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Effectiveness of an original vaginal plication of the uterosacral ligaments as vault prolapse prevention

Vesna ANTOVSKA

Aim: The aim of this study was to evaluate the effectiveness of an original vaginal plication of the uterosacral ligaments as a preventive procedure for recurrent vault prolapse.

Materials and methods: In total, 216 women with stage III/IV genital prolapse (POPQ system) underwent vaginal hysterectomy combined with uterosacral ligaments plication. First, the rectum was dissected from the posterior vaginal wall; next, 3 absorbable sutures were placed through both uterosacral ligaments; finally, a fourth suture was placed circularly through both uterosacral ligaments and the posterior vaginal margin. Statistical analysis made use of Student's paired test and Mantel-Haenszel's chi-square test.

Results: At the last follow-up (mean: 38.6 months), the following results were observed: 15 vault prolapses (15/216, 6.94%) (93.06% success rate); higher values for the most distal position of any part of the upper anterior wall from the vaginal cuff to a point located in the midline of the anterior vaginal wall 3 cm proximal to the external urethral meatus, the leading edge of the cervix and leading edge of the vaginal vault, the most distal position of any part of the upper posterior wall from the vaginal cuff to a point located in the midline of the posterior vaginal wall 3 cm proximal to the hymen, and total vaginal length (all with $P < 0.001$); apical segment reparation (211/216, 97.68%) including the most severe segment reparations (204/216, 94.44%); a decrease in urinary stress incontinence ($P < 0.001$), frequency ($P < 0.05$), urgency ($P < 0.001$), nocturia ($P < 0.001$), incomplete voiding ($P < 0.001$), weak stream ($P < 0.001$), and manual reposition to start voiding ($P < 0.001$); and a significant improvement in urodynamic investigations including bladder capacity, percentage of regular cystometry, and positive default transmission (all with $P < 0.01$). No postoperative hemorrhages or lesions of the ureter, bladder, or rectum were reported.

Conclusion: This new procedure could be sufficiently effective in preventing vault prolapse.

Key words: Vault prolapse, uterosacral ligaments, urinary incontinence

Introduction

Posthysterectomy vaginal vault prolapse has been treated with more than 40 different surgical procedures, which can be categorized as obliterative or reconstructive and which may be performed abdominally or vaginally. Open abdominal procedures, such as transabdominal sacropexy, are reserved for complex cases or failed procedures. There are 5 vaginal procedures for recurrent vault prolapse: sacrospinous ligament vaginal vault suspension,

endopelvic fascia vaginal vault fixation, iliococcygeal fixation, posterior pelvic shelf colpopexy, and the high McCall culdoplasty (1). Because of negative experiences in our practice with partial or complete prosthesis ejection after transabdominal lumbosacral colpopexy (12/41, 29.27%) and after intravaginal slingplasty tension-free prosthesis (7/32, 21.88%), we introduced our original vaginal plication of the uterosacral ligaments (VPUS) as a complementary preventive procedure during vaginal hysterectomy

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for vaginal vault suspension. We used the natural pelvic connective tissue as a supportive material.

There are several similar procedures that also use the natural pelvic connective tissue for vaginal vault suspension, such as the bilateral uterosacral ligament vaginal suspension (BUVS) (2), Shull-Bachofen suspension of the vaginal apex (ShBS) (3), the original McCall culdoplasty (4), and Karram's high uterosacral vaginal vault suspension (HUSS) (5). The BUVS and ShBS are very similar procedures, as the authors themselves have said. During BUVS and ShBS, the sutures are placed in the posteromedial aspect of each proximal uterosacral ligament separately and through the corresponding aspects of the pubocervical and rectovaginal fascia. During HUSS and McCall culdoplasty, the permanent sutures are placed through the uterosacral ligaments from side to side, incorporating the intervening peritoneum and the intervening upper part of the vaginal wall. During HUSS, 2 additional delayed, absorbable sutures are used to suspend the anterior and posterior vaginal wall as high as up to the uterosacral ligaments on each side. In fact, HUSS is the combination of 2 procedures, the ShBS and the McCall culdoplasty.

Our original VPUS is a procedure primarily for support restoration of the apical segment, especially for cases with complete exteriorization of the vaginal walls and tremendous weakening, stretching, or partial rupture of the vaginal ligaments and pelvic connective tissue.

The aim of this study was to evaluate the effectiveness and safety of this preventive procedure. We hypothesized that it would be both sufficiently safe and effective in the prevention of recurrent vault prolapse.

Materials and methods

The eligibility criterion for the present study was the presence of severe genital prolapse (GP) grade III/IV, requiring vaginal repair. In accordance with the CONSORT statement (6), the study was carried out at the Department of Urogynecology of the University Clinic of Gynecology and Obstetrics, Medical Faculty, Saints Cyril and Methodius University, Skopje, between 1 January 2006 and 31

December 2007. The experimental group consisted of patients with GP stage III/IV (GP group; $n = 216$). The experimental arm of our research was the application of our original VPUS during vaginal hysterectomy combined in all cases with our 4-corner deltoid-like vaginal suspension (4-CDVS) (7). In cases with a complete exteriorization of the vaginal walls, Rouhier's colpohysterectomy was performed. The control arm of our study was the presence or absence of recurrent prolapse (last follow-up: mean of 38.6 months). All patients were treated with a preoperative/postoperative transvaginal estrogen regimen of estradiol hemihydrate at 25 μg (Vagifem^R, Novo Nordisk): 7 days preoperatively it was administered as 1 tablet/day; in the first postoperative week 1 tablet/day was maintained; in the next 3 months, patients took 2 tablets/week. All procedures were performed by the author. With regard to the determination of sample size, every patient with stage III/IV GP admitted to our department in the abovementioned period was assessed for eligibility ($n = 243$). Of these, 10 patients were excluded because they refused to participate. A further 6 patients were excluded because of some contraindications: 3 cardiovascular disturbances, 1 pulmonary disease, and 2 cases of poorly regulated diabetes mellitus. A further 11 patients dropped out because they did not return for follow-up visits. A total of 216 patients completed the study. All subjects were given information in written form explaining the study and the procedure, and written consent was obtained. The study was a prospective observational clinical study. It was approved by the local research ethics committee of the Macedonian Association of Gynecologists and Obstetricians.

The specific objective of the present study was to evaluate the effectiveness of VPUS in terms of recurrent vault prolapse prevention. Our hypothesis was that this procedure would be safe and sufficiently effective for this application.

The preoperative evaluation consisted of: collecting demographic data (age, duration of postmenopausal age, parity, smoking, alcohol consumption, exercise, diet, body mass index, systolic/diastolic blood pressure, and profession); a complete evaluation for urinary incontinence including a structured questionnaire based on the

recommendations of the International Continence Society (8), Marshall's coughing test in an upright and lithotomic position as well as during artificial cervix repositioning to test for potential urinary stress incontinence (USI) after filling the bladder with 300 mL of 3% boric acid, and urodynamic assessment including retrograde provocative multichannel urethrocytometry, passive/dynamic urethral pressure profilometry, cough/Valsalva leak point pressure, simple uroflowmetry, postvoided residual urine; and, finally, a complete evaluation for GP including a structured questionnaire and pelvic organ prolapse quantification (POPQ) according to the guidelines of the International Continence Society (9), involving a pelvic examination in a lithotomic position while performing a Valsalva maneuver with maximal effort and a Pozzi maneuver with maximum pulling down of the cervix using the Pozzi clamp, for full GP development, after complete emptying of the bladder and rectum.

The standard surgical procedure was vaginal hysterectomy or Rouhier's colpohysterectomy combined with our 4-CDVS and our new VPUS as a preventive procedure for recurrent vault prolapse. The original 4-corner deltoid-like vaginal suspension can be seen in Figure 1 and the original vaginal plication of the uterosacral ligaments is shown in Figure 2.

The vaginal placcation of the uterosacral ligaments was performed as follows. First, a major dissection and excision of the intervening peritoneum between both uterosacral ligaments is performed as prevention for recurrent elythrocele and high closure of the pelvic peritoneum. Next, a major rectum dissection is performed from the posterior vaginal wall downwards to the apex of the rectovaginal septum, keeping the posterior leaf of the Halban vaginal fascia attached to the vaginal wall. This maneuver is very important for recurrent rectocele prevention. The inner loose ends of the uterosacral ligaments become quite naked and well visible in the lateral angles of the open vaginal vault. In cases where the upper part of the posterior vaginal wall is extremely relaxed, a triangular vaginal cutting is recommended. Next, 3 separate 1-0 delayed-absorbable sutures are placed through the necked part of both uterosacral ligaments, keeping a distance of 1.5 cm between

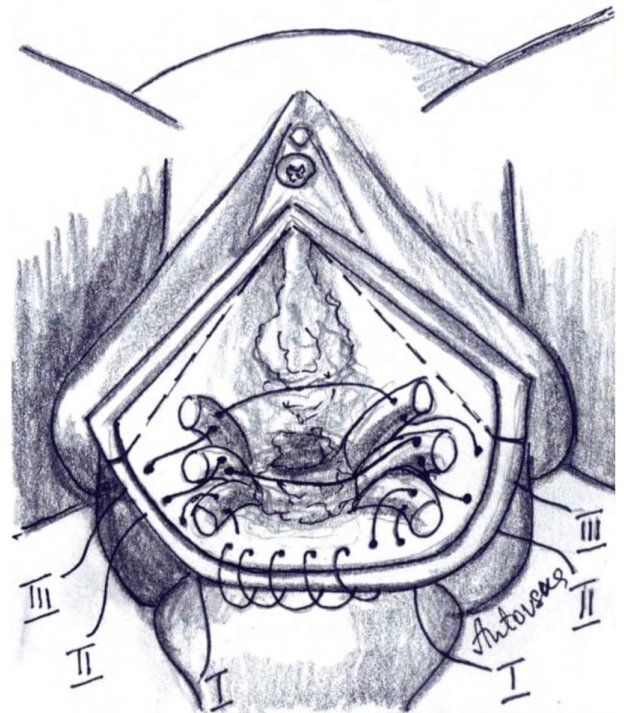


Figure 1. Our original 4-corner deltoid-like vaginal apex suspension: suture I, through both the uterosacral ligaments side-to-side and circularly through the posterior part of the vaginal apex; suture II, through both the cardinal ligaments side-to side and through lateral angles of the vaginal apex; suture III, through both the round ligaments side-to-side and through the anterior angle of the future vaginal apex.

the sutures. This stage provides a consolidation, shortening, and strengthening of both uterosacral ligaments, the final result of which will be a strong suspension of the vaginal apex, the horizontalization of the vagina for the prevention of recurrent vault prolapse and enterocele, and the shortening and reinforcement of the uterosacral ligaments. In the final step of the procedure, the fourth suture is placed through the loose edge of both uterosacral ligaments and the central third of the posterior vaginal margin for additional elevation/elongation of the vagina and reinforcement of the suspension.

We combined the VPUS with the 4-CDVS because we believed that the 2nd suture of the 4-CDVS provides a central vaginal position with its lateral forces and that the 3rd suture acts like a balance to the VPUS as a recurrent cystocele prevention. In all cases, we performed the suburethral duplication

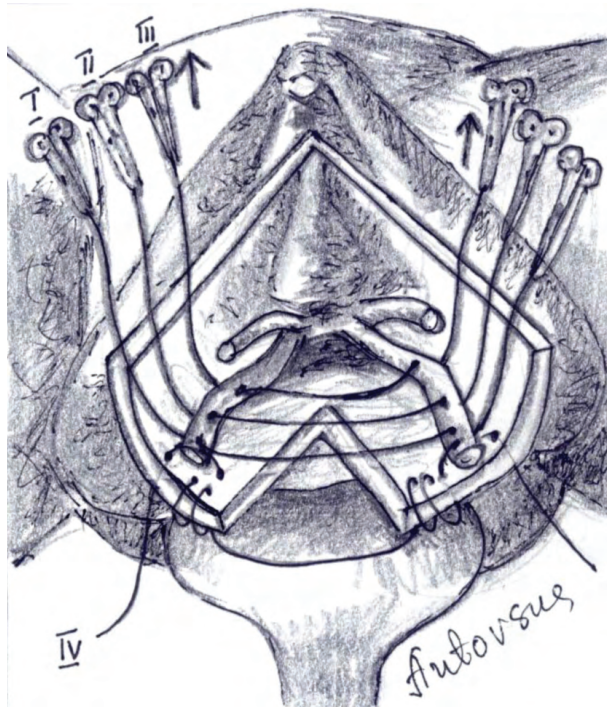


Figure 2. Our original vaginal plication of the uterosacral ligaments: 3 separate 1-0 delayed-absorbable sutures are placed through the necked part of both uterosacral ligaments in the side-to-side manner; the 4th suture is identical to the 3rd suture of the original 4-corner deltoid-like vaginal apex suspension.

of the vaginal wall according to Lazarevski (10) for postoperative stress incontinence prevention; this procedure is shown in Figure 3.

After finishing the vaginal hysterectomy but before performing VPUS, it was necessary to perform a wide mobilization of the bladder and urethra, together with their surrounding gentle fasciae, backwards and upwards. This step was performed with a midline longitudinal anterior colporrhaphy to the external urethral meatus and blunt finger dissection with a single thickness of gauze along the strong Halban vaginal fascia, which remained stuck to the vaginal epithelium. The wide bladder mobilization is crucial for the safety of the ureters, which are pushed 3–4 cm upwards behind the symphysis; with that maneuver, they stay out of the way of the sutures. This mobilization is very similar to that which is done during the radical trachelectomy. This step is also important for the successful repositioning of the ptotic bladder to its normal, high position for recurrent cystocele prevention. This wide bladder dissection is

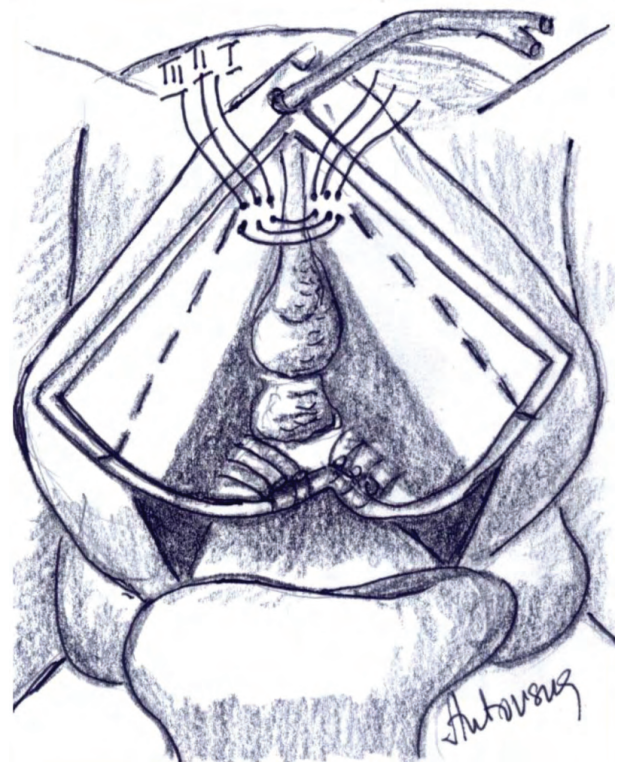


Figure 3. Suburethral duplication of the vaginal wall according to Lazarevski: plication of the strong vaginal endopelvic fascia of Halban with 3 slingoidal layers just underneath the bladder neck with 3 mattress 1-0 delayed-absorbable sutures, i.e. a pyramidal supporting wedge just underneath the bladder neck, which functions only during increased abdominal pressure.

the reason why we never performed intraoperative cystoscopy, but we had no intraoperative lesions of the bladder or ureter. It also provides a wide access to the Retzius space and bladder neck, which is crucial for performing the suburethral vaginal duplication according to Lazarevski, the procedure that we were obliged to perform as a preventive procedure for postoperative USI. At the third-month follow-up examination, we performed intravenous urography to exclude postoperative ureteral kinking or hydronephrosis. None of the patients had positive results.

After completing the operative procedure, we recommend a complete restoration of the inside-out vaginal eversion (especially in enormous procidentia) and aggressive pushing-up of the vaginal vault as an essential step that could play a crucial role in

achieving a higher postoperative vaginal length and lower incidence of the recurrent vault prolapse.

Figure 4 represents the possible mechanism of action of our VPUS. This mechanism could be a medial rotation of the inner ends and concomitant consolidation of the uterosacral ligaments, resulting in a strong vector force that lifts and fixes the vaginal vault in the upper position.

Postoperative care consisted of postoperative prophylaxis for infection (3 days of cephalosporin of the third generation) and postoperative prophylaxis for thromboembolism (low-molecular Heparin at 5000 UI/12 h until withdrawal).

The follow-up analyses included: 1) the initial follow-up at the 4-week postoperative visit, when signs of wound healing, duration of dysuria after removal of a urethral catheter, and degree of suture sites' reepithelization were evaluated; 2) the third-month follow-up control, when an intravenous urography was performed to exclude postoperative hydronephrosis; and 3) the last follow-up (mean: 38.6 months), when all patients underwent a complete evaluation for urinary incontinence and GP and an assessment of the time of renewal and satisfaction of sexual intercourse, as well as patient outcome assessment.

Statistical analysis

Statistical analysis was performed using Student's paired test to compare demographic data and the preoperative and postoperative POPQ-stage of GP, and Mantel-Haenszel's chi-square test to compare demographic data, preoperative/postoperative functional symptoms and urodynamic diagnoses, and preoperative/postoperative POPQ-stage of GP according to the formula below.

$$\chi^2 = \frac{n [(AD - BC) - n/2]^2}{(A + B)(C - D)(A + C)(B + D)}$$

A P-value of less than 0.05 was considered statistically significant.

Results

At the last follow-up (mean: 38.6 months), we observed recurrent vault prolapse in 15 patients

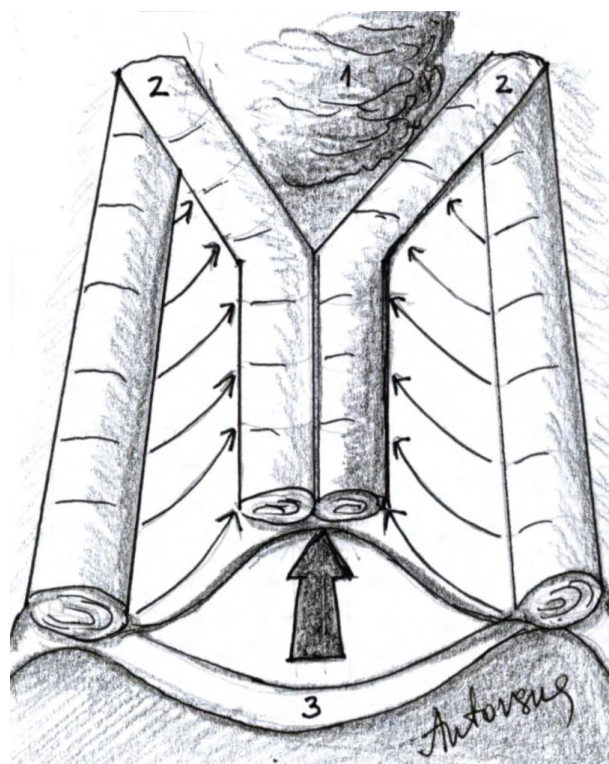


Figure 4. Mechanism of action of our original vaginal plication of the uterosacral ligaments: 1 - rectum; 2 - uterosacral ligaments; 3 - vaginal vault.

(15/216, 6.94%), indicating a success rate of 93.06% in the correction of stage III/IV GP. There were no complications such as postoperative hemorrhage; lesion of the ureter, bladder, or rectum; postoperative fistulas; or ureteral kinking and hydronephrosis. Figure 5 shows all 15 cases of recurrent prolapse: 7 patients with prolapse stage I of the anterior and apical segment; 3 patients with prolapse stage II of the anterior segment, combined with stage I of the apical segment; 3 patients with prolapse stage I of the anterior, posterior, and apical segments; 1 case of prolapse stage III of the anterior, posterior, and apical segments; and 1 case of prolapse stage IV of the anterior, posterior, and apical segments (in a patient who, in the early postoperative period, had serious pulmonary infection and experienced persistent coughing).

In these 15 cases of recurrent vault prolapse, age was significantly higher and the duration of postmenopausal period was significantly longer ($P < 0.05$ and $P < 0.001$, respectively), and the diastolic pressure was higher ($P < 0.01$) and height was lower

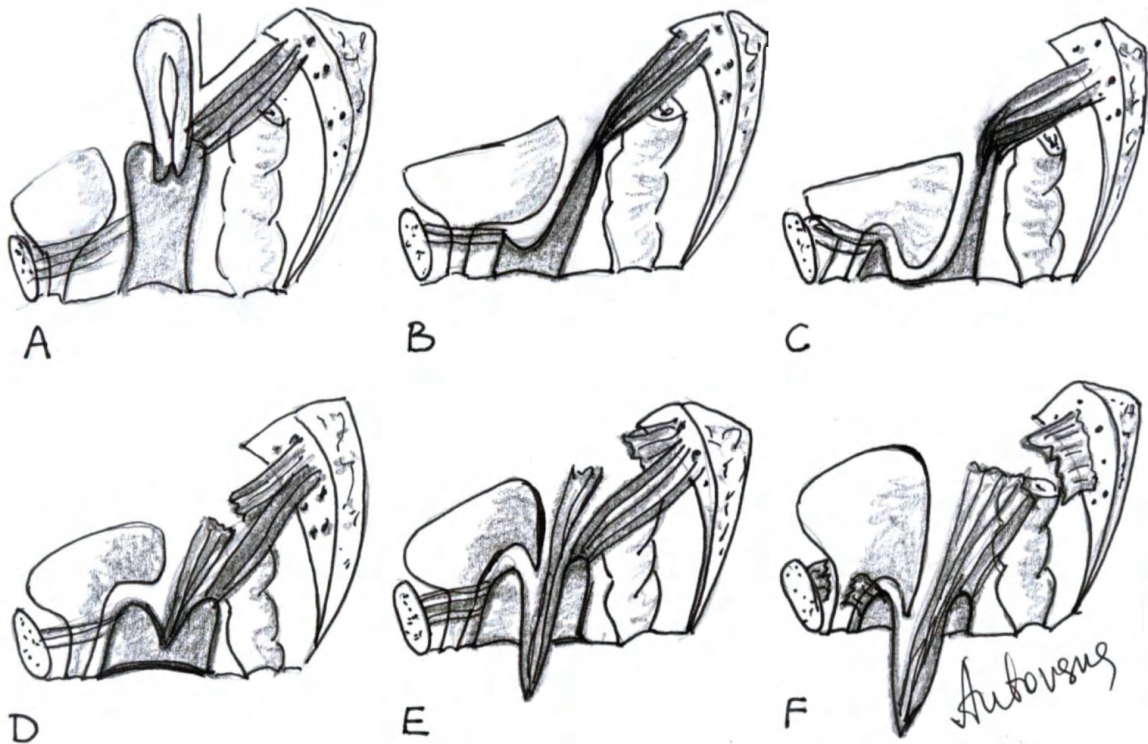


Figure 5. The 15 cases of recurrent prolapse seen in the 216 cases studied: A) normal position of the pelvic organs; B) stage I of the anterior segment combined with stage I apical prolapse (n = 7); C) stage II of the anterior segment combined with stage I apical prolapse (n = 3); D) stage I of the anterior and posterior segments combined with stage I apical prolapse (n = 3); E) stage III of the anterior, apical, and posterior segment (n = 1); F) stage IV of the anterior, apical, and posterior segment (n = 1).

($P < 0.001$). With regard to occupation, this group included more farmers and retired persons ($P < 0.05$ for both). We believe that occupation and age could have an important role in the etiology of the recurrent prolapse (Table 1).

Comparing the preoperative and last follow-up (mean: 38.6 months) POPQ anatomic landmarks, we found significantly higher values for the most distal position of any part of the upper anterior wall from the vaginal cuff to a point located in the midline of the anterior vaginal wall 3 cm proximal to the external urethral meatus (Ba), the leading edge of the cervix and leading edge of the vaginal vault (C), the most distal position of any part of the upper posterior wall from the vaginal cuff to a point located in the midline of the posterior vaginal wall 3 cm proximal to the hymen (Bp), and total vaginal length (tvl) (all of them with $P < 0.001$) and a point located in the midline of the anterior vaginal wall 3 cm proximal to

the external urethral meatus (Aa) ($P < 0.01$) during the Valsalva maneuver (Table 2).

Comparing the preoperative and last follow-up (mean: 38.6 months) POPQ stages of each segment, we found that more than 93% of patients had no GP in spite of the preoperative severe stage III/IV GP. The reparation of the apical segment was especially successful, as seen in 211 out of 216 cases (97.68%) (Table 3).

Regarding the cure rate of USI/GP in light of preoperative/postoperative functional symptoms according to the questionnaire and clinical examination, we noted a very high decrease of USI ($P < 0.001$); a decrease in frequency and urgency ($P < 0.05$ and $P < 0.001$, respectively); and a decrease in other urinary symptoms such as nocturia, incomplete emptying, weak stream, and manual reposition to start voiding (all with a significance of $P < 0.001$) (Table 4).

Table 1. Demographic data (age, duration of postmenopausal age, parity, habits of smoking and alcohol consumption, exercise, diet, body mass index, systolic/diastolic blood pressure, and profession) of patients without vault prolapse at follow-up (NVP, n = 201) and those with recurrent vault prolapse (VP, n = 15).

Variable	Without recurrent vault prolapse at last follow-up (mean: 38.6 months), NVP (n = 201)	With recurrent vault prolapse at last follow-up (mean: 38.6 months), VP (n = 15)	χ^2 / t
Age (years) (mean \pm SD)	65.1 \pm 11.3	73.4 \pm 3.1	2.53 (*)
Duration of postmenopausal period (years) (mean \pm SD)	13.5 \pm 7.8	24.5 \pm 4.6	5.67 (§)
Parity (mean \pm SD)	3.4 \pm 1.8	3.2 \pm 1.5	0.44 (NS)
Height (cm) (mean \pm SD)	165.1 \pm 5.7	160.2 \pm 6.1	3.36 (§)
Weight (kg) (mean \pm SD)	71.3 \pm 8.4	72.5 \pm 6.1	0.57 (NS)
Body mass index (mean \pm SD)	26.1 \pm 4.2	28.2 \pm 3.2	0.97 (NS)
Smoker	39/216 (18.5%)	1/15 (6.66%)	0.60 (NS)
Alcohol consumer	10/216 (4.6%)	0/15 (0.0%)	0.038 (NS)
Factory worker	38/216 (17.6%)	1/15 (6.66%)	0.54 (NS)
Farmer	67/216 (31.0%)	8/15 (53.33%)	4.28 (*)
Clerk/teacher	26/216 (12.0%)	0/15 (0.0%)	3.42 (NS)
Housewife	57/216 (26.4%)	2/15 (13.33%)	0.66 (NS)
Retired person	28/216 (13.0%)	5/15 (33.33%)	6.56 (*)
Exercise	12/216 (5.6%)	0/15 (0.0%)	0.11 (NS)
Diet	46/216 (21.3%)	2/15 (13.33%)	0.56 (NS)
Diastolic blood pressure (mmHg)	88.9 \pm 18.2	92.4 \pm 11.3	2.65 (†)
Systolic blood pressure (mmHg)	138.3 \pm 12.4	142.3 \pm 8.1	1.25 (NS)

Mantel-Haenszel's χ^2 test with df of 1: (*) $P < 0.05$; (†) $P < 0.01$; (§) $P < 0.002$; (§§) $P < 0.001$.

Student's paired test (t): (*) $P < 0.05$; (†) $P < 0.01$; (§) $P < 0.002$; (§§) $P < 0.001$.

Urodynamic investigations such as bladder capacity, percentage of regular cystometry, and positive default transmission showed significant postoperative improvement (all with $P < 0.01$), as did detrusor instability ($P < 0.01$) (Table 5).

Discussion

In order to explain the differences among VPUS and other vaginal procedures such as BUVS, ShBS, the original McCall culdoplasty, and HUSS, some pictures are provided in Figure 6 that represent a comparison among these procedures and our VPUS. As can be seen, they are very similar. Nevertheless, there are some important differences. A wide mobilization of the bladder and rectum provides satisfactory safety for the bladder, both ureters, and the rectum during VPUS. Two Breisky-Navratil retractors and essential

intraoperative cystoscopy are used to protect these structures during BUVS and ShBS. Despite this prevention, Barber et al. (2) reported an 11% rate of ureteral injury. During the abovementioned procedures, the supportive structures are placed in the posteromedial aspect of each proximal uterosacral ligament separately, through the corresponding parts of the pubocervical and rectovaginal fascia during BUVS and ShBS. During HUSS and McCall culdoplasty, the permanent sutures are placed through the uterosacral ligaments from side to side, incorporating the intervening peritoneum and intervening upper part of the vaginal wall. As can be seen from Figure 6, HUSS is, in fact, the combination of ShBS and McCall culdoplasty. During VPUS, the first step is a huge dissection and excision of the intervening peritoneum and high closure of the Douglas space, as future enterocele prevention. After

Table 2. Comparison between the preoperative and last follow-up quantitative description of pelvic organ position with anatomic landmarks in the GP group (n = 216) treated with our original VPUS.

POPQ stage	Preoperative values		Last follow-up (mean: 38.6 months)	t ₁	t ₂
	Valsalva (1)	Pozzi (2)	Valsalva (3)	(1–3)	(2–3)
Aa	-1.06 ± 0.62	-0.65 ± 0.94	-2.77 ± 0.47	2.22 *	2.02
Ba	3.67 ± 1.24	4.83 ± 1.37	-2.77 ± 0.47	4.88 (§)	5.28 (§)
C	4.61 ± 1.62	6.78 ± 1.16	-8.89 ± 1.01	7.07 (§)	10.17 (§)
D	-2.25 ± 1.30	1.08 ± 0.87	/	/	/
Bp	2.12 ± 1.08	4.23 ± 1.07	-2.83 ± 0.56	0.06 (§)	5.88 (§)
Ap	-2.31 ± 0.71	-2.00 ± 1.04	-2.83 ± 0.56	0.58	0.70
Gh	5.24 ± 0.99	5.45 ± 0.79	3.98 ± 0.64	1.067	1.46
Tvl	2.49 ± 1.08	2.32 ± 0.82	8.89 ± 1.01	4.35 (§)	5.05 (§)
Pb	2.67 ± 0.42	2.25 ± 0.68	2.46 ± 0.60	0.29	0.23

Student's paired test (t): (*) P < 0.05; (†) P < 0.01; (§) P < 0.002; (§§) P < 0.001.

POPQ – International Continence Society's Pelvic Organ Prolapse Quantification system.

Legend: **Aa** – a point located in the midline of the anterior vaginal wall 3 cm proximal to the external urethral meatus (in the projection of the urethrovesical junction); **Ba** – the most distal position of any part of the upper anterior wall from the vaginal cuff to point Aa; **C** – leading edge of the cervix, leading edge of the vaginal vault; **D** – the depth of the Douglas recession (distance between the hymen and the most distal point of the Douglas); **Bp** – the most distal position of any part of the upper posterior wall from the vaginal cuff to point Ap; **Ap** – a point located in the midline of the posterior vaginal wall 3 cm proximal to the hymen (in the projection of the rectovaginal septum apex; **gh** – genital hiatus; **tv1** – total vaginal length; **pb** – perineal body.

that, 3 separate supportive sutures are placed into the retroperitoneal space, in the side-to-side aspect through the loose part of both uterosacral ligaments, and tied separately in the central area. These sutures incorporate neither the intervening peritoneum nor the upper part of the posterior vaginal wall. The plication of the urethra-vesical junction is performed according to Hurt's technique (11) by surrounding gentle, loosened periurethral fascia during BUVS. On the contrary, we chose to perform the vaginal suburethral duplication according to Lazarevski, with 3 mattress sutures placed through the strong Halban vaginal fascia, just underneath the bladder neck as a type of supporting wedge.

The advantage of VPUS (combined with 4-CDVS) over sacrospinous ligament suspension (SSS) could be the provision of a central position and normal inclination of the vagina. SSS, on the other hand, causes a lateral and dorsocaudal inclination of the vagina, which results in 18%–92% de novo USI (1,12). Our VPUS offers wide access to the bladder neck for performing antistress procedures, as well as excellent conditions for concomitant enterocele

repair. In 57 patients with SSS, Morley and DeLancey (13) noted 12.28% recurrent vault prolapses and 15.79% postoperative USI. Lantzsch et al. (14) reported 14.63% recurrent vault prolapses in 200 unilateral SSS cases. In our own study, we noted only 6.95% recurrent vault prolapses and only 2.8% postoperative USI.

The disadvantages and risks of abdominal sacral colpopexy may include prosthesis ejection, vaginal overtension/dyspareunia, postoperative vertebral osteitis/continuous lower-back pain, intraoperative lesion of the right ureter or rectosigmoid colon, vessel injuries (vein cava, right common iliac vein), and/or partial rectosigmoidal stenosis with long-lasting constipation. Nevertheless, its main advantage is providing good access to the Retzius space for performing Burch colposuspension. On the contrary, our VPUS offers a good chance for the whole-length cleavage of the vaginal walls, which is necessary for a complete restoration of sliding bladder prolapse and prolapse stage III/IV of the anterior segment, as well as enterocele and procidentia repair.

Table 3. Comparison between the preoperative and last follow-up stages of the anterior, posterior, apical, and most severe segments of prolapse in the study group (GP, n = 216) treated with our VPUS.

POPQ stage	GP group (n = 216), preoperative values		GP group (n = 216), last follow-up (mean: 38.6 months)	X1	X2
	Valsalva (1) n/N (%)	Pozzi (2) n/N (%)	Valsalva (3) n/N (%)	1-3	2-3
Anterior segment					
Stage 0	0/216 (0.0)	0/216 (0.0)	201/216 (93.05)	379.6 (‡)	379.6 (‡)
Stage I	0/216 (0.0)	0/216 (0.0)	10/216 (4.63)	12.39 (‡)	12.39 (‡)
Stage II	14/216 (6.48)	7/216 (3.24)	3/216 (1.39)	6.12 (*)	0.92
Stage III	86/216 (39.81)	67/216 (31.02)	1/216 (0.46)	101.56 (‡)	73.74 (‡)
Stage IV	116/216 (53.70)	142/216 (65.74)	1/216 (0.46)	223.21 (‡)	204.90 (‡)
Posterior segment					
Stage 0	0/216 (0.0)	0/216 (0.0)	211/216 (97.68)	416.31 (‡)	416.31 (‡)
Stage I	0/216 (0.0)	0/216 (0.0)	3/216 (1.39)	5.37 (‡)	5.37 (‡)
Stage II	15/216 (6.94)	27/216 (12.50)	0/216 (0.0)	13.54 (‡)	28.59 (‡)
Stage III	97/216 (44.91)	54/216 (25.00)	1/216 (0.46)	119.12 (‡)	56.34 (‡)
Stage IV	104/216 (48.15)	135/216 (62.50)	1/216 (0.46)	130.91 (†)	189.84 (‡)
Apical segment					
Stage 0	0/216 (0.0)	0/216 (0.0)	211/216 (97.68)	416.31 (‡)	416.31 (‡)
Stage I	0/216 (0.0)	0/216 (0.0)	13/216 (6.02)	15.55 (‡)	15.55 (‡)
Stage II	0/216 (0.0)	0/216 (0.0)	0/216 (0.0)	0.0	0.0
Stage III	89/216 (41.20)	49/216 (22.68)	1/216 (0.46)	106.24 (‡)	49.97(‡)
Stage IV	127/216 (58.80)	167/216 (77.31)	1/216 (0.46)	173.48 (‡)	265.20(‡)
Stage of the most severe segment of prolapse					
Stage 0	0/216 (0.0)	0/216 (0.0)	204/216 (94.44)	115.85(‡)	115.85 (‡)
Stage I	0/216 (0.0)	0/216 (0.0)	10/216 (4.63)	12.39 (‡)	12.39 (‡)
Stage II	0/216 (0.0)	0/216 (0.0)	3/216 (1.39)	5.37 (*)	5.37 (*)
Stage III	89/216 (41.20)	49/216 (22.68)	1/216 (0.46)	106.24 (‡)	49.97 (‡)
Stage IV	127/216 (58.80)	167/216 (77.31)	1/216 (0.46)	173.48 (‡)	265.20 (‡)

Legend: **POPQ** – International Continence Society's Pelvic Organ Prolapse Quantification system; **Stage 0** – Aa, Ap, Ba, and Bp are all at –3, but C is greater than or equal to (tv1 – 2); **Stage I** – the most distal portion of the prolapse is >1 cm above the hymen; **Stage II** – the most distal portion of the prolapse is less than or equal to 1 cm proximal to or distal to the plane of the hymen; **Stage III** – the most distal portion is >1 cm below the hymen but protrudes no further than 2 cm less than the tv1; **Stage IV** – the distal portion of the prolapse protrudes to at least (tv1 – 2) cm; **X1** – differences between columns 1 and 3; **X2** – differences between columns 2 and 3.

Mantel-Haenszel's χ^2 test with df of 1: (*) P < 0.05; (†) P < 0.01; (§) P < 0.002; (‡) P < 0.001.

In the last decade, some new methods have been used, including mesh technology, which offers both high success rates and high complication rates. The greatest disadvantage of these operative procedures is the high percentage of vaginal erosion and mesh ejection. For this reason, conventional surgical methods have recently become popular. In a study of 52 women with vault prolapse stage 2 or higher

who underwent transobturator and infracoccygeal hammock (median follow-up: 36 months), Sergeant et al. (15) noted a 31% rate of mesh contraction and a 13% rate of dyspareunia. In 50 patients treated with laparoscopic sacrocolpopexy with porcine intestinal grafts or dermal collagen (mean follow-up: 33 months), Deprest et al. (16) observed a high anatomical failure rate (49% and 34%, respectively).

Table 4. Preoperative and postoperative functional symptoms according to the questionnaire and clinical examination in the GP study group treated with our VPUS.

	Preoperative values (n = 216)	Last follow-up (n = 216) (mean: 38.6 months)	X ² 1–2 column
Urinary symptoms (according the questionnaire and clinical examination (Marshall test))			
Stress incontinence	43 (19.9%)	6 (2.8%)	19.23 (‡)
1. Genuine USI (without prolapse reposition)	12 (5.56%)	3 (1.4%)	2.49
2. Potential USI (during prolapse reposition)	31 (14.4%)	3 (1.4%)	12.07 (‡)
Frequency	36 (16.7%)	12 (5.6%)	6.47 (†)
Urgency	29 (13.4%)	11 (5.1%)	53.55 (‡)
Hesitancy	21 (9.7%)	10 (4.6%)	1.91
Nocturia	48 (22.2%)	12 (5.6%)	12.20 (‡)
Incomplete emptying	118 (54.6%)	3 (1.4%)	75.26 (‡)
Weak stream	129 (59.7%)	2 (0.9%)	87.66 (‡)
Manual reposition to start voiding	131 (60.65%)	1 (0.5%)	91.48 (‡)
Bowel symptoms			
Flatus incontinence	11 (5.1%)	0 (0.0%)	5.14 (†)
Incontinence of liquid stool	1 (0.5%)	0 (0.0%)	0.12
Urgency of defecation	2 (0.9%)	0 (0.0%)	0.56
Discomfort with defecation	23 (10.6%)	2 (0.9%)	8.92 (*)
Constipation	49 (22.7%)	18 (8.3%)	8.22 (*)
Digital manipulation to finish defecation	58 (26.9%)	2 (0.9%)	29.84 (‡)
Feeling of incomplete evacuation	61 (28.2%)	2 (0.9%)	31.80 (‡)
Rectal protrusion during defecation	8 (3.7%)	0 (0.0%)	3.58
Sexual symptoms			
Pain with coitus	0/134 (0%)	16/134 (11.9%)	9.04 (*)
Unsatisfactory coitus	134/134 (100%)	3/134 (2.2%)	59.97 (‡)
No sexual partner (widowed, divorced)	82/216 (37.9%)	82/216 (37.9%)	
Other local symptoms			
Vaginal pressure and heaviness	216/216 (100%)	5/216 (2.3%)	205.27 (‡)
Vaginal/perineal pain	216/216 (100%)	8/216 (3.7%)	199.62 (‡)
Awareness of tissue protrusion	216/216 (100%)	5/216 (2.3%)	205.27 (‡)
Low back pain	216/216 (100%)	12/216 (5.6%)	192.33 (‡)
Abdominal pressure	87/216 (40.3%)	10/216 (4.6%)	38.90 (‡)
Observation or palpation of a mass	216/216 (100%)	5/216 (2.3%)	205.27 (‡)

X² – differences between preoperative and last follow-up values for the whole group.
Mantel-Haenszel's χ^2 test with df of 1: (†) P < 0.05; (*) P < 0.01; (‡) P < 0.001.

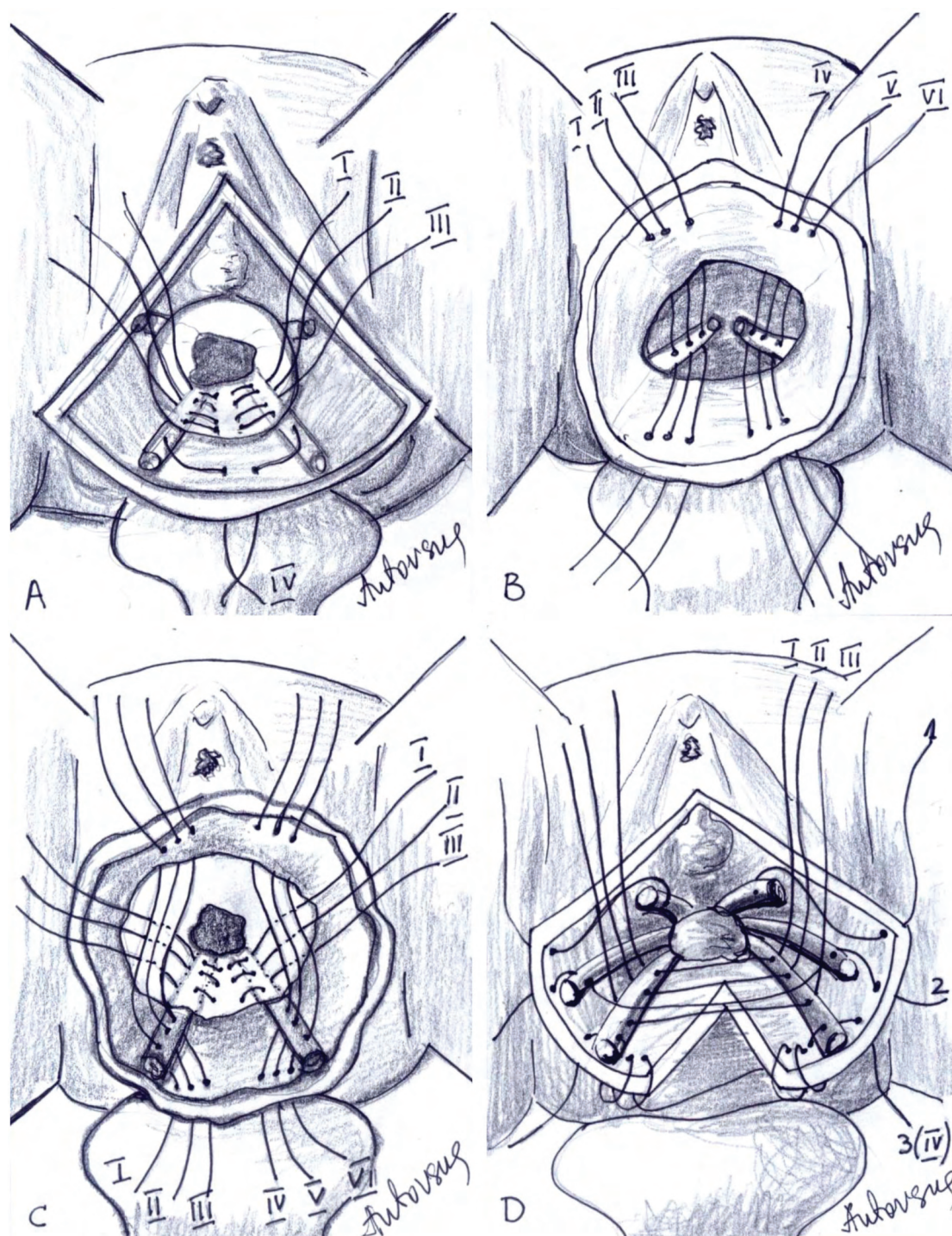


Figure 6. Comparison of our original uterosacral plication with other similar procedures: A) original McCall culdoplasty; B) bilateral uterosacral ligament vaginal suspension and Shull-Bachofen suspension of the vaginal apex; C) Karam's high uterosacral vaginal vault suspension; D) our original vaginal plication of the uterosacral ligaments.

Table 5. Preoperative and postoperative urodynamic investigations.

	Preoperative values	Last follow-up	χ^2
	GP group (n = 216)	GP group (n = 216) (mean: 38.6 months)	1–2 column
Cystometry			
Detrusor instability	45 (20.83%)	15 (6.94%)	8.42 (*)
Decreased capacity of the bladder	63 (29.17%)	28 (12.96%)	8.28 (*)
Regular cystometry	171 (79.17%)	201 (93.05%)	9.00(*)
UPP max	83.92 ± 11.07	88.21 ± 10.21	0.28
dUPP (default transmission)			
Positive dUPP (present USI according to urodynamic examination)	33 (15.28%)	6 (2.77%)	9.90 (*)
Negative dUPP (absent USI according to urodynamic examination)	183 (84.72%)	210 (97.23%)	10.66 (*)

χ^2 – differences between preoperative and last follow-up values in the study group.
Mantel-Haenszel's χ^2 test with df of 1: (†) P < 0.05; (*) P < 0.01; (‡) P < 0.001.

According to Claerhout et al. (17), sacrocolpopexy with xenogenic grafts results in a 31.5% anatomical cure rate, but it also has a high failure rate for vault, anterior, and posterior compartments (31%, 18.8%, and 50%, respectively). In 39 patients with major prolapse treated with tissue fixation system, Petros and Richardson (18) reported an 86% symptomatic cure rate (3 years of follow-up).

Our original vaginal plication of uterosacral ligaments during vaginal hysterectomy as a preventive procedure for recurrent vault prolapse seems to be quick, safe, and sufficiently effective in patients with advanced stage genital prolapse. The large number of patients (216 patients) and extensive follow-up period (mean: 38.6 months) considered in this study help to support this conclusion.

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