, the parameter that differed most between the groups was the surgery duration. The first randomized controlled trial on a comparison of LSSC and SSLP was designed in 2017; the long-term (5-year) outcomes of this study will reveal the advantages and disadvantages of sacrocolpopexies performed with minimally invasive approaches over ligament fixation (16). McFerrin et al. (17) and Costantini et al. (18) showed that the transition from open to robotic surgery was feasible for POP without compromising improvements in pelvic anatomy, urinary incontinence, and injury to the lower urinary tract.

New techniques with minimally invasive approaches are required to shorten the surgery duration (19). In the LLS technique, which was first described by Dubuisson and Chapron (1998) (20) for POP, presacral injuries were rare because there were no surgical dissections in the presacral region. In the current study, LLS was a minimally invasive approach that resulted in a shorter surgery duration than LSSC, while late postoperative outcomes were similar. Chatziioannidou et al. (21) reported that the rate of repeat surgery using the LLS technique was 5.1%, and the recovery rate was 87.3%. Dubuisson and Chapron (20) reported a success rate of 86% and a recurrence rate of 4.6% using the LLS technique with a shorter follow-up time of 18 months. Mereu et al. (22) reported that 6.4% of female patients undergoing the LLS series underwent repeat surgery for POP at a 2-year follow-up. However, these studies included a small number of patients who underwent hysterectomy (19-21), and the incidence of intraoperative complications, such as urinary tract, presacral, and lower gastrointestinal tract injuries, was also lower. In the current study, no intraoperative complications were detected, and only one case each had *de novo* cystocele/rectocele and recurrence of VVP. LLS surgery, an effective procedure to treat anterior and apical POP, has been related to a lower risk of mesh-related complications, and, therefore, widely preferred for VVP surgery by reducing other potential complications (19-21). However, further randomized controlled studies are needed to validate these findings.

In the current study, the number of patients recruited was small due to the strict exclusion criteria, the low number of patients who underwent postoperative follow-up and therefore could be included in the calculation of recurrence rates, and the generally infrequent incidence of VVP surgery. Due to the retrospective study design, the number of patients who underwent laparoscopic techniques, such as LSSC and LLS, was small. On the other hand, all of the cases had a history of hysterectomy and similar POP-Q stages, which can be considered a major strength of the study. Despite these shortcomings, to the best of our knowledge, this has been the first study to compare four surgical techniques (LPSC, LSSC, LLS, and SSLP) for VVP. In addition, this study may draw the attention of clinicians towards minimally invasive techniques for VVP surgery, and encourage randomized controlled studies on this subject.

Conclusion

The optimal surgical technique for VVP continues to be a challenge, as VVP surgeries are difficult, protracted, and require surgical skills. Although SSLP and LPSC are no longer preferred when other minimally invasive surgeries are feasible, they had similar surgical outcomes to the other techniques in the current study. LLS is a reliable technique that can shorten the surgical duration of LSSC. The current study found that the four techniques for VVP had similar surgical outcomes and recurrence rates, with the only difference in the duration of surgery (SSLP < LPSC < LLS < LSSC). However, considerable developments have been observed in VVP surgery in recent years due to improvements in technological and surgical skills. Further studies are necessary to evaluate factors that can improve the safety and reliability of VVP surgery.

Ethics

Ethics Committee Approval: This cross-sectional, retrospective study was approved by the Local Ethics Committee of the University of Health Sciences Türkiye, Etlik Zübeyde Hanım Obstetrics and Gynecology Training and Research Hospital, Ankara, Türkiye (approval no: 05/42, date: 21.04.2022).

Informed Consent: Retrospective study.

Authorship Contributions

Surgical and Medical Practices: A.A., B.Ş., A.K.Ö., T.K.T., V.K., Concept: A.A., V.K., Y.E.Ü., Design: A.A., V.K., Y.E.Ü., Data Collection or Processing: A.A., B.Ş., A.K.Ö., T.K.T., Analysis or

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References

1. Ulubay M, Kinci MF, Pay RE, Dede M. Electrosurgical bipolar vessel sealing versus conventional clamping and suturing for total abdominal hysterectomy. Pak J Med Sci. 2022;38:156-161.
2. Hur HC, Donnellan N, Mansuria S, Barber RE, Guido R, Lee T. Vaginal cuff dehiscence after different modes of hysterectomy. Obstet Gynecol. 2011;118:794-801.
3. Iaco PD, Ceccaroni M, Alboni C, et al. Transvaginal evisceration after hysterectomy: is vaginal cuff closure associated with a reduced risk? Eur J Obstet Gynecol Reprod Biol. 2006;125:134-138.
4. Marchionni M, Bracco GL, Checcucci V, et al. True incidence of vaginal vault prolapse. Thirteen years of experience. J Reprod Med. 1999;44:679-684.
5. No authors listed. Pelvic Organ Prolapse: ACOG Practice Bulletin, Number 214. Obstet Gynecol. 2019;134:126-142.
6. Vandendriessche D, Sussfeld J, Giraudet G, Lucot JP, Behal H, Cosson M. Complications and reoperations after laparoscopic sacrocolpopexy with a mean follow-up of 4 years. Int Urogynecol J. 2017;28:231-239.
7. Kinci MF, Sezgin B, Arslaner MO, Akin Gökbel D, Gökbel İ, Sivaslioğlu AA. Anatomical and symptomatic outcomes in patients with Le Fort colpocleisis with or without hysterectomy. BMC Womens Health. 2022;22:286.
8. Schulten SFM, Claas-Quax MJ, Weemhoff M, et al. Risk factors for primary pelvic organ prolapse and prolapse recurrence: an updated systematic review and meta-analysis. Am J Obstet Gynecol. 2022;227:192-208.
9. Murphy AM, Clark CB, Denisenko AA, D'Amico MJ, Vasavada SP. Surgical management of vaginal prolapse: current surgical concepts. Can J Urol. 2021;28:22-26.
10. Dieter AA. Pelvic Organ Prolapse: Controversies in Surgical Treatment. Obstet Gynecol Clin North Am. 2021;48:437-448.
11. Geoffrion R, Larouche M. Guideline No. 413: Surgical Management of Apical Pelvic Organ Prolapse in Women. J Obstet Gynaecol Can. 2021;43:511-523.
12. Campbell P, Cloney L, Jha S. Abdominal Versus Laparoscopic Sacrocolpopexy: A Systematic Review and Meta-analysis. Obstet Gynecol Surv. 2016;71:435-442.
13. De Gouveia De Sa M, Claydon LS, Whitlow B, Dolcet Artahona MA. Laparoscopic versus open sacrocolpopexy for treatment of prolapse of the apical segment of the vagina: a systematic review and meta-analysis. Int Urogynecol J. 2016;27:3-17.
14. Ichikawa M, Kaseki H, Akira S. Laparoscopic versus abdominal sacrocolpopexy for treatment of multi-compartmental pelvic organ prolapse: A systematic review. Asian J Endosc Surg. 2018;11:15-22.
15. Akbaba E, Sezgin B. Modified laparoscopic lateral suspension with a five-arm mesh in pelvic organ prolapse surgery. BMC Womens Health. 2021;21:244.
16. Coolen AWM, van IJsselmuiden MN, van Oudheusden AMJ, et al. Laparoscopic sacrocolpopexy versus vaginal sacrospinous fixation for vaginal vault prolapse, a randomized controlled trial: SALTO-2 trial, study protocol. BMC Womens Health. 2017;17:52.
17. McFerrin C, Pilkington JE, Pilet H, Frilot CF, Gomelsky A. Abdominal versus robotic sacral colpopexy: A detailed analysis of outcomes. Neurourol Urodyn. 2021;40:1811-1819.
18. Costantini E, Mearini L, Lazzeri M, et al. Laparoscopic Versus Abdominal Sacrocolpopexy: A Randomized, Controlled Trial. J Urol. 2016;196:159-165.
19. Sezgin B, Kıncı MF, Akbaba E, Akın MN, Gökbel İ, Sivaslıoğlu AA. Comparison of laparoscopic high and vaginal uterosacral ligament suspension in the management of apical prolapse. Pelviperineology. 2021;40:183-189.
20. Dubuisson J, Chapron C. Laparoscopic iliac colpo-uterine suspension for the treatment of genital prolapse using two meshes: a new operative laparoscopic approach. J Gynecol Surg. 1998;14:153-159.
21. Chatziioannidou K, Veit-Rubin N, Dällenbach P. Laparoscopic lateral suspension for anterior and apical prolapse: a prospective cohort with standardized technique. Int Urogynecol J. 2022;33:319-325.
22. Mereu L, Tateo S, D'Alterio MN, et al. Laparoscopic lateral suspension with mesh for apical and anterior pelvic organ prolapse: A prospective double center study. Eur J Obstet Gynecol Reprod Biol. 2020;244:16-20.