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ORIGINAL ARTICLE

Back to the future: vaginal hysterectomy and Campbell uterosacral ligaments suspension for urogenital prolapse

Caroline Pettenati[1] · Florence Cour[1] · Pierre-Olivier Bosset[1] · Titouan Kennel[2] · Adrien Vidart[1] · Thierry Lebret[1]

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Abstract

Introduction and hypothesis To evaluate vaginal hysterectomy (VH) associated with vaginal native tissue repair (VNTR) using Campbell uterosacral ligament suspension (C-USLS) for the treatment of predominant uterine prolapse associated with cystocele.

Methods We conducted a retrospective monocentric study including patients who underwent VH and C-USLS, without concomitant mesh, for primary urogenital prolapse between January 2011 and June 2018. We evaluated the anterior and apical prolapse recurrence rate, using a composite criterion (symptomatic, asymptomatic recurrence, POP-Q stage ≥ 2). We analyzed 2-year recurrence-free survival using the Kaplan-Meier method. Univariate and multivariate analyses were performed to identify variables associated with recurrence. Secondary outcomes included postoperative complications, lower urinary tract symptoms (LUTS) and sexual satisfaction.

Results Ninety-four patients were included. Eighty-three (88.3%) and 65 (69.1%) patients had stage ≥ 3 uterine prolapse and cystocele, respectively. Mean follow-up was 36 months. Prolapse recurrence rate was 21.3% including 3.2% of cystocele. Two-year recurrence-free survival was 80%. Age, body mass index, POP-Q stage and associated surgical procedure were not significantly associated with recurrence. Early complications were reported for 20 patients (21.2%), mostly grade ≤ 2 (95%). De novo LUTS were reported in 11 cases (11.7%). Preoperative stress urinary incontinence and urgency were cured for 12 (80%) and 29 (80.6%) patients, respectively. Sexual satisfaction rate for patients with preoperative sexual activity was 95.8%.

Conclusion C-USLS following VH as primary treatment for predominant uterine prolapse with associated cystocele is a safe procedure with satisfying mid-term functional results. This VNTR could be an alternative in light of the worldwide market withdrawal of actual vaginal mesh.

Keywords Cystocele · Hysterectomy · Non-mesh · Urogenital prolapse · Uterosacral ligaments · Vaginal native tissue repair

Introduction

Pelvic organ prolapse (POP) with predominant uterine prolapse was historically managed by vaginal hysterectomy (VH) with native tissue repair. However, the recurrence rate was notably high, particularly for anterior vaginal wall prolapse, with a rate of up to 40–70% [1]. Vaginal synthetic mesh has been developed with the aim to reduce the recurrence rate. Vaginal synthetic mesh use significantly grew until 2008 when the US Food and Drug Administration (FDA) gave a first safety alert because of vaginal retraction and mesh exposure. In April 2019, the FDA ordered market withdrawal of all vaginal synthetic mesh until new studies with high levels of evidence [2]. Indeed, no study with long follow-up or sufficient scientific quality could demonstrate that the benefit/risk balance favored vaginal mesh repair compared to native tissue repair.

This anti-mesh era lets us presume the increase of vaginal native tissue repair (VNTR) procedures to manage urogenital prolapse. We aimed to retrospectively analyze our mid-term results of urogenital prolapse with predominant uterine prolapse associated with cystocele, managed by VH and cystocele VNTR, using uterosacral ligaments suspension (USLS) according to the Campbell procedure (C-USLS).

✉ Caroline Pettenati
c.pettenati@hopital-foch.org

[1] Department of Urology, Hopital Foch, University of Versailles-Saint-Quentin-en-Yvelines, 40 rue Worth, 92150 Suresnes, France

[2] Department of Clinical Research and Innovation – DRCI, Hopital Foch, University of Versailles-Saint-Quentin-en-Yvelines, 40 rue Worth, 92150 Suresnes, France

Materials and methods

Patients We conducted a retrospective monocentric study including all patients who underwent VH and cystocele VNTR using the C-USLS procedure for primary urogenital prolapse with predominant uterine prolapse associated with cystocele between January 2011 and June 2018. Patients were aged > 18 years old and gave their informed consent for the study. The study was approved by the local ethics committee (Institutional Review Board No. IRB00012437) and by the French national commission of informatics and freedoms (CNIL No. 2,213,325 v 0). Inclusion criteria were symptomatic urogenital prolapse including uterine prolapse or uterine cervix prolapse with hypertrophic cervix extension, grade ≥ 2 associated with cystocele of any grade, according to POP-Quantification System (POP-Q). Exclusion criteria were concomitant vaginal or laparoscopic mesh implant, including any device for urinary incontinence, and follow-up < 1 year. Preoperative assessment included clinical examination (urinary, sexual and digestive symptoms, evaluation of patent or occult stress urinary incontinence, prolapse stage in lying and standing positions, at rest and with effort, vaginal examination), pelvic and kidney-bladder ultrasounds, urodynamic testing and cervical smear test.

Surgical procedure We performed VH with cystocele VNTR using C-USLS. Hysterectomy was explained to patients and performed with their informed consent.

Preoperative preparation

Urine cytobacteriological examination was mandatory and needed to be sterile or treated with an adapted antibiotic for at least 48 h. We did not perform bowel preparation.

Peroperative sequence

- Prophylactic intravenous antibiotic was administered according to the national Anesthesia Society guidelines. A Foley urinary catheter was placed.
- Cystocele dissection: We performed an anterior inverted-T colpotomy following infiltration of the anterior vaginal wall using adrenaline diluted in saline solution. We dissected the vesicovaginal lateral space up to each arcus tendineous fascia pelvis and dissected the cystocele from the uterus.
- Vaginal hysterectomy: Hysterectomy was performed using absorbable sutures for each individualized pedicle and ligament. The procedure was standardized and performed by three experimented surgeons, assisted by residents. The peritoneum was closed, leaving the pedicles extra-peritoneal. Uterosacral ligaments were individualized during hysterectomy, and ligation was performed using braided absorbable suture, which was left without a needle to be used for C-USLS after hysterectomy.
- C-USLS: Uterosacral ligaments were freed from any attachment to the vaginal wall to assure sufficient length and avoid vaginal shortening and shrinking during C-USLS. Lateral digital dissection between the vaginal wall and bladder neck was performed to approach the posterior surface of the superior pubic ramus, lateral to the pubic symphysis, at the insertion of the levator ani muscle (puborectalis and pubovaginalis muscles). The dissection allowed avoiding ureteral injury during C-USLS. Non-braided absorbable suture was placed with a needle holder at this anterolateral muscle insertion, one suture each for the right and left side, with three knots to fix the suture to the pubic ramus. Uterosacral ligaments were then crossed to be attached to each contralateral symphyseal insertion of the levator ani tendineous fascia, using the braided suture placed during USL ligation and tied with the contralateral non-braided suture placed on the levator ani muscle insertion. Suture strength and position on the ischiopubic ramus without vaginal wall transfixing were checked with a pull test.
- Associated procedures: Sacrospinous colpopexy (SSC) was not systematic and only performed to repair significant vaginal vault prolapse according to peroperative examination following C-USLS: unilateral SSC was performed, with a non-braided non-absorbable suture placed with a Capio automatic suture capturing device (Boston Scientific, Marlborough, MA, USA). Associated procedures were performed in case of rectocele, including levator ani myorrhaphy (until 2011), fascia recti plication or posterior colpoperineorrhaphy.
- End of procedure and postoperative instructions: Vaginal packing was placed at the end of surgery and removed at day 1 with the Foley urinary catheter. Postoperative instructions included medication to regulate the intestinal transit (macrogol, oral solution) and rest for 4 weeks (no sports activities, carrying of heavy loads or sexual intercourse).

Data collection and follow-up We assessed preoperative patients and prolapse characteristics, peroperative and early postoperative features. Prolapse stage was defined according to the International Urogynecological Association (IUGA)/International Continence Society (ICS) simplified POP-Q system. Postoperative consultations were planned at 4–6 weeks and at 1 year, with clinical examination, uroflowmetry and post-void residual urine volume measurements. Further consultations were planned according to patients' complaints. Postoperative data were collected regarding prolapse

recurrence, lower urinary tract symptoms (LUTS) and sexual function. Data were retrospectively collected through chart review, and all patients were called to complete missing data and assess occurrence of symptomatic urogenital prolapse recurrence, LUTS or sexual symptoms, leading to medical advice. End of follow-up was noted at recurrence or at last medical evaluation.

Analysis The objective of our study was to evaluate the apical and anterior vaginal wall prolapse recurrence rate following C-USLS, using a composite criterion including symptomatic and asymptomatic recurrence (POP-Q ≥ 2). Associated objectives were to evaluate redux surgery for prolapse recurrence, delay between primary surgery and recurrence, early postoperative complications according to the Clavien-Dindo classification (≤ 30 days) and the IUGA/ICS joint terminology and classification of the complications related to native tissue female pelvic floor surgery, postoperative LUTS including stress urinary incontinence (SUI) and urgency, and postoperative sexual function [3].

Statistics We analyzed the 2-year recurrence-free survival using the Kaplan-Meier method. Uni- and multivariate analyses were performed using the Cox model to identify variables associated with recurrence. The factors included in the analysis were age at diagnosis, body mass index (BMI), preoperative apical and anterior POP-Q stage, and associated surgical procedures on the apical or posterior vaginal wall. Statistical tests were performed as two-sided with a p value < 0.05 considered significant. Statistics were calculated using the SAS v9.4 software.

Results

Between January 2011 and June 2018, 205 patients underwent interadnexal VH for POP, including 116 procedures associated with C-USLS. Twenty-two patients had a follow-up < 1 year and were excluded. Our study included 94 patients corresponding to the inclusion criteria (Fig. 1). Preoperative clinical characteristics are described in Table 1. Median age at surgery was 74 (44–89) years. Eighty-three patients (88.3%) had POP-Q stage ≥ 3 uterine prolapse, and 65 patients (69.1%) had stage ≥ 3 associated cystocele. Cystoceles were combined, associating lateral and central cystoceles. Rectocele was associated in 16 cases (17%).

Prolapse recurrences are reported in Table 2. The mean follow-up was 36 months. The recurrence rate was 21.3% (n = 20) with a 2-year recurrence-free survival of 80% (Fig. 2). In three cases, the anterior vaginal wall prolapse recurrence rate was 3.2%, including one isolated cystocele (1.1%) and two (2.1%) associated with vaginal vault prolapse. Other prolapse recurrences included 17 vaginal vault prolapses (18.1%), 4 (23.5%) of which had initial SSC during the VH + C-USLS procedure. Median time to recurrence was 12 months. Age at diagnosis, BMI, POP-Q stage and associated surgical procedures on the apical or posterior vaginal wall were not significantly associated with recurrence in uni- and multivariate analysis (Table 3). Two patients (9.1%) chose a pessary as an alternative treatment for recurrence. Redux surgery was performed in 11 cases (11.7%). Eight laparoscopic sacral colpopexies were proposed; six were performed; two patients chose to delay surgery because of minimal discomfort associated with prolapse recurrence. VNTR with SSC was performed for five patients (5.3%).

Per- and postoperative characteristics are described in Table 4. VH and C-USLS were associated with apical or posterior VNTR in 25 cases (26.6%), including 16 SSCs (17%). Median length of hospital stay was 2 days (1–6). Early complications were reported for 20 patients (21.2%), including mostly Clavien-Dindo grade ≤ 2 (19 patients, 95%). Bleeding complications were anemia without transfusion (IUGA/ICS Classification 7Aa/T1/S1) in five cases (5.3%), transfusion (7Aa/T1/S1) in three cases (3.2%), pelvic hematoma (7Aa/T1/S3) in five cases (5.3%) and vaginal bleeding (1B/T2/S1) in one case (1.1%). Pelvic hematomas due to anemia were diagnosed by CT scan, and none required surgery. Four patients (4.2%) presented postoperative urinary retention with spontaneous resolution at urinary catheter removal 24 h later (4B/T1/S3). Two patients (2.1%) received antibiotic treatment for postoperative fever associated with positive cytobacteriological examination of the urine (4B/T1/S3). One patient (1.1%) required urinary diversion with a double-J stent due to unilateral hyperalgesic renal colic without identified obstruction cause on CT scan (4Cb/T1/S5). The double-J stent was removed at 1 month without further complication.

LUTS results are reported in Table 5. De novo urinary symptoms were reported in 11 cases (11.7%) including 6 cases (6.4%) of de novo SUI with midurethral sling required in 2 cases (2%). Persistent postoperative SUI was reported in 3 cases (3.2%), requiring corrective surgery in 2 cases (2%). Among the 15 and 36 patients with preoperative SUI and urgency respectively 12 (80%) and 29 (80.6%) were cured following VH + C-USLS procedure. One patient had persistent dysuria with hypocontractile bladder and a high bladder capacity, as observed in her preoperative urodynamic testing. Considering sexual function, 24 patients (25.5%) declared preoperative sexual activity and did not report postoperative impairment due to prolapse surgery, except one patient who presented late vaginal stenosis at 6 months, with secondary dyspareunia. Stenosis was successfully managed with vaginal self-dilatation leading to sexual function recovery.

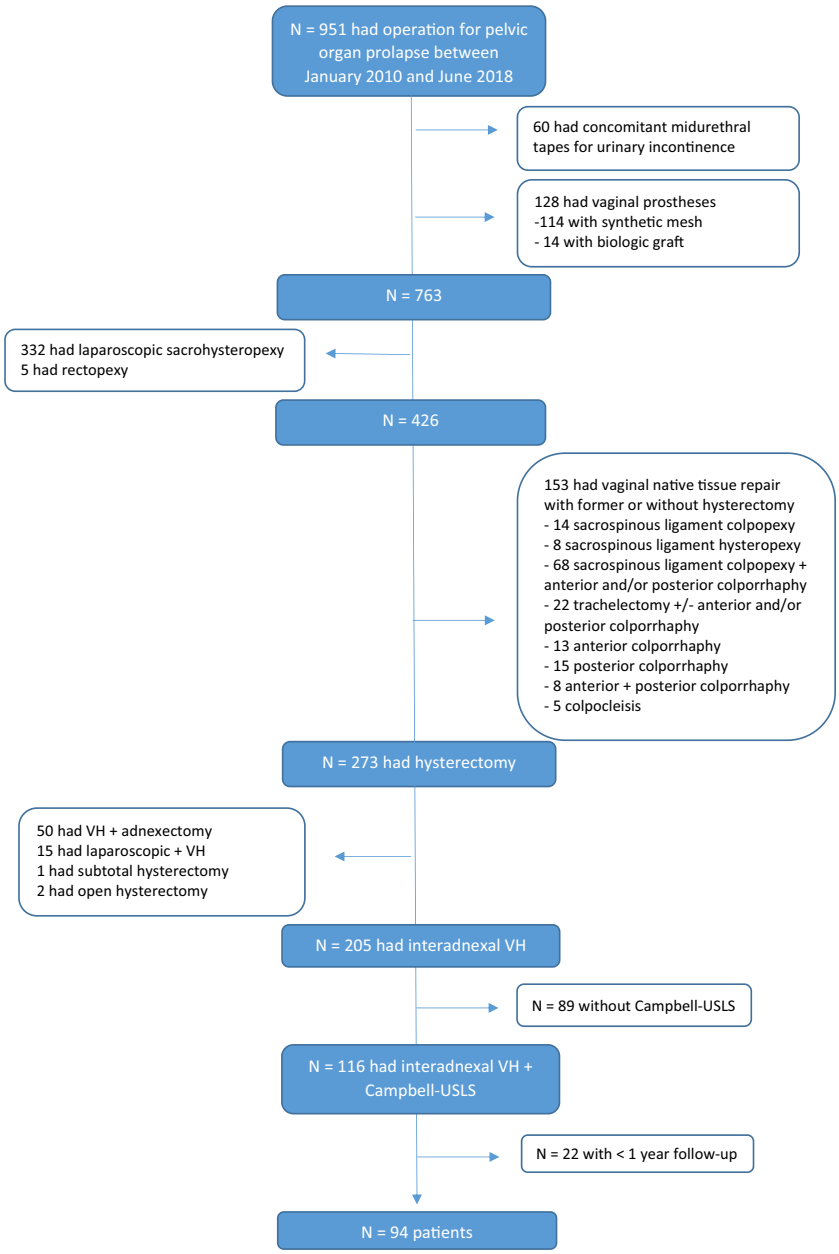

Fig. 1 Flow chart. N = number, VH = vaginal hysterectomy, USLS = uterosacral ligament suspension

Discussion

Our prolapse recurrence rate following VH and cystocele VNTR with the C-USLS procedure for urogenital prolapse was 21.3%, including 3.2% cystocele recurrence (isolated or associated with vaginal vault prolapse). Our 2-year recurrence-free survival was 80%. Several series reported a recurrence rate of the anterior vaginal wall as high as 40%–70% [1]. Interestingly, a recent review reported success rates for anterior vaginal wall repair with native tissue ranging from 35 to 97%, meaning 3% to 65% of failure [4]. This wide range of results derived from diversity in technique, outcome criteria and success/recurrence definition. Previous reports of high recurrence rates using native tissue repairs left these techniques by the wayside while mesh-augmented repairs were developed during the 1990s.

Urogenital prolapse management faced a turning point in 2019 due to the withdrawal of vaginal mesh from the market, particularly affecting cystocele vaginal repair and leading to a renewed interest in VNTR. Since 2008 and the first FDA security alert, flourishing literature witnessed to the rebirth of historical cystocele VNTR [5]. Despite better anatomic results using mesh-augmented cystocele repair compared to VNTR, distrust progressively raise grew related to early and late complications including mesh exposure, vaginal retraction and the reoperation rate due to complications. In a 2016 Cochrane review, the authors concluded that evidence did not support the use of mesh repair for anterior vaginal wall

Table 1 Overall preoperative clinical characteristics

Characteristics	Overall
Patients (*n*)	94
Age (years), mean (± SD_a)	72 (± 10)
Body mass index (kg/m^2), mean (± SD)	24.9 (± 4)
Breast cancer antecedent, *n* (%)	10 (1.1%)
Sexual activity, *n* (%)	
• Yes	24 (25.5)
• No	46 (49)
• Not reported	24 (25.5)
Prolapse classification$_b$	
Cystocele, *n* (%)	
• Stage ≤ 2	29 (30.9)
• Stage 3	43 (45.7)
• Stage 4	22 (23.4)
Uterine prolapse, *n* (%)	
• Stage 2	11 (11.7)
• Stage 3	22 (23.4)
• Stage 4	61 (64.9)
Predominant uterine cervix prolapse, *n* (%)	
• Stage ≥ 3	11 (11.7)
Rectocele, *n* (%)	16 (17)
• Stage ≤ 2	14 (14.9)
• Stage 3	0
• Stage 4	2 (2.1)

[a] Standard deviation

[b] According to the Pelvic Organ Prolapse Quantification System

prolapse because of increased morbidity [6]. Many reviews were based on underpowered studies with heterogeneous outcomes definition, evaluation bias and multiple concomitant procedures. Due to the evidence lack and complications rate, mesh withdrawal was requested by national health care institutions [2, 7].

Table 2 Prolapse recurrence

Patients	*N* =94
Prolapse recurrence, *n* (%)	20 (21.3)
Body mass index (kg/m^2), mean (± SD_a)	24.9 (± 4)
Symptomatic recurrence	17 (18.1)
Asymptomatic recurrence	3 (3.2)
Prolapse recurrence, *n* (%)	
• Anterior vaginal wall	3 (3.2)
- Cystocele alone	1 (1.1)
- Associated with vaginal vault prolapse	2 (2.1)
• Apex (without associated cystocele)	17 (18.1)
- Vaginal vault prolapse alone (stage$_b$ ≤3)	11 (11.7)
- Associated with rectocele	3 (3.2)
- Vaginal vault eversion (stage 4)	3 (3.2)
Time to recurrence (months), mean (± SD)	18.6 (± 19.8)
Surgery for recurrence, *n* (%)	11 (11.7)
Follow-up (months), mean (± SD)	35.9 (± 25.5)

[a] Standard deviation

[b] According to the Pelvic Organ Prolapse Quantification System

Multiple alternatives exist to manage predominant uterine prolapse with uterine cervix prolapse and associated cystocele. Two strategies led us to choose VH and C-USLS procedure.

First was the choice of VH rather than the uterine preservation technique. When applicable and accepted by the patient, we chose to perform total VH as our patients mean age was 72 years old and uterine prolapses were mainly POP-Q stage ≥ 3 (n = 83, 88.3%) with secondary cystocele. Patients with symptomatic prolapse had a significant higher rate of cervix elongation (RR 0.10; $CI_{95\%}$ 0.03, 0.16; p = 0.005) [8]. Conservative treatment would not cure hypertrophic cervix extension and stage 3–4 uterine prolapse. In a recent evidence-based review by Hoke et al., there were no differences in recurrence rate between conservative uterine procedures and VH with VNTR, except for women with stage 4 prolapse who might be at higher risk of recurrence following sacrospinous hysteropexy [9]. Milani et al. reported that transvaginal uterosacral hysteropexy was associated with a significantly higher apical recurrence rate compared to vaginal hysterectomy, mostly related to cervical elongation (21.2% versus 1.9%, p = 0.002), with a higher reoperation rate (13.5% versus 1.9% p = 0.04) [10]. Laparoscopic sacrocolpopexy with subtotal hysterectomy would not cure hypertrophic cervix extension as mesh fixation is on the uterine isthmus and trachelectomy would then be needed [11]. In a 2016 Cochrane review, no clear conclusion could be reached comparing uterine-preserving surgery versus VH for uterine prolapse. One RCT suggested that prolapse awareness was less likely after VH than after abdominal sacrohysteropexy (RR 0.38 CI_{95} 0.15–0.98) [12]. Accordingly, a meta-analysis by Oliveira et al. reported a significantly lower reoperation rate after VH compared to uterine-preserving procedures [13].

Second, the choice of USLS according to Campbell procedure was made. Cystocele associated with apical prolapse may be central, lateral or both. Central cystocele used to be managed by anterior colporrhaphy with plication of the pubocervical fascia in the midline and lateral cystocele by abdominal or vaginal paravaginal repair, with varying techniques and success rates [1]. Significant recurrence rates were reported, particularly for lateral cystocele recurrence and for preoperative stage ≥ 3 prolapse [14]. Uterosacral ligaments have been described as durable suspending structures in the management of uterine prolapse [15]. C-USLS was first described in 1948 by A.S Campbell [16]. The procedure allowed an anterior support for central cystocele by crossing ligaments on the midline under the bladder neck and for lateral cystocele by ligament attachment on bilateral pelvic sidewalls (at the posterior surface of the superior pubic ramus, lateral to the

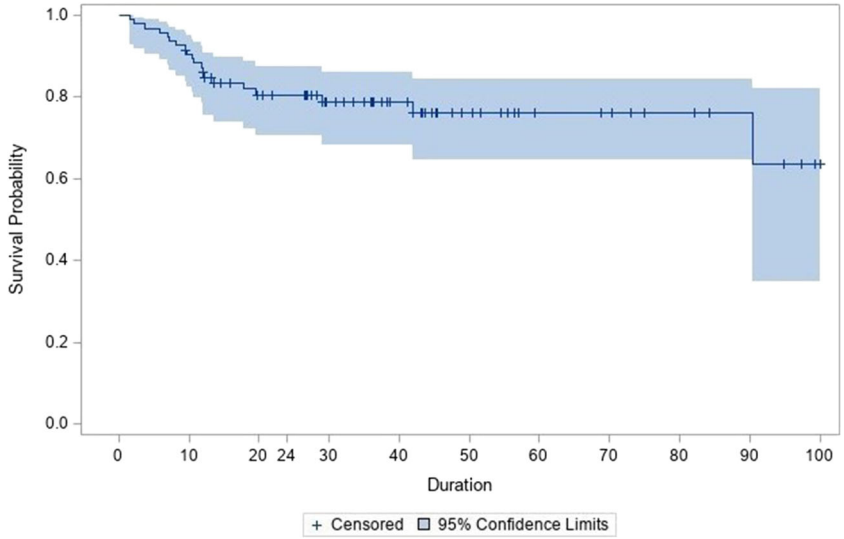

Fig. 2 Prolapse recurrence-free survival. Duration in months. Survival analysis was performed using the Kaplan-Meier method. Two-year recurrence-free survival was 80%

pubic symphysis). Advantages are using autologous tissue as a supportive sling—the uterosacral ligaments, which are easily individualized during VH, and eye-controlled fixation on each symphyseal insertion of the puborectalis and pubovaginalis muscle. Furthermore, we used absorbable suture, as permanent suture does not reduce prolapse recurrence risk and could cause exposure to suture erosion [17].

Postoperative complications were mostly ≤ grade 2, according to the Clavien-Dindo classification. Anemia, transfusion and pelvic hematoma were the main complications, and all were medically managed. Our mean operating time was 91.7 min, and three patients (3.2%) required postoperative transfusion. These results are concordant with published literature on VH morbidity [18]. Despite the reported postoperative complications, mean length of hospital stay remained short (2 days). We did not report ureteral injury. However, one patient required a double-J stent for postoperative lumbar pain without an identified obstructive cause on enhanced CT scan. A double stent was removed at 1 month without further complications.

Table 3 Factors associated with recurrence (multivariate analysis)

	OR_a [CI_b 95%]	*p* value
Age	1,01 [0.96; 1.07]	0.60
Body mass index	0.97 [0.89; 1.06]	0.55
Uterine prolapse POP-Q_c ≥3	0.87 [0.11; 6.98]	0.89
Cystocele POP-Q≥3	1.77 [0.70; 4.48]	0.23
Associated surgical procedure	0.64 [0.25; 1.69]	0.37

[a] Odds ratio

[b] Confidence interval

[c] Pelvic Organ Prolapse Quantification System

Our prolapse recurrence rate was 21.3%. Nineteen cases involved vaginal vault prolapse. This result could be explained by anterior vaginal wall correction using USLS favoring other vaginal wall frailty. In our cohort, SSC was only performed when vaginal vault prolapse was observed during the procedure; 16 patients (17%) had concomitant SSC, 4 of whom presented with vaginal vault prolapse recurrence (25%). Our vaginal vault prolapse recurrence rate led us to study the alternative of systematic SSC to strengthen our VNTR. However, neuropathic postoperative pain was

Table 4 Overall per- and postoperative characteristics

Characteristics	Overall
Patients (*n*)	94
Operating time (minutes), mean (± SD_a)	91.7 (± 31.8)
Associated surgical procedure, *n* (%)	25 (26.6)
• Sacrospinous colpopexy (Richter)	16 (17)
• Levator ani myorraphy	7 (7.4)
• Fascia recti plication	1 (1.1)
• Posterior colpoperineorrhaphy	4 (4.2)
None	69 (73.4)
Length of hospital stay (days), mean (± SD)	2 (± 1)
Early complications (≤ 30 $days)_b$, *n* (%)	20 (21.3)
• Grade I	10 (10.6)
• Grade II	9 (9.6)
• Grade III	1 (1.1)
•≥Grade IV	0
Uterus histological analysis, *n* (%)	
• Benign	90 (95.8)
• Low-grade CIN_c	2 (2.1)
• High-grade CIN	2 (2.1)

[a] Standard deviation

[b] According to the Clavien-Dindo classification

[c] Cervical intraepithelial neoplasia

Table 5 Lower urinary tract symptoms

Preoperative LUTS[a]	*n* (%)	Postoperative LUTS	*n* (%)
Patients	*N*=94	Patients	*N*=94
SUI[b]		SUI	
• None	79 (84%)	• De novo	6 (6.4)
• Patent	9 (9.6)	• Resolved	12 (80)
• Occult	6 (6.4)	• Persistent	3 (20)
Urgency/UUI[c]		Urgency/UUI	
• None	58 (61.7)	• De novo	5 (5.3)
• Urgency	36 (38.3)	• Resolved urgency	29 (80.6)
• UUI	13 (13.8)	• Persistent urgency	7 (19.4)
		• Resolved UUI	8 (61.5)
		• Persistent UUI	5 (38.5)
Voiding symptoms		Voiding symptoms	
• None	45 (47.9)	• De novo	0
• Dysuria	47 (50)	• Resolved	48 (98)
• Urinary retention	2 (2.1)	• Persistent dysuria	1 (2)

[a] Lower urinary tract symptoms

[b] Stress urinary incontinence

[c] Urgency urinary incontinence

reported to be as high as 9.7–12.5% in the SSC group compared to 6–7.8% in the USLS group in a randomized multicenter study [19]. In our study, the vaginal vault prolapse recurrence rate was 20% (19 patients in a cohort of 94 patients). Compared to the risk of chronic pain following SSC, we chose not to perform systematic SSC. Associated procedures on the posterior vaginal wall might also be a bias in the evaluation of recurrence rate.

Other recurrence risk factors such as preoperative high-grade prolapse and high body mass index (BMI) were also described [14, 20, 21]. In our cohort, most patients had POP-Q stage 4 uterine prolapse (64.9%) and POP-Q stage ≥ 3 cystocele (69%). In our uni- and multivariate analysis, POP-Q stage ≥ 3 and BMI were not significantly associated with recurrence.

Following VH and cystocele repair with the C-USLS procedure, recurrence management presented no particular difficulty. Indeed, laparoscopic sacral colpopexy could be proposed for cystocele and vaginal vault prolapse. For our three patients with cystocele recurrence, one was asymptomatic, and two were managed with sacral colpopexy. Secondary vaginal SSC was also an alternative for vaginal vault prolapse. The challenge lies in cystocele recurrence when a laparoscopic approach is impossible. This situation was one indication for vaginal mesh implantation. Mesh-augmented repairs should therefore not be forgotten, and it seems worthwhile to pursue their evaluation and surveillance in order to develop safe new devices.

We reported an 11.7% rate of de novo urinary symptoms including 6.4% de novo SUI, 2% requiring corrective surgery with mid-urethral slings. De novo urinary urgency was reported in 5.3% and managed with anticholinergic drugs. These rates seemed in the lower limit of ranges reported in previous reviews on VNTR [4, 6, 12, 22]. This could be explained by two factors. First, de novo SUI might be limited with Campbell procedure as this allowed median support by crossing the uterosacral ligaments in the midline. Interestingly, among our 15 patients with preoperative SUI, 12 (80%) did not have persistent postoperative SUI. Second, we did not implant a midurethral sling (MUS) during our procedure, even in case of preoperative patent or occult SUI. Indeed, as reported by Baessler et al. in a 2018 Cochrane review, SUI treatment might be postponed as no difference was observed for postoperative SUI between concomitant versus delayed MUS [23]. Rechberger et al. recently reported a significant decrease in urinary incontinence and urgency occurrence and a significant associated improvement of quality of life following VNTR [24]. Accordingly, among the 36 and 13 patients with preoperative urgency and urgency urinary incontinence, respectively, we reported resolution of these LUTS in 29 (80%) and 8 (61.5%) patients after VH and C-USLS.

Previous studies reported significant sexual function improvement following VNTR for urogenital prolapse [25, 26]. Furthermore, to our knowledge, there is no evidence that suggests differences in sexual function following VH versus the uterine-preserving technique [11]. For C-USLS, the uterosacral ligaments were dissected to be freed from vaginal attachments and avoid vaginal diameter reduction at the end of the procedure. In our study, among the 24 patients who declared preoperative sexual activity, none reported postoperative impairment except one who had secondary vaginal stenosis managed by vaginal self-dilatation with complete recovery. Sexual activity assessment was based on postoperative consultations and phone call interviews, which represented an evaluation bias.

Success rates depend on the recurrence definition. As previously reported, a standardized method to evaluate success of POP surgery has to be established [4]. Success and recurrence definitions could explain, at the time of historical VNTR of cystocele, which anatomic criteria were predominant, the high recurrence rates reported in literature and the decreased use of these techniques for the benefit of synthetic mesh. We reported recurrence as a composite criterion including symptomatic and asymptomatic recurrence with POP-Q stage ≥ 2 prolapse. According to Barber et al., subjective cure or absence of vaginal bulge symptoms were most strongly correlated with patients' assessment of improvement and treatment success, meaning patients' satisfaction [27]. Chmielewski et al. reanalyzed the study by Weber et al., using updated evaluation criteria (no prolapse beyond the hymen, symptomatic prolapse or surgery for recurrence). Failure rates for anterior colporrhaphy dropped from 70% to 11% [28]. During our follow-up, 17 patients (18.1%) presented symptomatic

recurrent POP, including 3 symptomatic cystoceles (3.2%). Eleven patients (11.7%) required redux surgery for recurrence including two cystoceles (2.1%). Similar reoperation rates were reported, ranging from 1 to 12% [28–30]. These data would be positively interpreted but we must consider limitations including follow-up length. Our median time to prolapse recurrence was 12 months. Furthermore, some patients with symptomatic or anatomic recurrent prolapse would fear redux surgery and delay care. In our cohort, two patients declared vaginal bulge symptoms and presented an isolated POP-Q stage 2 vaginal vault prolapse at clinical examination. Laparoscopic sacral colpopexy was proposed, but the two patients delayed surgery because of minimal symptomatic impact. POP surgery remains a functional surgery with the aim of answering patients' complaints and discomfort. If considering only symptomatic recurrence, which seems to be the most pertinent evaluation criterion over anatomic success, cystocele VNTR seems to offer satisfying results.

With a mean follow-up of 36 months, our study joined the published literature on mid-term results of cystocele VNTR. With a median follow-up of almost 9 years, Schiavi et al. reported a 25% and 17% global recurrence rates after VH and modified McCall culdoplasty or Shull suspension, respectively, for stage ≥ 3 uterine prolapse with or without coexisting other vaginal wall prolapse. Recurrence mainly occurred on the anterior vaginal wall [15]. We developed a database that will be regularly updated to present our long-term results of VH + C-USLS for urogenital prolapse. Prolapse recurrence is undoubtedly a known risk in a woman's lifetime. Follow-up and counseling are crucial. Major issues will be to prevent recurrence by developing knowledge on POP physiopathology and to manage recurrence from an actual non-mesh perspective.

Limitations of the study We acknowledge limitations in our retrospective study. First, prolapse staging was evaluated by the three operating surgeons without blinding for postoperative assessment, which could be an evaluation bias. However, a simplified POP-Q system was systematically used, and retrospective data collection was performed by a fourth surgeon. Our population included associated procedures (26.6%), such as SSC, which might be a bias in the evaluation of recurrence on the apical and anterior compartments. This could have negatively impacted our cystocele recurrence rate as SCC might favor anterior vaginal wall frailty. Being retrospective, our study was not designed to afford pre- and postoperative comparative data using validated functional questionnaires on POP and urinary symptoms and sexual quality of life. Sexual function evaluation was declarative and evaluated during consultation. In case of missing data, patients were called and asked if their sexual life had been positively or negatively impacted by the surgery. Finally, longer follow-up is needed to consider long-term results on the prolapse recurrence rate and functional urinary and sexual symptoms.

Conclusion

Uterosacral ligament suspension according to Campbell following vaginal hysterectomy as a primary treatment for symptomatic predominant uterine prolapse with associated cystocele, is a safe procedure with satisfying mid-term functional results. This vaginal native tissue repair could be an alternative in the context of the worldwide market withdrawal of vaginal mesh.

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Titouan Kennel: Data analysis.
Adrien Vidart: Project development, Manuscript editing.
Thierry Lebret: Project development, Manuscript editing.

Declarations

Conflict of interest Caroline Pettenati, Florence Cour and Titouan Kennel declare that they have no conflict of interest.
Pierre-Olivier Bosset is a consultant for Janssen.
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