

The hybrid technique of pelvic organ prolapse treatment: apical sling and subfascial colporrhaphy

Dmitry Shkarupa¹ · Nikita Kubin¹ · Alexey Pisarev¹ · Anastasiya Zaytseva¹ · Ekaterina Shapovalova²

Received: 1 December 2016 / Accepted: 28 January 2017
© The International Urogynecological Association 2017

Abstract

Introduction and hypothesis The majority of patients with cystocele undergoing reconstructive surgery have combined defects of pubocervical fascia and uterosacral/cardinal ligament complex. In this regard, the simultaneous correction of both defects is rational. Furthermore, decreasing the use of synthetic materials in pelvic floor surgery is an important goal. The aim was to evaluate the objective and subjective cure rate of a hybrid technique: bilateral sacrospinous fixation using modern monofilament synthetic tape (apical sling) combined with the original technique of subfascial colporrhaphy.

Materials and methods This prospective study involved 148 women suffering from cystocele combined with apical prolapse. We used the following criteria to evaluate the results of surgical treatment: results of the vaginal examination (POP-Q system), urodynamic tests, bladder ultrasound, special questionnaires (Pelvic Floor Distress Inventory [PFDI-20], Pelvic Floor Impact Questionnaire [PFIQ-7], Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire [PISQ-12], International Consultation on Incontinence Modular Questionnaire Short Form [ICIQ-SF]). All listed parameters were determined before the surgery and at control examinations at 1, 6, and 12 months after the treatment.

Results At the 1-year follow-up, the objective cure rate for prolapse was 97.8%. The rate of anatomical recurrence was 2.2% (3 out of 138). The following long-term complications were noted: de novo urgency and stress urinary incontinence de novo in 2 (1.4%) and 4 (2.9%) patients, respectively. Comparison of the scores by the questionnaires also revealed a significant improvement in the quality of life in the postoperative period. Patient satisfaction rate was 97.1%.

Conclusion The hybrid technique is an effective and safe uterus-sparing method for patients with advanced forms of cystocele combined with apical prolapse. This technique improves voiding function, quality of life, and provides a high satisfaction rate.

Keywords Hybrid technique · Apical sling · Subfascial colporrhaphy

Introduction

Pelvic organ prolapse (POP) is an increasing problem for older women. By the age of 80 the risk of indications for surgical treatment of POP is about 20% [1]. Cystocele is the most common form of prolapse and presents in more than one third of the women, regardless of uterine status [2]. The traditional method of cystocele correction is anterior colporrhaphy, a technique that addresses the second level of support, according to De Lancey [3]. At the same time, Rooney et al. reported that expressed forms of anterior vaginal wall descent in 80% are combined with significant defects at the apical level [4]. Moreover, according to recent studies, isolated surgical correction of the apical prolapse simultaneously improved anterior vaginal wall descent in half of the patients [5, 6].

There are many techniques designed to address apical prolapse, the most studied of which are the following:

✉ Ekaterina Shapovalova
katerina_andmed@mail.ru

¹ Department of Urology, Saint-Petersburg State University Clinic, 154, Fontanka Embankment, Saint-Petersburg 190103, Russia

² Department of Gynecology, Saint-Petersburg State University Clinic, 154, Fontanka Embankment, Saint-Petersburg 190103, Russia

sacrocolpopexy (by open and laparoscopic access), sacrospinous fixation, McCall culdoplasty, and uterosacral ligament fixation (USLF). All these approaches have a number of limitations (such as long operation time or high cost) and are often accompanied by intraoperative complications such as massive blood loss and postoperative complications (erosions, defecation dysfunction, postoperative ileus, ureteral obstruction, dyspareunia) [7–11]. Furthermore, laparoscopic sacrocolpopexy requires complex technical equipment and a long learning curve.

In 1997, Petros first described the method of apical prolapse repair with transvaginal synthetic mesh: infracoccygeal sacropexy [12]. The first results of this technique were published in 2001, more popularly known as “posterior intravaginal slingplasty” (PIVS) [13, 14]. It had shown promising anatomical results, but was not widespread in its classical form owing to the imperfect polyfilament (microporous) structure of the original tape (IVS; Tyco Healthcare), which caused multiple severe mesh-associated complications [15]. After a few years, the idea of PIVS developed into the technologies of Apogee, Elevate (AMS), and Prolift (Ethicon). Correction of the apical compartment in these techniques is achieved by the fixation of the mesh sheets to sacrospinous ligaments bilaterally. To preserve the advantages of mesh techniques and reduce the risk of tissue trauma and mesh-related complications, the evolution of reconstructive surgery followed the path of reducing the implant size and fixation points. One of the representatives of this direction is “minimal mesh” repair, using the Uphold system (Boston Scientific) [16].

The primary aim of this study was to evaluate the objective cure rate of a hybrid technique: bilateral sacrospinous fixation with modern monofilament synthetic tape: an apical sling combined with the original technique of subfascial colporrhaphy. The secondary aim was to estimate the impact of the surgery on voiding function, quality of life, and the patient’s satisfaction.

Materials and methods

One hundred forty-eight patients with POP stage III or IV—apical prolapse combined with anterior vaginal wall descent—were consecutively admitted to the Department of Urology of the University Clinic of Saint-Petersburg State University. All women selected a uterus-sparing method of reconstruction, they were provided with information about risks and possible complications, and the patients signed an informed consent. This prospective study was registered and approved by the ethics committee of the Clinic. Patients underwent reconstruction of the pelvic floor in accordance with the proposed method from September 2014 to April 2015. Exclusion criteria were: cervical elongation (a cervix extending beyond 2 cm of the uterosacral ligament insertion points), previous or

current pelvic organ cancer, cervical dysplasia, undiagnosed irregular vaginal bleeding, endometriosis and chronic pelvic pain, and stress urinary incontinence (SUI). Main preoperative data were collected including complaints, demographic data, and a medical and personal history. Previous cystocele repair, utero-vaginal prolapse repair, mid-urethral slingplasty had been performed in 6.0%, 2.6%, and 3.4% respectively (Table 1).

All patients had a physical examination and comprehensive preoperative urogynecological and urodynamic tests, and ultrasound measurement of post-voiding residual volume (PVR). Urge incontinence was found in 21% (31 out of 148). Prolapse staging was recorded according to the POP quantification (POP-Q) system [17]. Postoperative examination was performed by physicians of the Department of Urology 1, 6, and 12 months after surgery and then annually. Anatomical success of the surgery was defined as the absence of stage 2 prolapse or higher. Voiding function was assessed by comparing pre- and postoperative data. The quality of life (QoL) was estimated at each follow-up appointment by the use of questionnaires translated and validated in Russia: Pelvic Floor Distress Inventory (PFDI-20), Pelvic Floor Impact Questionnaire (PFIQ-7), Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire (PISQ-12), and the International Consultation on Incontinence Modular Questionnaire Short Form (ICIQ-SF) [18]. To reduce interviewer bias, physicians blinded to the surgical procedure assisted the patients in filling out questionnaires. Patient’s satisfaction was assessed using a separate dichotomous (yes/no) questionnaire item. Also, a satisfaction criterion was the answer to the question: “Would you recommend the procedures to friends?”

Surgical technique

All surgical procedures were performed by two staff urologists experienced in this technique of POP repair. Patients received intravenous antibiotics (amoxicillin clavulanate according to

Table 1 Baseline patient’s demographics

Parameter	N = 148
Age, years, mean ± SD	62.21 ± 9.19
BMI, kg/m ² , mean ± SD	27.49 ± 4.41
The number of childbirths, mean ± SD	1.93 ± 0.67
Menopause, n (%)	134 (90.6)
Sexually active women, n (%)	54 (36.5)
Previous surgeries, n (%)	
Suburethral sling	5 (3.4)
Prolapse repair with mesh	2 (1.3)
Anterior/posterior colporrhaphy	9 (6.0)
Laparohysteropexy	2 (1.3)

weight) within an hour before the operation. Surgery was performed under general anesthesia. After the deep hydrodissection of the anterior vaginal wall starting from the apex (40 cc of sterile saline), a full-thickness midline vaginal incision was made. The incision was made at least 3 cm away from the external orifice of the urethra and 2 cm from the cervical canal. The paravaginal avascular space was entered. The vaginal edges were grasped by the Allis clamps and blunt subfascial dissection was continued bilaterally. The key part of the dissection was the clear visualization of the internal surface of the pubocervical fascia: it looked glossy and the vaginal vessels were seen through it. In most cases, the fibers of detrusor muscle were determined in the anterior part of the incision. Thus, there was visual control of the bladder during all the following steps. The bilateral blunt dissection toward the sacrospinous ligaments was then continued. When the ischial spines were reached bilaterally, the sacrospinous ligaments and rectum were palpated as well. Skin incisions were made in the perianal area about 7 cm laterally and 3 cm downward from the anus. Then, the introducer with the tunneler on it passed bilaterally through the skin incisions and the ischio-rectal space, and perforated the sacrospinous ligaments not less than 2 cm medially from the ischial spine (Fig. 1).

The tuneler was then pushed from the introducer into the vaginal incision and left in the ligament and ischio-rectal space

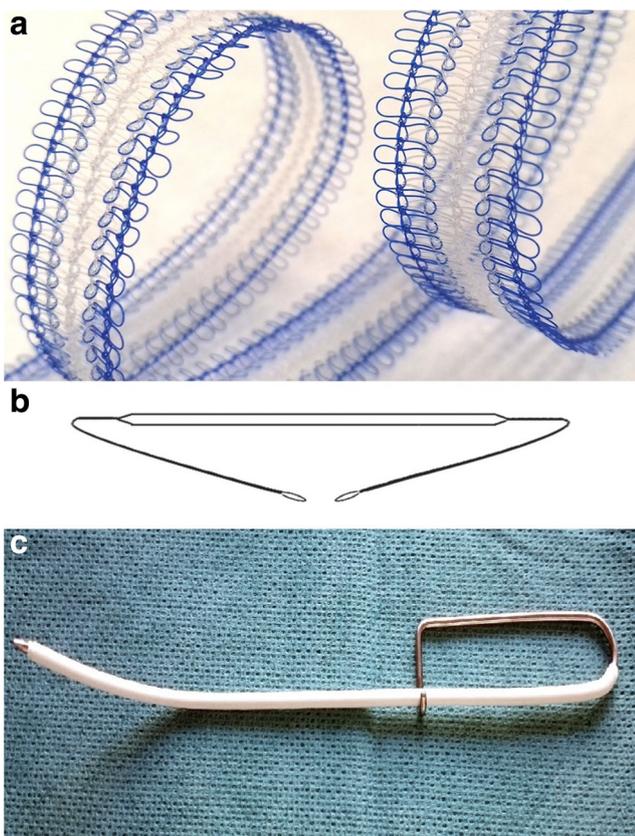


Fig. 1 a, b Tape UroSling 1. c The introducer with the tunneler

bilaterally. The monofilament polypropylene woven unstretchable tape (60 g/m²) with atraumatic edges 1.5 cm x 45 cm (UroSling 1; Lintex, St Petersburg, Russia), with the help of its applicators, was inserted through the tunnellers bilaterally (Fig. 2). The rectum was checked for intactness and the sling was fixed to the anterior surface of the cervix with three interrupted USP 1 nonabsorbable sutures. We used the Ftorex nonabsorbable polyester braided suture, coated with fluoropolymer pseudo-monofilament (Lintex). The latter has no capillarity, no micropores, and the same biocompatibility as monofilament polypropylene suture, but it is soft and needs only three knots to fix the suture. The long tails of the third suture were left to be tied later to the subfascial colporrhaphy continuous suture, which was applied onto the internal surface of the vaginal (endopelvic) fascia according to the Halsted–Zoltan technique similar to intradermal cosmetic continuous suture. In most cases (when the vaginal wall was thick enough not to perforate) we used for this step a nonabsorbable suture, Ftorex USP1; otherwise we used an absorbable braided polyglycolic suture: PGA USP1. Then, the Halsted–Zoltan suture was pulled and the fascia was closed (Fig. 3). Finally, the colporrhaphy suture was tied to the fixing suture of the apical sling, which had been left with long tails previously. Thus, a single construction of the repaired anterior vaginal wall was created and the apical sling was fixed to the sacrospinous ligaments bilaterally.

The vagina was closed using a continuous USP 2/0 PGA suture. When the skin ends of the apical sling were pulled out, the whole construction moved upward to the correct position. The rectum lumen was then examined to check that it had not been obstructed by the apical sling. Cystoscopy was performed routinely to ensure that there was no bladder injury. Vaginal packing and a urethral catheter were placed and removed within 24 h. The patient was mobilized on the day of the surgery.

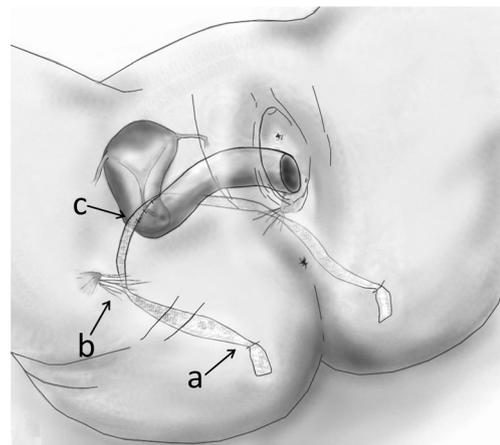
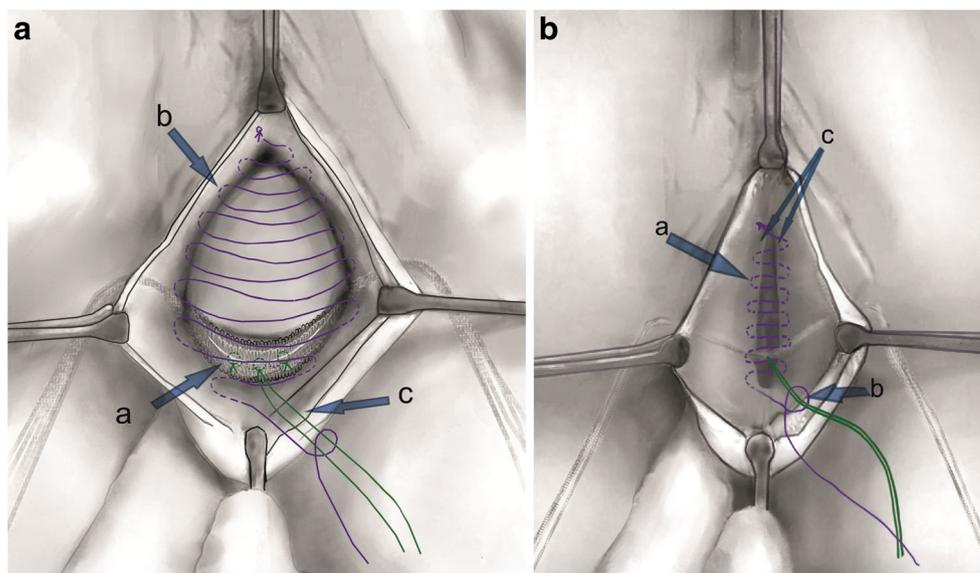


Fig. 2 Position of the apical sling: a the tape UroSling, b sacrospinous ligament, c semicircumference of the anterior cervix uteri

Fig. 3 **a** Subfascial anterior colporrhaphy with a Halsted–Zoltan suture: *a* the tape, *b* Halsted–Zoltan suture, *c* long tail of the third fixing ligature of the tape. **b** Creating a single construction: *a* the colporrhaphy suture is pulled, *b* the fixing ligature and the suture are tied together, *c* approximation of the internal surface of the fascia



These clinical results were analyzed using STATISTICA for Windows software (version 10, StatSoft, Tulsa, OK, USA). A set of descriptive statistics was used for the quantitative parameters: mean values, standard deviation, and minimum and maximum values. QOL scale and POP-Q system were processed by comparing the initial data and values obtained during observation. They were compared using the sign and Wilcoxon signed rank tests. Frequency characteristics of qualitative parameters were analyzed using nonparametric Chi-squared and Fisher's tests. We considered a value of $p < 0.05$, conventional for medical sciences, as the criterion for the statistical reliability of the conclusions.

Results

One hundred forty-eight women were successfully operated. Mean surgery duration from incision to conclusion of the entire procedure was 32 ± 11 min (range 20–65); mean volume of intraoperative blood loss was 40 ± 10 ml (range 20–120). The average duration of bladder drainage was 1.07 ± 0.69 days (maximum 4), and duration of hospital stay was 2.1 ± 0.75 days (maximum 4). No cases of intraoperative damage of the bladder or rectum were registered, or clinically significant bleeding requiring transfusion. The main postoperative complications are shown in Table 2.

Twelve-month follow-up data were available for 138 patients (93.2%). Four of the 148 withdrew consent and 6 failed to appear at the 1-year appointment (all showing cure at 6 months). Objective cure rate was 97.8% (135 out of 138). Anatomical anterior recurrence was noted in 3 subjects (2.2%): in 1 patient after 6 months postoperatively and in 2 patients after a year. However, in only 2 patients did the

prolapse stage exceed 2 (according to the POP-Q). Significant improvements were seen in POP-Q points Aa, Ba, and C, with no significant change seen in total vaginal length (TVL). The mean Ba score changed from 2.1 ± 1.6 at baseline to -2.7 ± 0.9 at the 12-month follow-up ($p < 0.001$). The mean C score changed from 3.2 ± 2.7 at baseline to -7.9 ± 0.5 at follow-up ($p < 0.001$; Table 3).

Preoperatively, 7 (4.7%) patients had residual urine volume equal to or more than 100 ml (maximum 307 ml); 12 months postoperatively, residual volume did not exceed 50 ml in any of the subjects. Statistically significant ($p < 0.001$) improvement in the peak flow rate (Qmax) was also observed (Table 3). Previous urgent symptoms were resolved in 68% (21 out of 31). De novo urgency developed in the postoperative period in 7 patients (4.7%). Symptoms of overactive bladder regressed in most patients under administration of anticholinergic drugs. De novo SUI was observed in 12 women (8.3%). A suburethral sling was inserted into 8 patients within 6 months for this pathological condition, and 4 patients refused the proposed surgical treatment because of mild symptoms. Buttock pain was observed in 14 subjects (9.7%) and resolved with nonsteroidal anti-inflammatory drugs used for 2 weeks postoperatively. Urinary retention occurred in 2 patients (1.4%), and was resolved with an indwelling transurethral Foley catheter after 3 days. No cases of mesh erosion, defecation dysfunction (constipation/incontinence) or chronic pelvic pain were observed at the 12-month follow-up.

Most of the patients (136; 98.6%) filled out all the questionnaires (Table 3). Comparative analysis of the scores revealed significant improvement of postoperative QOL. Table 3 shows that all summary PFDI-20 scores significantly decreased after surgery ($p < 0.001$). POPDI-6 focused on prolapse-related QOL, which improved from 38.3 ± 20.9 to 6.3 ± 7.1 ($p < 0.001$). Quality of

Table 2 Postoperative complications

Complications	1 month (<i>n</i> = 144)	6 months (<i>n</i> = 144)	12 months (<i>n</i> = 138)
Hematoma in the surgical area (<200 ml), <i>n</i> (%)	6 (4.2)	0	0
Urinary retention ($V_{RU} > 100$ ml), <i>n</i> (%)	2 (1.4)	0	0
De novo urgency, <i>n</i> (%)	7 (4.7)	2 (1.4)	2 (1.4)
De novo SUI, <i>n</i> (%)	12 (8.3)	4 (2.8)	4 (2.9)

SUI stress urinary incontinence

sexual life was assessed according to PISQ-12, and also significantly improved after surgery. Initially, 54 women were sexually active, 7 of them (12.9%) told about dyspareunia (defined as “always” or “usually” in question 5 of the PISQ-12, “Do you feel pain during sexual intercourse?”), which regressed in the postoperative period in 5 (71.4%) of them. De novo dyspareunia developed in 4 patients (7.4%). In addition, 6 women (9.6%) who were not sexually active before surgery, returned to sexual activity 1 year after treatment.

Assessment of patient satisfaction showed that 97.1% (134 out of 138) were satisfied with the operation and 97.8% (135 out of 138) said that they would recommend the procedures to friends.

Table 3 Results (anatomy, function, quality of life)

	Baseline (mean \pm SD score)	12-month (mean \pm SD score)
POP-Q measurements		
Aa	0.3 \pm 1.1	-2.3 \pm 0.8***
Ba	2.1 \pm 1.6	-2.7 \pm 0.9***
Ap	-2.5 \pm 0.9	-2.6 \pm 0.6
Bp	-2.3 \pm 1.7	-2.7 \pm 0.8
C	3.2 \pm 2.7	-7.9 \pm 0.5***
D	0.9 \pm 2.1	-8.8 \pm 0.7***
TVL	8.7 \pm 0.8	8.9 \pm 0.7
PVR (ml)	20.2 \pm 43.5	1.6 \pm 7.1***
Q max (ml/s)	20.4 \pm 11.4	25.2 \pm 6.2***
PFDI-20	95.1 \pm 42.1	22.5 \pm 18.3***
PFIQ-7	71.5 \pm 46.9	23.2 \pm 14.9***
PISQ-12	26.3 \pm 1.4	33.6 \pm 0.6***
ICIQ-SF	5.5 \pm 4.5	1.4 \pm 1.3***

TVL total vaginal length, PVR post-voiding residual volume, PFDI-20 Pelvic Floor Distress Inventory, PFIQ-7 Pelvic Floor Impact Questionnaire, PISQ-12 Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire, ICIQ-SF International Consultation on Incontinence Modular Questionnaire Short Form

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (statistically significant differences)

Discussion

The aim of reconstructive surgery in cases of POP is to restore normal anatomy and physiology of the pelvic organs so that patients can return to a high quality of life. This study included patients suffering from advanced stages of cystocele combined with apical prolapse. Cystocele repair is the most common type of POP surgery, with anterior colporrhaphy the most frequently chosen surgical approach [19]. However, isolated correction of the anterior compartment is associated with a high recurrence rate, which is up to 70%, according to some authors [20]. The original colporrhaphy technique implies interrupted absorbable sutures laid on the external surface of the fascia. In our proposed method, colporrhaphy of the musculofascial layer of the vagina is performed with a one-thread continuous suture on the internal surface of the fascia. With this technique, the ligature is isolated from the vaginal mucosa. This allows the use of nonabsorbable sutures if the fascia is thick enough, providing greater durability.

Recent studies have reported the close relationship between apical prolapse and anterior vaginal vault descent [4–6]. The authors found that correction of the apical level of support was needed in patients with advanced stages of cystocele. In addition to widespread traditional methods, our technique is aimed at restoration of apical prolapse. Sacrocolpopexy has a high long-term cure rate, but it is associated with a long operation time (90–382 min) and a risk of life-threatening hemorrhage (up to 1,100 ml) [7, 21, 22]. Robotic-assisted and laparoscopic access requires pneumoperitoneum and the Trendelenburg position, which may limit the use of this method in patients with somatic comorbidity. There were no cases of significant blood loss in our study, and the short operation time and intravenous anesthesia make this technique available for the majority of patients. The most common postoperative complication of sacrospinous ligament fixation is the high rate of de novo prolapse in anterior compartment approaches (20–33%) and dyspareunia caused by vaginal narrowing in 10–17.6% [7–9]. No cases of de novo prolapse were observed in our study; de novo dyspareunia was found in 4 subjects (7.4%). Our technique, in contrast to the original unilateral sacrospinous

fixation, allows the central position of the apical compartment of the vagina to be maintained and eliminates the need for extensive dissection in the area of the sacrospinous ligament. Generally, apical suspension procedures, such as sacrocolpopexy and USLF, are often performed with concomitant hysterectomy; the latter increases the operation time, hospital stay duration, and the risk of intraoperative complications [23]. McCall culdoplasty is recommended as a preventive procedure at the time of hysterectomy. The effectiveness of USLF is about 64.5%; ureteral occlusion, one of the most common complications of this procedure, is reported in 3.7–9% [10, 24]. The rate of fecal incontinence and dyspareunia after USLF is reported to be up to 12.5% and 20.8% respectively [10].

The closest alternative to our technique is a method of bilateral sacrospinous hysteropexy using a “minimal” mesh kit (UpHold system, Boston Scientific). Vu et al. reported a recurrence rate of approximately 28.3% and mesh exposure in 1.9% [16]. Jirschele et al. published a success rate of this method about 97% for the apical and anterior compartments; nevertheless, the extrusion and reoperation rates were 6.52% and 7.53% respectively [23]. A serious limitation of the studies mentioned above is the absence of data on operation time and intraoperative complications. A similar success rate (94%) was reported in 2016; however, mesh exposure was in 1.7%, leading to 3 surgical interventions [25]. The authors mentioned 3 cases of bladder perforation, 1 case of hemorrhage >1,000 ml and 2 mesh removals because of pain. In our study, there were no accidental bladder or bowel perforations, or mesh exposure. The latter was achieved by using modern monofilament mesh and the subfascial technique of colporrhaphy, which isolates the tape from the mucosa.

The simultaneous correction of apical and anterior compartments, without additional procedures, is obtained using large-size mesh kits, such as Elevate Apical and Anterior (AMS). The effectiveness of this system after a 12-month follow-up was reported to be about 90–98%; adverse events included mesh exposure in 3–5% and urinary retention in 11.9% [19, 26]. In comparison with the Elevate system, our hybrid technique provided similar anatomical results with minimal synthetic material. Simultaneous correction of two compartments was achieved by a “single construction” created with a subfascial continuous colporrhaphy suture fixed to the anterior apical sling, which we believe is a key element in cystocele repair.

There are some limitations of this study. First, the short follow-up period (12 months) is not long enough to draw a strong conclusion. Second, this study is nonrandomized. Strengths include the prospective study design and the use of validated questionnaires for the measurement of subjective outcomes. Longer term studies are planned to draw firm conclusions.

Conclusion

The hybrid technique of bilateral sacrospinous fixation with modern monofilament synthetic tape (apical sling) combined with the original technique of subfascial colporrhaphy is an effective and safe uterus-sparing method for patients with advanced forms of cystocele combined with apical prolapse. This technique improves voiding function, quality of life, and provides a high level of patient satisfaction.

Compliance with ethical standards

Financial disclaimer/conflict of interest None.

References

1. Wu JM, Matthews CA, Conover MM, Pate V, Jonsson Funk M. Lifetime risk of stress urinary incontinence or pelvic organ prolapse surgery. *Obstet Gynecol*. 2014;123(6):1201–6.
2. Hendrix SL, Clark A, Nygaard I, Aragaki A, Barnabei V, McTiernan A. Pelvic organ prolapse in the Women’s Health Initiative: gravity and gravidity. *Am J Obstet Gynecol*. 2002;186(6):1160–2.
3. DeLancey JO. Anatomic aspects of vaginal eversion after hysterectomy. *Am J Obstet Gynecol*. 1992;166:1717–24.
4. Rooney K, Kenton K, Mueller ER, et al. Advanced anterior vaginal wall prolapse is highly correlated with apical prolapse. *Am J Obstet Gynecol*. 2006;195:1837–40.
5. Summers A, Winkel LA, Hussain HK, et al. The relationship between anterior and apical compartment support. *Am J Obstet Gynecol*. 2006;194:1438–43.
6. Elliot CS, Yeh J, Comiter CV, Chen B, Sokol ER. The predictive value of a cystocele for concomitant vaginal apical prolapse. *J Urol*. 2013;189:200–3.
7. Maher CF, Qatawneh AM, Dwyer PL, Carey MP, Cornish A, Schluter J. Abdominal sacrocolpopexy or vaginal sacrospinous colpopexy for vaginal vault prolapse: a prospective randomized study. *Am J Obstet Gynecol*. 2004;190:20–6.
8. Holley RL, Vamer RE, Gleason BP, Apfel LA, Scott S. Sexual function after sacrospinous ligament fixation for vaginal vault prolapse. *J Reprod Med*. 1996;41:355–358.
9. Choi KH, Hong JY. Management of pelvic organ prolapse. *Korean J Urol*. 2014;55:693–702.
10. Margulies R, Rogers MA, Morgan DM. Outcomes of transvaginal uterosacral ligament suspension: systematic review and metaanalysis. *Am J Obstet Gynecol*. 2010;202:124–34.
11. Siff L, Barber MD. Native tissue prolapse repairs: comparative effectiveness trials. *Obstet Gynecol Clin North Am*. 2016;43(1):69–81.
12. Petros PE. New ambulatory surgical methods using an anatomical classification of urinary dysfunction improve stress, urge, and abnormal emptying classification of urinary dysfunction. *Int Urogynecol J*. 1997;8:270–8.
13. Petros PE. Vault prolapse II: restoration of dynamic vaginal support by infracoccygeal sacropexy, an axial day-case vaginal procedure. *Int Urogynecol J*. 2001;12:296–303.
14. Farnsworth BN. Posterior intravaginal slingplasty (infracoccygeal sacropexy) for severe posthysterectomy vaginal vault prolapse—a preliminary report on efficacy and safety. *Int Urogynecol J Pelvic Floor Dysfunct*. 2002;13:4–8.

15. Capobianco G, Donolo E, Wenger JM, et al. Efficacy and 9 years' follow-up of posterior intravaginal slingplasty for genital prolapse. *J Obstet Gynaecol Res.* 2014;40(1):219–23.
16. Vu MK, Letke J, Jirschele K, et al. Minimal mesh repair for apical and anterior prolapse: initial anatomical and subjective outcomes. *Int Urogynecol J.* 2012;23(12):1753–61.
17. Bump RC, Mattiasson A, Bo K, et al. The standardization of terminology of female pelvic organ prolapse and pelvic floor dysfunction. *Am J Obstet Gynecol.* 1996;175:10–7.
18. Shkarupa DD, Kubin ND, Peshkov NO, Komyakov BK, Pisarev V, Zaytseva AO. Russian version of questionnaires for life quality assessment in patients with pelvic organ prolapse and stress urinary incontinence. *Exp Clin Urol.* 2016;1.
19. Rapp DE, King AB, Wolters BR, Wolters JP. Comprehensive evaluation of anterior elevate system for the treatment of anterior and apical pelvic floor descent: 2-year follow-up. *J Urol.* 2014;191:389–94.
20. Gomelsky A. Vaginal prolapse repair suture repair versus mesh augmentation: a urology perspective. *Urol Clin North Am.* 2012;39(3):335–42.
21. Winters JC, Cespedes RD, Vanlangendonck R. Abdominal sacral colpopexy and abdominal enterocele repair in the management of vaginal vault prolapse. *Urology.* 2000;56:55–63.
22. Pan K, Zhang Y, Wang Y, Wang Y, Xu H. A systematic review and meta-analysis of conventional laparoscopic sacrocolpopexy versus robot-assisted laparoscopic sacrocolpopexy. *Int J Gynaecol Obstet.* 2016;132(3):284–91.
23. Jirschele K, Seitz M, Zhou Y, Rosenblatt P, Culligan P, Sand P. A multicenter, prospective trial to evaluate mesh-augmented sacrospinous hysteropexy for uterovaginal prolapse. *Int Urogynecol J.* 2015;26:743–8.
24. Paz-Levy D, Yehay D, Neymeyer J, Hizkiyahu R, Weintraub AY. Native tissue repair for central compartment prolapse: a narrative review. *Int Urogynecol J.* 2016; DOI: [10.1007/s00192-016-3032-6](https://doi.org/10.1007/s00192-016-3032-6)
25. Altman D, Mikkela TS, Beck KM, et al. Pelvic organ prolapse repair using Uphold™ Vaginal Support System: a 1-year multicenter study. *Int Urogynecol J.* 2016;27:1337–45.
26. Su TH, Lau HH, Huang WC, Hsieh CH, Chang RC, Su CH. Single-incision mesh repair versus traditional native tissue repair for pelvic organ prolapse: results of a cohort study. *Int Urogynecol J.* 2014;25(7):901–8.