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Combined anterior trans-obturator mesh and sacrospinous ligament fixation in women with severe prolapse—a case series of 30 months follow-up

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Abstract
Introduction and hypothesis To study the efficacy and safety of performing anterior mesh (Perigee) with vaginal reconstructive surgeries (sacrospinous ligament fixation) for treatment of advanced prolapse.
Methods One hundred twenty-eight patients, POP-Q stage III (n=85) or IV (n=43), underwent surgery. The objective cure was defined as less than stage 2 prolapse. Introital ultrasonography was used for mesh morphological evaluation.
Results Post-operative data were available for 120 patients. At 30 months, the objective cure was 91.8%. The subjective cure was 93.3% on POPDI-6 feedback. No apical and anterior recurrence was observed. Surgical complications were minor. Five cases (4.1%) of mesh extrusion was observed. Mesh shortening, shrinkage, and thickening was also observed.
Conclusion The combination of anterior vaginal mesh and vaginal reconstructive surgery appears to be a safe and effective in restoring the anatomy and achieving favorable pelvic function. The anterior mesh deployed seems to cover a lesser area than anticipated. A longer period of follow-up is necessary to confirm its efficacy.

Keywords Perigee · Pelvic organ prolapse · Sacrospinous fixation · Trans-obturator mesh · Ultrasonography

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Introduction

Management of massive pelvic organ prolapse (POP) is challenging. The conventional surgical treatment for massive uterovaginal and vaginal vault prolapse is usually accomplished either by vaginal route using sacrospinous ligament suspension and uterosacral suspension or by abdominal route using sacrocolpopexy. In a meta-analysis of 22 randomized control trials, a Cochrane review concluded that abdominal sacrocolpopexy is associated with a lower rate of recurrent vault prolapse and dyspareunia than the vaginal sacrospinous colpopexy (SS) and uterosacral suspension [1]. The review, however, opines that the benefits must be balanced against a longer operating time, longer time to return to activities of daily living, and increased cost of the abdominal approach.

The advantages of vaginal route include minimal invasiveness, less mobility, lower cost, shorter surgical time, and the fact that it allows for simultaneous correction of co-existing cystocele and rectocele [2]. The commonly adopted vaginal sacrospinous suspension has been associated with preferential anterior compartment prolapse recurrence. Long-term studies have documented that, following primary surgery of SS for prolapse, recurrence rate is highest in the anterior compartment [3]. Also, the Cochrane review proposed that the use of mesh or graft inlays at the time of anterior vaginal wall repair may reduce the risk of recurrent cystocele [1].

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There are various methods currently adopted for applying trans-vaginal mesh (TVM) in repairing the anterior vaginal wall which can be grouped into self-tailored mesh and commercial available kits design for anterior compartment [4–6]. The merits of using commercialized available kit provide a systematic and standardized manner of deploying the mesh. It may shorten the surgical time, lessen the dissection site, widen the mesh covering area, and flatten the tension-free deployed mesh. With this in background, we have incorporated the current commercially available TVM (Perigee® AMS) that has been designed for providing anterior compartment support along with the conventional vaginal pelvic reconstructive surgery using sacrospinous ligament fixation (SSF) for apical support and fascial repairs for posterior compartments in treating massive urogenital prolapse. In this study, we report our experiences on the combined surgery, hoping to provide benefits of the vaginal surgery as well as durability of pelvic supports.

Materials and methods

From August 2006 to May 2009, women who were referred to the first author at the outpatient department for trans-vaginal surgical correction of severe symptomatic pelvic organ prolapse, i.e., uterus or vaginal vault prolapse of stages III and IV according to the International Continence Society (ICS) grading system [7] on maximum Valsalva maneuver, were enrolled as subjects. Pre-operative evaluation included appropriate medical history, urine analysis, physical examination, and pelvic examination. All women were asked to complete a 72-h voiding diary, Incontinence Impact Questionnaire (IIQ-7) [8], Urogenital Distress Inventory (UDI-6) questionnaires [9], and Pelvic Organ Prolapse Distress Inventory 6 (POPDI-6) [10] as part of subjective evaluations. Objective evaluation included a POP-Q staging [7], multi-channel urodynamics, 1 h pad test, and introital ultrasonography. Patients with medical diseases such as diabetic mellitus, chronic cough, asthma, bronchitis, constipation, cardiac valve disease with anti-coagulant, and vaginal ulcer had to be treated and corrected accordingly before the surgery. The specifics of the procedure were discussed with the patient, and they were informed on the potential complications following mesh placement. The exclusion criteria were medically unfit for surgery as recommended by a medical physician and patients unwilling to undertake the mesh procedure.

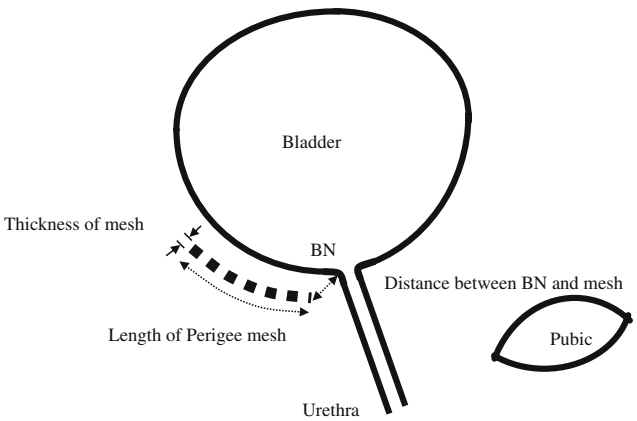
Vaginal examinations were performed with the patients in semi-supine lithotomic position. A split speculum technique was employed to evaluate the descent of the vaginal vault, anterior and posterior vaginal walls, and uterine prolapse. The examination was recorded using the nine points describing the vaginal vault, anterior and posterior vaginal walls, uterine prolapse, total vaginal length, genital hiatus, and perineal body measurement according to the same principle suggested by the ICS [7]. Prolapse is classified according to the ICS ordinal stages of pelvic organ prolapse (POP-Q) form 0 to IV. All conditions were defined according to the standards of the ICS [7].

The introital ultrasonography was performed with the patient in semi-supine position. A 3.5-MHz curved linear-array transducer (Aloka SSD 1200; Aloka Ltd., Tokyo, Japan) was positioned adjacent to the vaginal introitus and used to investigate the morphology of the implanted mesh in sagittal and transverse plans. The length and thickness of the mesh (Fig. 1) as well as the distance between bladder neck and proximal end of the mesh were measured. In addition, the presence of mesh folding was evaluated and vaginal mucosa thickness between vaginal outer wall and mesh margin were measured (Fig. 2).

The multi-channel urodynamic study included filling and voiding cystometry with surface electrode electromyography, urethral pressure profile measurement, and free uroflowmetry using an 8-Fr double-lumen urethral catheter. Reduction of the prolapse with a ring pessary was practiced for all patients when urodynamic evaluations were performed. The diagnosis of urodynamic stress incontinence (USI) was made on the basis of demonstrable involuntary leakage of urine during increased abdominal pressure, in the absence of a detrusor contraction observed at filling cystometry. Patients who only had urinary leakage when the prolapse had been repositioned were considered as having occult USI. The criteria for bladder outlet obstruction was based on bladder outlet obstruction nomogram for women suggested by Blaivas et al. [11].

Surgical procedure

A spinal, epidural, or general anesthesia was used according to the patient and surgeon's preference. The pelvic reconstructive



BN = bladder neck

Fig. 1 Measurements for Perigee mesh. *BN* bladder neck

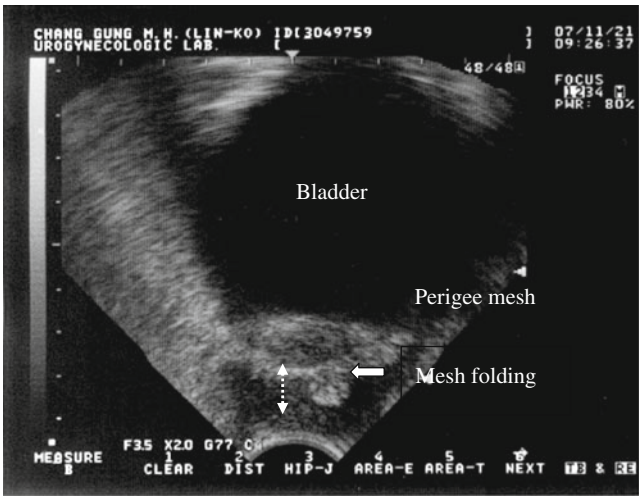


Fig. 2 Introital ultrasound demonstrating mucosal thickness (*double head arrow*) and Perigee mesh folding (*arrowhead*) at transverse view

surgeries including vaginal total hysterectomy, anterior vaginal mesh procedure (Perigee procedure), sacrospinous ligament fixation, posterior colporrhaphy, and mid-urethral tension-free sling were performed in sequence accordingly, if indicated. The Perigee (American Medical Systems, Minnetonka, MN, USA) device which was designed for anterior vaginal defect was used for the mesh deployed at the anterior vaginal wall. The synthetic material provided in the Perigee system is a pre-cut, non-absorbable monofilament soft Prolene mesh with four arms covered by a plastic sheath and tipped with a needle connector.

The Perigee procedure was carried out similar to that described by Rane et al. [4] on all subjects. In brief, a Foley catheter was inserted for constant urinary drainage and bladder neck identification. Hydro-dissection was employed to facilitate the dissection. A 3-cm midline longitudinal incision was made in the anterior vaginal wall from bladder neck that enabled the mucosal dissection underneath up to the cervix or vagina apex. The lateral dissection was carried out till the inferior pubic rami level allowing for the bladder and urethra mobilization medially and the four Perigee needles to pass through. Two incisions were made on each side, one superior incision was made in the genitofemoral folds at the level of the clitoris, and one inferior incision was made 2 cm lateral and 3 cm inferior to the superior incision. After insertion of all the needles in place, the mesh arm connectors were then connected to their tip. Each needle was pulled back and the mesh underneath the cystocele was kept in a tension-free manner. The mesh was drawn down to the lowermost portion of the cystocele; excessive inlaying mesh was trimmed and fixed at that point by 2-0 polyglactin absorbable suture (Vicryl; Ethicon, Somerville, NJ, USA). After the length of mesh was measured, the vaginal incision was closed with a continuous 2/0 polyglactin suture.

Miyazaki previously described the use of Miya hook for trans-vaginal sacrospinous ligament fixation [12]. The same technique was adopted. With the Miya hook, two 1-0 polypropylene sutures were placed on the right sacrospinous–coccygeal complex and through the undersurface of the right and left apical vaginal wall. If there was a difficulty in approaching the right complex, the left side was then utilized for the fixation. The Perigee mesh arms were adjusted and trimmed at the skin after the sacrospinous sutures were tied, rectovaginal fascia was plicated, and vaginal incision was closed. Cystoscopy evaluation for the integrity of lower urinary tract was performed. All patients were given a prophylactic antibiotic of 500 mg Cefazolin prior to surgery and continued every 6 h after surgery for 1 day.

A Foley drain and a vaginal pack were placed for 72 h. Bladder was scanned (BVI 3000; Diagnostic Ultrasound Corp., Bothell, WA, USA) for post-void residuals every 4 h after Foley catheter removal. Sterile, intermittent catheterization was performed when the post-void residual urine volume exceeded 150 ml. Catheterization was stopped once the amount of post-void residual was consistently <20% of that from self-voiding. Subjects with a residual urine volume persistently above 150 ml for more than 5 days were to be taught clean intermittent self-catheterization (CISC).

Appropriate estrogen replacement in all postmenopausal patients, either systemically or with intravaginal estrogen cream, was to be recommended before and after the surgery unless patients were contraindicated and against its usage. Follow-up visits were scheduled at 1 week, 1 month, 3 months, 6 months, 1 year, and thereafter at annual year after the surgery. For those unable to participate in the follow-ups, a telephone communication was made to ensure the status of that patient's well-being every year post-operatively. The outcome measure of this study was the objective cure rate, defined as less than stage 2 prolapse at the anterior vaginal wall and at all compartments. In addition, introital ultrasonography evaluations were performed at first month, third month, and first year after the surgery. IIQ-7, UDI-6, and POPDI-6 questionnaires were completed by all patients post-operatively. Patient feedback on POPDI-6 with no or mild abdominal organ falling out sensation (question 3) and no or mild heaviness (question 2) were considered subjective success. Patients with pad of a weight >2 g or with demonstrated urinary leakage on urethral pressure profilometry (cough profile) were considered de novo USI and recurrent USI accordingly.

A post hoc sample size calculation of 126 subjects was needed to detect a difference in failure rate of 15%, with a confidence level of 95%, statistical power of 80%. Descriptive statistics was used for demographics and peri-operative data. Paired-samples t test was applied for comparison of pre- and post-operation continuous data. Values of p <0.05 were considered statistically significant for all comparisons. All statistical methods were performed

using the commercial software SPSS, version 11. The institutional review board of Chang-Gung Memorial Hospital approved the chart evaluation of the study.

Results

The mean age was 63.3±11.5 (95% CI 61.3–65.3) years, median parity was 4 (range, 1–12), and mean BMI was 25.3±3.1 (95% CI 24.8–25.8) kg/m^2. The demographic and peri-operative data is summarized in Table 1. A combination of Perigee and sacrospinous ligament fixation applied in advanced uterus prolapse and vaginal vault eversion was accomplished in 128 consecutive patients (85 were stage III and 43 were stage IV prolapse). The concurrent pelvic surgical procedures included 110 vaginal total hysterectomies and 16 trans-obturator vaginal tape (TOT) procedures.

No patients required blood transfusion. No bladder and rectal injury was recorded. Minor complications included four urinary tract infections, four reports of transient gluteal pain, three perineal pain, and three febrile episodes. All of them responded well on medical and conservative treatment. In the immediate post-operative period, bladder scan and intermittent catheterization were stopped for 71 (55.5%,) patients at less than 24 h upon the removal of the Foley catheter. Ten patients (7.8%) maintained intermittent catheterization for more than 72 h. All of them were classified as severe bladder outlet obstruction and five of them concurrent with detrusor underactivity pre-operatively. Two patients performed CISC after discharge for 7 days.

There were five cases (4.1%) of mesh extrusion observed between 3 weeks and 3 months after surgery. The exposure site was small and located at the distal anterior vaginal wall. All of them required trimming of the eroded mesh with no additional suturing of the vaginal epithelium at out-patient office setting. With continuous daily administration of local estrogen therapy, re-epithelialization of the vagina has taken place 3 months later. Within the follow-up period, no other cases of defective healing of vaginal and vulva wounds or rejection of the Prolene mesh were observed.

Table 1 Demographic of the patients and prior pelvic surgery, n=128

	Number of patients	Percentage
Mean age (year)[a]	63.3±11.5 (61.3-65.3)	
Median parity[a]	4 (1–12)	
Mean BMI (kg/m^2)[a]	25.3±3.1 (24.8–25.8)	
Postmenopausal	109	85.2
Urodynamic		
USI	27	21.1
Overt USI	11	
Occult USI	16	
DO	12	9.4
Mixed incontinence	7	5.5
BOO	59	46.1
Detrusor underactivity	4	3.2
Prior pelvic surgery	15	11.7
VTH+A-P	7	
VTH+A-P+SS	1	
TVT	1	
TAH	4	
Lumbar spinal surgery	2	
Mean operating time (min)[a]	74.7±17.8 (71.5–77.8)	
Mean intraoperative blood loss (ml)[a]	103.1±96.7 (86.2–120.0)	
Mean hemoglobin difference (g/dl)[a]	1.25±1.3 (1.02–1.48)	
Mean hospital stay (days)[a]	4.21±0.60 (4.10–4.32)	
Median period of follow-up (months)[a]	30 (12–47)	
Concurrent surgery		
Perigee+SS+A-P	15	
Perigee+SS+VTH+A-P	97	
Perigee+SS+A-P+TOT	3	
Perigee+SS+VTH+A-P+TOT	13	

BMI body mass index, *USI* urodynamic stress incontinence, *DO* detrusor overactivity, *BOO* bladder outlet obstruction, *VTH* vaginal hysterectomy, *A-P* anterior and posterior colporrhaphy, *SS* sacrospinous ligament fixation, *TVT* tension-free vagina tape, *TOT* trans-obturator sling, *TAH* abdominal hysterectomy

[a] Data listed as either mean±standard deviation with 95% CI in parentheses or median with range in parentheses

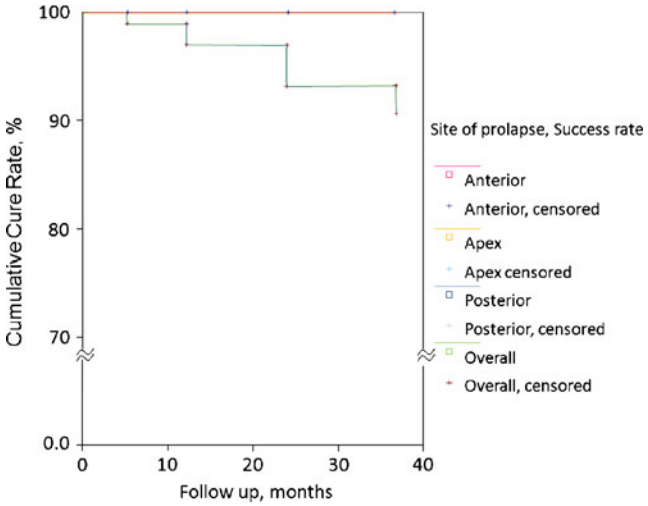


Fig. 3 Time to prolapse. The cumulative cure rate for massive prolapse was 91.8% and for anterior compartment was 100% at median follow-up duration of 30 months. There were eight censored cases, two at sixth month, four at first year, one at 2 years, and one at third year post-operative follow-up

The median follow-up duration was 30 months (range, 12–47). Eight women were unable to participate in the follow-up schedule due to personal problems. The objective data for post-operative follow-up was available for 120 women. At 30 months median follow-up duration, the anatomical cure rate at the anterior compartment was 100% (120/120), and the overall objective success (at all compartments) was 91.8% (109/120) (Fig. 3) The pre- and post-operative POP-Q stages clinical measurements are detailed in Table 2. No stage 2 and above recurrences of anterior and apical prolapse were observed. However, cumulative recurrent prolapse of stage II on the posterior vaginal wall (rectocele) was observed in 11 patients. Two further progressed to stage 3, yet all patients preferred to have no additional surgery. The subjective success rate was 93.3% (112/120) at 30 months median follow-up duration. The pre- and post-operative UDI-6, IIQ-7, and POPDI-6 satisfaction scoring was 13.32±4.14 (95% CI 14.6–15.7) and 9.80±3.13 (95% CI 10.1–10.9) ($p<0.01$), 11.96±5.61 (95% CI 14.6–15.7) and 8.56±4.55 (95% CI 10.1–10.9) ($p<0.01$), and 15.13±3.28 (95% CI 14.6–15.7) and 10.50±2.38 (95% CI 10.1–10.9) ($p<0.01$), respectively.

Of the 27 patients with urinary leakage on stress urethral pressure profile pre-operatively, 16 were classified as occult USI and 11 were classified as overt USI. Concurrent TOT procedure was offered to 16 patients (nine overt USI and seven occult USI), with 15 objectively cured and one failure (overt USI pre-operatively). On the other hand, eight occult and three overt USI patients chose to have no concurrent anti-USI surgery; six of them had persistent USI post-operation (two overt USI and four occult USI). In addition, there were seven (5.8%) de novo post-operative USI. The pre- and post-operative 1-h pad test was 6.88±18.70 g (95% CI 3.61–10.15) and 2.84±9.19 g (95% CI 1.23–4.44) ($p<0.01$). The results of the pre- and post-operative multi-channel urodynamic assessment are tabulated in Table 3.

Ultrasound outcomes are presented in Table 4. The post-operative mesh length at first month post-operatively (38.60±7.83 mm, 95% CI 37.19–40.03) measured with ultrasound was only 80.4% of the initial mesh length measure at surgery (31.05±6.30 mm, 95% CI 2.99–3.21). In addition, a tendency of the mesh length to decrease and the mesh thickness to increase was observed over the follow-up period of 1 year. There was no significant change in the measurement of the distal end of mesh from the bladder neck at third month and 1 year as compared to the measurement at the first month post-operatively. The vagina mucosa thickness was decreasing but showed no statistical significance. There were five (3.9%) cases of mesh folding

Table 2 Pelvic organ prolapse quantification measurement at pre-operative and post-operative follow-up, $n=120$

Pre-operative		Post-operative follow-up	Paired *t* test (*p* value)
Aa	2.02±0.95 (1.85–2.19)	−2.85±0.34 (−2.91–2.79)	<0.01
Ba	6.50±2.24 (6.09–6.9)	−2.80±0.64 (−2.92–−2.69)	<0.01
C	6.45±2.67 (5.96–6.93)	−7.95±1.03 (–8.13–−7.76)	<0.01
Ap	1.33±1.29 (1.09–1.56)	−2.95±0.21 (−2.99–−2.92)	<0.01
Bp	4.70±2.53 (4.25–5.16)	−2.40±1.31 (−2.63–−2.16)	<0.01
D	6.44±2.87 (5.89–6.98) ($n=108$)	−6.67±1.63 (−8.38–−4.95) ($n=6$)	
Tvl	9.70±1.30 (9.47–9.9)	8.83±1.23 (8.60–9.25)	<0.01
Gh	5.56±0.95 (5.39–5.73)	5.26±0.69 (5.14–5.39)	<0.01
Pb	2.79±1.17 (2.58–3.00)	3.04±0.81 (2.89–3.18)	<0.01

Data listed as mean±standard deviation with 95% CI in parentheses

Aa anterior wall 3 cm from hymen; *Ap* posterior wall 3 cm from hymen; *Ba* anterior wall, most dependent par (cm); *Bp* posterior wall, most dependent par (cm); *C* cervix or vaginal cuff (cm); *D* posterior fornix (if cervix is present) (cm); *Gh* genital hiatus, meatus to fourchette (cm); *Pb* perineal body, post fourchette to mid anus (cm); *Tvl* total vaginal length (cm)

Table 3 Urodynamic data, $n=116$

Parameter	Pre-operative	Post-operative at 1 year	Paired t test (p value)
Qmax	18.2±9.7 (16.5–19.9)	21.0±9.8 (19.2–22.7)	0.002
Res	93.2±113.2 (69.9–116.5)	44.2±44.7 (36.4–52.0)	0.000
CC	432.4±111.5 (412.9–451.9)	414.8±106.4 (396.2–433.4)	0.028
MUCP	98.2±41.0 (91.0–105.4)	84.5±38.5 (77.8–91.2)	0.000
FUL	23.6±8.7 (22.1–25.1)	20.6±6.6 (19.4–21.7)	0.000
Dmax	29.2±20.4 (25.6–32.8)	21.2±12.4 (19.1–23.4)	0.000

Data listed as mean±standard deviation with 95% CI in parentheses

Qmax maximum urinary flow (m/s), *Res* post-void residual urine (ml), *CC* cystometric capacity (ml), *MUCP* maximum urethral closure pressure (cmH2O), *FUL* functional urethral length (cm), *Dmax* detrusor pressure at maximum flow (cmH2O)

at the initial follow-up and it persisted throughout the follow-up period. Among the five cases of mesh folding, only one had vagina mesh erosion.

Discussion

In the present study, overall objective cure of 91.8% and anterior compartment cure of 100% are shown after an extensive pelvic reconstructive surgery comprising of sacrospinous ligament fixation and anterior vaginal mesh repair for massive prolapse at a median follow-up of 30 months. These results confirm the short-term effectiveness of the combined procedures as compared to the vaginal apex support cure rate of 64–97% after sacrospinous ligament fixation [1,13–15] and 85.7% at 1 year on post-hysterectomy vaginal vault prolapse after trans-vaginal mesh surgery in the literature [5,16]. There were only 11 cases classified as recurrent prolapse which is not subjected to the anterior and apical vaginal wall. These favorable results with acceptable minor morbidity are ascribed to the site-specific deployment of the synthetic mesh over the anterior attenuated native fascia. It means to reinforce native tissue and provide strong support on high potential site of developing prolapse after the conventional methods of repair. A similar concept was obtained in a study by Gauruder-Burmester et al. [17] who reported a result of 93% success rate at 1-year follow-up with Perigee and Apogee systems for recurrent pelvic organ prolapse. The development of rectocele following the concurrent surgery may presumably be due to the absence of site-specific mesh reinforcement.

In the contrast, Feiner et al. [18] have reported a 1-year success rate of 87% on the anterior compartment and 75% success rate on all compartments after uterus-preserving procedure of anterior vaginal mesh sacrospinous hysteropexy. While in our study, a similar procedure of sacrospinous ligament fixation and anterior vaginal mesh repair for massive prolapse was adopted and the vast majority of patients (95.3%) had no remaining uterus. Leaving the uterus in situ after the pelvic reconstructive surgery may be associated with a risk of cervical elongation and higher apical prolapse potentially accounting for the recurrence [19,20]. The encouraging results we obtained may allude to concomitant hysterectomy. Persistent medical conditions related to

Table 4 Topography and anatomical measurements of the mesh, $n=120$ (mean±SD), by introital ultrasonography

Parameter (mm)	First month	Third month	1 year	p value
Distance from BN to distal end the tape	11.95±5.56 (10.95–12.96)	12.23±4.05 (11.49–12.96)		0.581
			12.79±4.52 (12.97–14.61)	0.141
Length of the mesh	31.05±6.30 (2.99–3.21)	29.04±5.45 (2.80–3.00)		0.001
			28.31±5.53 (2.72–2.92)	<0.001
Thickness of the mesh	2.32±0.94 (2.15–2.49)	2.54±0.95 (2.37–2.71)		0.075
			2.71±1.31 (2.47–2.95)	0.010
Thickness of vagina mucosa	5.23±3.81 (4.54–5.92)	4.87±2.84 (4.35–5.38)		0.193
			4.69±2.65 (4.21–5.17)	0.077

Data listed as mean±standard deviation with 95% CI in parentheses. p value, for the comparison between third month and first year post-operatively to the first month post-operatively

BN bladder neck

unavoidable abdominal straining such as chronic cough, asthma, bronchitis, and constipation are other factors fostering prolapse after repair.

The cumulative risk of vaginal mesh erosion is 4.1% at a median follow-up duration of 30 months. All these cases were healed after adequate mesh trimming and local estrogen therapy on an out-patient basis in our studies. Instead, none of the mesh erosion recovered with local estrogen therapy alone. Also, approximating suture may not be necessary after the adequate trimming on the exposed mesh. Re-epithelialization over the defect on the vaginal mucosa would take place spontaneously. In addition to adequate local exposure to vaginal estrogen, all patients had the vagina mucosa defect healed within a period of 3 months. Folding of tape was noted in five women, and one was associated with mesh erosion. Varying degrees of mesh folding are also documented by 3D and 4D ultrasound studies [21], and it was regarded as a risk factor for mesh erosion. The incidence of vaginal mesh erosion following Perigee has been reported from 3.0% to 7.1% [4,17,22]. The vaginal mesh erosion rate observed in our study fits well into this range. Surgeon's experience [23], extensive length of vaginal incisions, T-shaped incisions in case of hysterectomy, dissection without infiltration, electrical cauterization, ischemic suturing, and mesh deployed with tension are various hypotheses for mesh exposure [24] following TVM surgery.

There was a significant shortening (20%) of mesh length measured before and immediately after the implant. Furthermore, a tendency of the mesh length to decrease and the thickness of the mesh to increase was observed in the follow-ups. It may suggest that the laying the sheet of the mesh is not even and a process of shrinkage on the mesh is undergoing. Tunn et al. [25] found that the post-operative mesh length was only 45% of the mesh initial length in 13 patients who had undergone anterior repair with Perigee 6 weeks prior to assessment. A plausible reason for the different degree of shortening measured on the mesh is the surgical technique, possibly because of the difference in traction force applied on the mesh caudally. Furthermore, Lo et al. [26] observed a time-dependent increase in the thickness and width of the suburethral sling during the 3-year period. Fibrogenesis may be accounted for the thickening over the time. Thus, Perigee seems to cover a lesser area of anterior vaginal wall than anticipated. The physician's awareness of attenuation on supporting element in the anterior vaginal wall and development of cystocele over time during post-operative vaginal examination is mandatory.

The chief limitation of the study includes the lack of a control group which would ideally include women being randomly allocated to anterior repair with and without trans-vaginal mesh. Therefore, a further study evaluation on the issue is ongoing. In addition, the measurement of mesh length is not immediately obtained post-operatively which leaves a time gap of 1 month on the morphological evaluation on the mesh. The strengths of our study are the reasonably large population size of 120 women, a relatively long period of follow-up as compared to literature reports, the pragmatic nature of the surgeries performed, and the use of validated questionnaires to assess subjective improvement, functional outcomes, and quality of life.

In conclusion, a combination of anterior vaginal mesh repair, sacrospinous ligament fixation, and anterior and posterior colporrhaphy for the treatment of severe prolapse is reasonably effective in restoring the anatomy and achieving favorable pelvic organ function. The anterior vagina mesh deployed seems to cover a lesser area than anticipated. The follow-up of this study was not long enough; additional studies with longer follow-up are necessary.

Conflicts of interest None.

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