Rivista Italiana di Colon-Proctologia Founded in 1982

PELVIPERINEOLOGY

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2025
Volume: 44
Issue: 2
August

www.pelviperineology.org

ISSN: 1973-4905 E-ISSN: 1973-4913

galenos Publishing House

PELVIPERINEOLOGY
Rivista Italiana di Colon-Proctologia Founded in 1982

EDITORIAL BOARD

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The journal is published online.

Owner: The International Society for Pelviperineology

Responsible Manager: Ahmet Akın Sivaslıoğlu

Editorial Office: International Society for Pelviperineology
e-mail: editorinchief@pelviperineology.org
Quarterly journal of scientific information registered at the Tribunale di Padova, Italy n. 741 dated 23-10-1982 and 26-05-2004
The journal is property of the International Society for Pelviperineology

Publisher Contact
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Web: www.galenos.com.tr
Publisher Certificate Number: 14521

Printer: La Grafica Faggian, Via F. Severi 2/4 Campodarsego (Padova) IT
E-mail: comm@lagraficafaggian.it
Printing Date: August 2025
ISSN: 1973-4905 E-ISSN: 1973-4913

International scientific journal published quarterly.

Official Journal of the: International Society for Pelviperineology (www.pelviperineology.com)
Associaciòn LatinoAmericana de Piso Pelvico
Perhimpunan Disfungsi Dasar Panggul Wanita Indonesia
The Israeli Society of Urogynecology and Pelvic Floor
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EDITORIAL

Dear Colleagues;

This issue, which contains extremely important scientific studies, also sheds light on the historical developments in the field of pelviperineology.

Prof. Peter Petros, the father of the ideas that overcame the ill fortune of the pelvic floor, evaluates the future of the Urethral Ligament Plication Surgery, while another prominent German-born pelvic floor surgeon, Prof. Wolfram Jäger, presents a brilliant brainstorming session on the pathogenesis of Urinary Incontinence. Moreover, our Chinese colleague Dr. Ding provides a systematic overview of the application of the Integral Theory System in clinical practice in a superb review.

Meanwhile, the scientifically valuable research studies and case reports raise the bar for our August 2025 issue to the highest level.

I'm sure you'll enjoy every page of this issue, and I thank everyone who contributed to its publication.

Enjoy reading.

Prof. Dr. Ahmet Akın SİVASLIOĞLU

Editor-in-chief

DOI: 10.34057/PPj.2025.44.02.2025-6-4
Pelviperineology 2025;44(2):39-40

Direct pubourethral ligament plication operation for cure of SUI- the next gold standard?

Peter PETROS

School of Mechanical and Mathematical Engineering, University of Western Australia, Perth, WA, Australia

Citation: Petros P. Direct pubourethral ligament plication operation for cure of SUI- the next gold standard? Pelviperineology. 2025;44(2):39-40

INTRODUCTION

This editorial concerns the urethral ligament plication (ULP) operation for cure of stress urinary incontinence (SUI) by direct repair of PUL (pubourethral ligament). The first publication of the ULP operation was 12 month data from a Pilot Trial in Pelviperineology in 2024.[1] And the first RCT has just been accepted for publication in the official Journal of the International Urogynecology Association[2] https://youtu.be/hf65CReFsjQU.

The ULP operation is the ultimate demonstration of the 1990 Integral Theory discovery,[3] that bladder continence is externally controlled by pelvic muscles and ligaments, with collagen-deficient ligaments being the main cause of SUI. The ULP is based on the same etiopathology as the midurethral sling (MUS) and its underlying theory. Both fit Thomas Kuhn's description of a scientific revolution: These arrive suddenly from outside the existing field of continence knowledge, and are disruptive of existing "normal science".[4] As per Kuhn's criteria,[4] the underlying Integral Theory was simply stated (collagen based), falsifiable, and supported by 12 original scientific studies, including the experimental MUS, and a new surgical principle, using implanted tapes to create collagenous neoligaments.[2]

Even today, the best description of the 1990 revolution in SUI remains the prescient foreword of Ingelman-Sundberg,[5] eminent professor in the field, co-founder of IUGA, and former member of the Swedish Nobel committee for medicine (see https://obgyn.onlinelibrary.wiley.com/toc/16000412/1990/69/S153). Especially relevant are Professor Ingelman-Sundberg's concluding remarks, that this new direction would bring SUI cure to many more women with considerable savings in cost.

Foreword I by Axel Ingelman-Sundberg[5]
"To me it has always been obvious that in general the reason behind female urinary incontinence has to be looked for outside the bladder i.e., in the structures supporting the urethra and bladder neck-specifically ligaments, pelvic floor muscles and vagina. If symptoms of urinary incontinence arise from a dysfuntional anatomy in the aforementioned structures then function should come with restoration of anatomy. In addition to the above statement one must also recognize the close relationship between the genital organs and the lower urinary tract. In many textbooks expressed as the urogenital tract. The sophisticated interplay between the here mentioned organs and structures in relation to female urinary continence and incontinence has been properly adressed in this supplement. From

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Received: 24 June 2025 **Accepted:** 22 July 2025 **Publication Date:** 18 August 2025

the complicated anatomy and physiology of the female urogenital tract follows that careful reading and proper knowledge is necessary to understand the presented concept. Based on applied molecular biology, experimental and clinical research the authors have cast new lights on diagnosis and treatment of female urinary incontinence. This is very important as the intensive development of social urogynecology during the last decade has increased the number of women referred for operation. Unfortunately the number of hospital beds available for surgery has not increased to the same extent. We are therefore forced to develop an operative treatment, which is followed by only a few days of hospitalization or which can be made as an office procedure. The papers in this supplementum will give an excellent background for future work in this field".A. Ingelman-Sundberg, Professor, Karolinska Institutet.

I see the ULP significantly extending the minimalist revolution commenced by the MUS in 1990, especially for disadvantaged nations. It requires minimal facilities and $2-3 materials cost. Safer than the MUS, it transforms SUI surgery from a blind to a direct vision procedure. A single polyester suture prevents ligament extension and provides sufficient new collagen to reinforce weakened PULs.[6]

Already the ULP is spreading widely, even laparocopically: https://youtu.be/byNvJDcH67w

It is early days, and much more data is required. However, as coinventor of the original midurethral sling, it is my considered view that the ULP may well become the next gold standard operation for SUI and this journal has been "in the driver's seat" from the very start.

Keywords: ULP operation; stress urinary incontinence; pubourethral ligament; integral theory

FOOTNOTES

DISCLOSURES

Financial Disclosure: The author declared that this study received no financial support.

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INVITED REVIEW

DOI: 10.34057/PPj.2025.44.02.2025-5-4
Pelviperineology 2025;44(2):41-49

New insights into the pathogenesis of (urgency) urinary incontinence

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Citation: Jäger W. New insights into the pathogenesis of (urgency) urinary incontinence. Pelviperineology. 2025;44(2):41-49

ABSTRACT

Urinary incontinence is a chronically progredient condition that usually begins around in the early forties of life with urine leakage after coughing or sneezing [stress urinary incontinence (SUI)]. Several years later the patients realize that after the feeling of urge to void they may lose urine when waiting too long [urgency incontinence, (UUI)]. The etiology of UUI is unknown. However, previous studies have shown that these patients with UUI could regain continence by the surgical tensioning and elevation of the vagina and the attached trigone of the bladder and the urethra. That effect was achieved by the surgical replacement of the uterosacral ligaments (USL) by laCESA or laVASA according to the Integral Theory by Petros. An additional suburethral tape led to overall continence rates (CR) in between 56% and 87% of these patients. Multivariate analyses revealed that the CR in patients younger than 60 years were significantly higher CR than in the older patients. The CR after a trans-obturator tape (TOT); however, was independent of the age at surgery. It has been hypothesized that this development of incontinence is caused by declining estrogen levels especially peri- and postmenopausally. All patients were suffering from UUI. The diagnosis and the age at menopause were evaluated in the context of personal interviews. In all patients with UUI, the vagina was elevated and tightened in the longitudinal axis laparoscopically by substituting the USL with polyvinylidene fluoride-structures of defined identical length (laCESA, laVASA). If that did not lead to continence, a suburethral tape (TOT 8/4) was inserted some months later. Between 2010 and 2022, 326 patients with UUI underwent the surgical replacement of the ligaments. After previous SUI they had developed UUI after menopause. Patients who got estrogen or estrogen/gestagen combinations before menopause became incontinent only after they had discontinued their hormonal treatment. In total, between 67% and 87% of the patients became continent after surgery. According to decades of life the CR after tensioning the vagina by laCESA/laVASA were between 46% and 58% in 50-year-old patients decreasing to 16% and 20% in patients older than 70 years. An additional TOT 8/4 led to continence in between 43% and 40% of the still incontinent patients irrespective of the age. In all patients urinary incontinence started premenopausally as SUI and progressed to UUI after menopause. This continuous worsening of UUI during the years after menopause was probably caused by the estrogen deficiency. The USL, the vagina and the trigone of the bladder express estrogen receptors indicating that their physiological function is dependent on estrogen. Declining estrogen levels lead to a hypo-estrogenic loss of elasticity leading to laxity, particularly in the USL the vagina and the adherent trigone of the bladder. The decreasing CR after tensioning of the vagina by laCESA/laVASA with increasing age can be interpreted as a consequence of the loss of elasticity caused by the longer duration of estrogen deficiency especially in the trigone of the bladder. Patients with perimenopausal hormone replacement therapy (HRT) only became incontinent when they stopped HRT. That observation warrants further investigations.

Keywords: Urgency urinary incontinence; OAB; CESA; VASA; hypo-estrogenic tissue remodeling; hormone replacement therapy

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Received: 12 May 2025 **Accepted:** 08 August 2025 **Publication Date:** 18 August 2025

INTRODUCTION

Urinary incontinence (UI) is a chronically progredient condition that usually begins around in the early forties of life with urine leakage during coughing or sneezing [stress urinary incontinence (SUI)]. Several years later the patients realize that after the feeling of urge to void they may lose urine when waiting too long [urgency incontinence (UUI)]. In the beginning of UUI patients can still reach the toilet "dry" if they go immediately after the urge to void, however, within few years the time intervals shorten until loss of urine becomes uncontrollable. That has significant impact on the quality of private and social life.

The etiology of UUI is unknown. Therefore, there is no specific therapy for UUI and current treatments are aimed to reduce symptoms.[1]

In 1997, however, a chance observation in operative oncological gynecology demonstrated that even patients with UUI could regain continence by the tensioning of the vagina.

During a posterior exenteration in a patient with cervical cancer invading the sigmoid the respective organs were resected, however, the bladder was preserved. In order to stabilize the bladder suspension, the upper wall of the vagina under the bladder remained inside. For further stabilization of the bladder the upper (abdominal) end of the vagina was fixed with a mesh (8x10 cm) to the promontory.

During postoperative (cancer) follow-up examinations, the patient reported that she had become continent after surgery, whereas she had been completely urinary incontinent before the exenteration and no treatment had helped her.

During the following years that stabilisation of the bladder after posterior exenteration was repeated in further six patients. Before surgery they al had been totally incontinent for several years and had been advised that there was no further treatment for them and they had to learn to live with the incontinence. All patients became continent after surgery.

The response of the patients was so enormous that it was decided to develop that surgery also for non-cancer patients with advanced UI.

The effect on restoring continence after posterior exenteration was interpreted as being due to the surgical elevation and tensioning of the vagina.

The urethra and the trigone of the bladder were the respective parts of the urinary system which were attached to the vagina.

It was therefore hypothesized that the stretching and elevation of the vagina in the longitudinal axis must have increased the closing pressure at the meatus internus. Beside the longitudinal stretching of the trigone the elevation of the vagina took the trigone out of the maximum pressure area in a more vertical axis when standing (Figure 1).[2]

Several different surgical techniques were established for sacropexy but none was recommended for treatment of UUI. Therefore, it was decided to develop a new surgical procedure imitating the effects of the mesh in posterior exenteration.

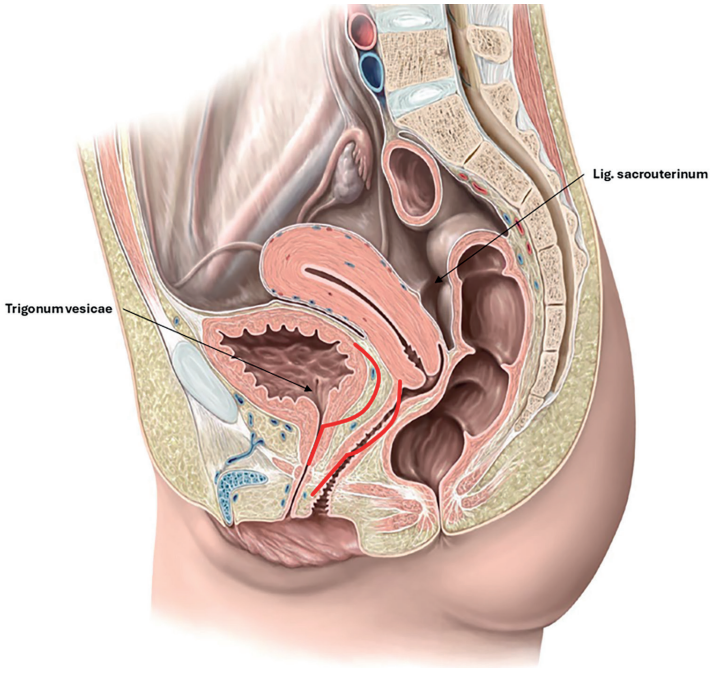

Figure 1. Hypothetical assumptions about how the anatomy of the trigonum vesicae and the anterior vaginal wall change with the descent of the uterosacral ligament (USL) and the anterior vaginal wall with the trigone of the bladder and the area of the meatus internus urethrae (red lines). The tensioning of the USL will restore the normal anatomical position

The main problem during that development phase was to find the best places for fixation of the tapes. The fixation at the sacrum led to a constriction of the sigmoid while the fixation on the back of the symphysis led to a limitation of the bladder volume.

The solution of that problem was found in the "bridge allegory" by Petros.

In 1993, Petros and Ulmsten[3] had presented that example in the "Integral Theory". They compared the position of the bladder and urethra on the vagina with a bridge which was hold up by the ropes of pillars in the front and in the back. The "rope" in front below the urethra was the pubourethral ligament (PUL) and the ropes holding the street on the back were the uterosacral ligaments (USL).[3]

They proposed that UI was based on an impaired function ("laxity") of the PUL and USL ligaments and probably not a neurological disorder.[4,5] That implied that continence is based on the normal physiological anatomical function of these ligaments.

The replacement of the PUL with suburethral tapes was so effective to cure SUI that it became recommended in all guidelines for treatment of SUI.[6]

It was hypothesized that the replacement of the USL could than probably cure UUI. Therefore, it was decided to replace the left and right USL by tapes.[7]

The respective tapes were placed in the peritoneal fold of the USL and sutured to the vaginal stump and below the promontory (vagino-sacropexy). According to the previously used mesh the length was about 9 cm. Since the method should also be possible in patients with uterus it was decided that in these patients the anatomical attachment of the vagina at the cervix should remain untouched. Therefore, instead of a total hysterectomy a supracervical hysterectomy was performed and the tapes sutured to the stump (cervico-sacropexy).[8]

According to the previous experiences in the patients who were totally incontinent before posterior exenteration it was expected that all patients with UI would become continent after cervico- or vagino-sacropexy.

In 1996 a laparotomy to implant alloplastic tapes as replacement of the USL for the treatment of UUI was massively criticized. Therefore, the Ethical Committee of the University of Erlangen, Germany, agreed that these operations could only be done in patients who had signed the informed consent agreement together with a notary. Furthermore, the operations should only be done in patients younger than 65 years as previous experiences were based on patients <65 years at exenteration.

After 20 patients an intermediate analysis should be performed.

When the USL were replaced by the tapes it was realized that after the first 20 patients only 11 patients became continent again. They either reported that they were totally continent or that nothing had changed at all after the operation ("all or nothing"-effect).

According to the previous experiences that was unexpected.

However, according to the "bridge allegory" of the Integral Theory holding ropes at both sides of the bridge are necessary to hold up the street (achieve continence). Therefore, it was decided that in those patients who remained incontinent after the USL replacement (posterior pillar) the anterior pillar (PUL) should also be replaced by a suburethral tape.

It was expected that after the suburethral tape the SUI symptoms would disappear but the urgency symptoms would remain. However, after the trans-obturator taped (TOT) 4 of the 9 incontinent patients after cervico- or vaginosacropexy became continent and they reported that the stress as well as the urgency symptoms had disappeared ("all or nothing"). Five patients remained incontinent.

It was unexplained why patients remained incontinent after both surgeries. It was assumed that this was caused by the different personal data as birth rates, body weight or other factors. However, it could not be excluded that this was caused by the imprecisely defined length of the tapes, the inherent elasticity of the material of the intra-abdominal tapes, and different tensioning of the suburethral tapes.

METHODS

Therefore, it was decided to standardize the surgical procedures as far as possible.

The exact length of the USL was unknown. Therefore, anatomical measurements were performed during examinations of corpses in the pathology. Considering the postmortal change of tissue the length of the USL was calculated between 8.5 and 9.5 cm.

Due to the uniform dimensions of the bony pelvis in women, it was possible to develop USL polyvinylidene fluoride-implants of identical length for all patients (Dynamesh-CESA: 9.3 cm, Dynamesh-VASA: 8.8 cm, Dahlhausen, Köln, Germany).[9] The fixation points of the implants (structures) on the sacrum and the vagina or cervix were also precisely defined and marked on the structures (Figures 2, 3).[10]

These standardized operations were named "CESA" or "VASA".

Furthermore, the placement of the TOT was described as "tension-free". The standardization of that description was tested in several studies by placing HEGAR-pins with different

diameters in the urethra and between the urethra and the tape. It turned out that the combination of a HEGAR 8 in the urethra and a HEGAR 4 between the urethra and the tape led to best results without narrowing of the urethra (TOT 8/4).[11]

The most important aspect of studies applying new treatments (medical or surgical) is the comparability of the same indication and the same treatment. Only when all patients had the same symptoms of UUI and got the identical treatment the results could be compared between patients and analysed.[12]

The way to define UUI had changed during the years from a previous diagnosis made by urodynamics to a diagnosis based on the subjective symptoms.

For the definition of UUI the questionnaire of the International Continence Society was used and adapted for the purposes of the study.[13] The definition of urgency UI was mainly based on the question of how patients react on the feeling of urgency while watching the news on TV. Two groups were separated: Those who could wait until the weather forecast or even longer were defined as continent.

Patients who had to go immediately because otherwise they lost urine on the way to the toilet were defined as "urgency urinary incontinent".

All patients were asked to determine the age at which they realized that they lost urine short after the urgency sensation (UUI).

The clinical results were controlled in interviews and documented in questionnaires during follow-up examinations.

Besides the usual clinical examinations, the patients were also examined vaginally in standing position, because they were not incontinent when they were in lying position.

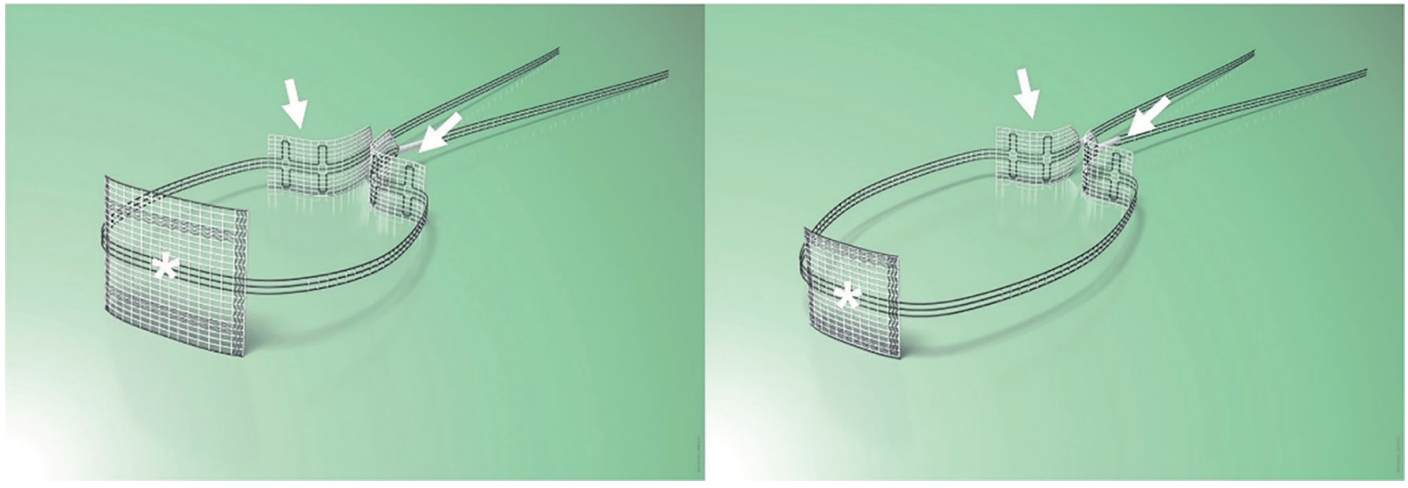

Figure 2. CESA and VASA structures. The arrows point to the suture sides on the sacral bone. The anterior part with the asterisk is fixed either on the cervix (left photo) or on the vaginal stump (right photo). Thereafter, the "arms" of the structure replacing the uterosacral ligament (USL) –the part between the fixation sides– are pulled through the peritoneal fold of the USL towards promontory. The CESA ligament is 0.5 cm shorter than the VASA ligament

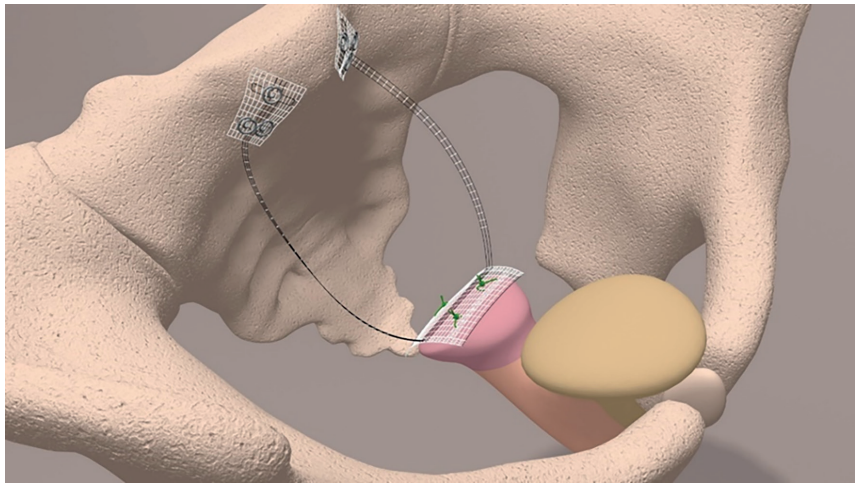

Figure 3. Schematic representation of the CESA structure *in situ*. Fixation of the structure to the cervical stump and the "uterosacral ligament arms" to the promontory. The fixation sides are marked on the structure

Patients were interviewed about their family history of incontinence, especially about her mother. Additionally, patients were asked about her age at menopause and if they had hormone replacement therapy (HRT) and for how long.

However, it had already been noticed in a previous Clinical Phase 1 study that several patients, even patients with mixed urinary incontinence (MUI), became continent just after CESA or VASA and did not need a TOT anymore.[7] Therefore, it was decided to begin treatment with the abdominal part (laCESA, laVASA) and add the vaginal part (TOT 8/4) three months later if needed.[7,14,15]

The study was approved by the Ethical Committee of the University of Köln, Germany. The age limitation for surgery (<65 years) and the signing of the informed consent by a notary were cancelled.

RESULTS

Since 2010, 326 patients with UUI who failed conservative treatments were operated by CESA or VASA in a clinical Phase II study (since 2016 laparoscopically: laCESA or laVASA).[15]

All patients reported that UI had begun with urine loss during coughing or sneezing or another comparable stress between the ages of 40 and 45 years (SUI).

All patients described the UI as a continuous development from SUI to UUI – never the other way round (first UUI then SUI).

Most patients experienced menopause at the age of 50 years.

After menopause or cessation of ovarian function, patients made the experience that after the urge to void they sometimes lost urine before reaching the toilet. After about 2 to 4 years, they experienced urine loss already upon standing up from a chair or on the way to the toilet (UUI).

During the digital examination in the standing position in all patients a slight prolapse of the vaginal wall in the suburethral and the sub-bladder part of the vagina was felt.

Patients who got estrogen or estrogen/gestagen combinations (HRT) before menopause became incontinent only after they had discontinued the HRT, some of them only between the ages of 60 and 70 years.

97% of patients reported that their mother also had UUI. As far as they knew that was probably at the same age when their own incontinence began.

The overall CR after laCESA was 39% and after laVASA 33%.[14] The additional TOT led to continence in between 35% and 45% of the remaining incontinent patients.[14] That led to overall continence rates (CR) between 67% and 87% in these patients (Figures 4, 5).

Multivariate analyses revealed that the difference in the CR after laCESA and laVASA was dependent on the age of patients at surgery. Patients younger than 60 years had significantly higher CR than the older patients. The CR after a TOT; however, was independent of the age at surgery.[14]

Overall, between 76% (laVASA) and 87% (laCESA) of patients under 60 years of age regained continence by the replacement of the USL and a suburethral tape (TOT 8/4).

In older patients (older than 60 years at surgery) CR ranged between 56% and 67%.[14]

The CR after tensioning the vagina by laCESA/laVASA were between 46% and 58% in 50-year-old patients, however only between 16% and 20% in patients older than 70 years. That

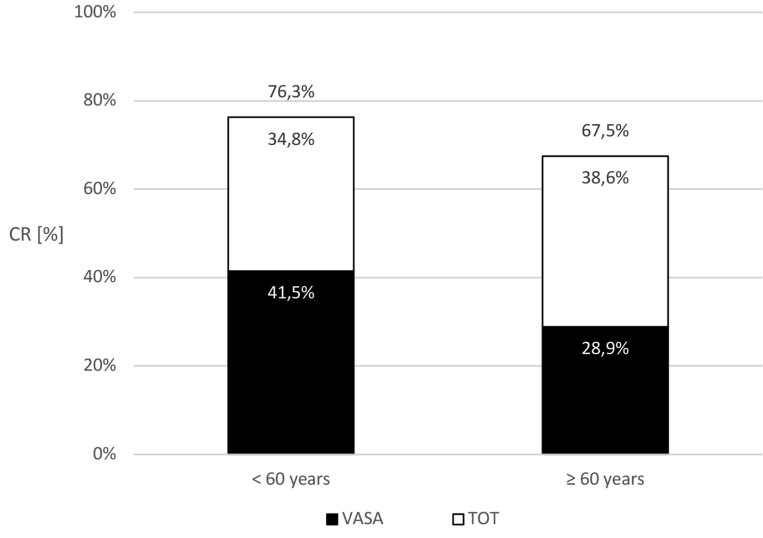

Figure 4. Continence rates (CR) after VASA and trans-obturator taped (TOT) 8/4 depending on the age at the time of surgery. The CR between <60 years and >60% were significant (p<0.01) for CESA-not for TOT 8/4

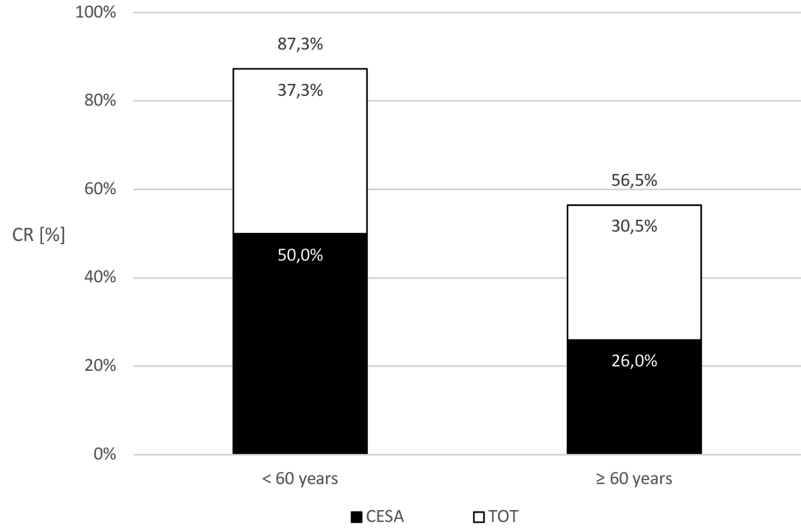

Figure 5. Continence rates (CR) after CESA and trans-obturator taped (TOT) 8/4 depending on the age at the time of surgery. The CR between <60 years and >60% were significant (p<0.01) for CESA-not for TOT 8/4

difference was statistically significant.[14] An additional TOT 8/4 led to continence in between 43% and 40% of the still incontinent patients irrespective of age at surgery.

The CR of an additional TOT 8/4 was between 40% and 43%.[14]

DISCUSSION

The studies demonstrated that patients with UUI can get continent again after surgical replacement of the USL and PUL as predicted in the Integral Theory. It further demonstrated that the results of surgery in terms of CR were critically dependent on age of patients especially on the years after menopause.

Surgery

The Integral Theory used the "bridge allegory" to explain the function of the ligaments for continence.[3] The vagina is held and tensioned by the ropes in front (PUL) and in the back (USL). The importance of the PUL for SUI had been shown impressively, however, the second aspect of the Integral Theory– the importance of the suspension of the vagina by the USL–was not pursued clinically.

However, the reason for this dysfunction of the ligaments especially the PUL leading to SUI and the occurrence in the early fourth decade of life remained unexplained.

Since all patients had the same symptoms of UUI and all had the same surgical procedures with structures of identical length sutured to the same defined anatomical sides the reason for failure to establish continence could be statistically analysed.

After meticulous statistical analyses it turned out that the only statistically important factor for CR after surgery was the age of the patients at surgery.[14]

The surgical elevation and tensioning of the vagina by laCESA or laVASA probably leads to the compression of the meatus (Figure 1). However, the number of patients who regained continence after laCESA or laVASA decreased significantly with increasing age after menopause.

That age dependency of CR was not observed after the suburethral tape (TOT 8/4). While a suburethral tape can cure SUI, this method alone is not capable of curing UUI. This observation strongly indicates that the effect of the suburethral tape is restricted to an area below the meatus internus which is not affected by decreasing estrogen levels. The results implicate that a suburethral tape (e.g., TOT) can probably only be effective for treatment of SUI and UUI as long as the trigone and the vagina are not submitted to the hypoestrogenic tissue remodelling and the USL are still intact.

Age Dependence

UI usually begins around in the early forties of life with urine leakage during coughing or sneezing (SUI).

After menopause –at about 50 years of age– patients realize that if they wait too long after the urgency, they may lose urine before reaching the toilet (UUI).

This continuous development ("pathophysiological continuum") between the ages of 40 years to 55 years from SUI via MUI to UUI leads to the hypothesis of a common underlying etiology which is caused by biological changes during that phase of a woman's life.[16,17]

Hormone Dependance

The progression from SUI to UUI (via MUI) after menopause led to the hypothesis that estrogens play a major role in that respect. That was first described by the North American Society of Menopause and the International Society for the Study of Women's Sexual Health.[16] That association between urgency and urgency UI is so close according to the opinion of these Societies that they put both forms of incontinence as symptoms of a common syndrome of menopause (genito-urinary syndrome of menopause). They conclude that urgency and UUI can be attributed to the decline of estrogens after menopause.[16,18] According to that hypothesis the respective important organs or structures important for continence must have estrogen receptors (ER).

It has been shown that ER are expressed in the uterus, the endometrium and the vaginal epithelium.[19] That could be explained by the norma menstrual cycle (Figure 6).[19,20]

However, ER were also found in comparable amounts in the trigone of the bladder and the urethral inner lining.[21]

On first view that seems incomprehensible what estrogens should exert in the bladder.

It is probably the ability of estrogens to form elastic hyaline structures which make them important for the trigone and the urethra. Elasticity is the ability to stretch and to contract. That elasticity is of crucial importance during pregnancy not only for the female genitalia but also for the female bladder.[21,22]

Beside the increase in uterine size during pregnancy the USL must increase their elasticity and length to hold the uterus during pregnancy and at birth. The elastic capacity of the vagina is enormous considering that until delivery the circumference of the vagina must stretch to approximately 38 cm for the passage of the child.[22] When the child during birth reaches the parts of the vagina where the bladder trigone is adherent, not only the vaginal wall must stretch but also the trigone of the bladder in order to prevent tearing of the bladder during the passage of the child's head. Finally, the urethra must also be able to stretch longitudinally during the child's exit out of the birth canal. Therefore, these structures also need to have ER.

During pregnancy, parallel to the child´s growth the concentrations of estrogens increase massively.[23] These increasing amounts of estrogen needed for uterine growth and the other mentioned anatomical structures until birth cannot be produced by the ovaries and therefore becomes a significant task of the placenta. The increase in estrogen levels during pregnancy, particularly in the last trimester, supports the assumption that estrogens are crucial for the aforementioned increase in tissue elasticity.[23,24]

It can be assumed that the declining levels of estrogens before menopause and the missing estrogens thereafter will lead to a loss of elasticity in all of these estrogen-sensitive tissues. That can lead to laxity or a shrinkage of the respective tissues.[3,18]

If UUI is generally based on estrogen deficiency and SUI and MUI have the same etiology than UI starts with the laxity of the PUL leading to SUI. That is in accordance with the "Integral

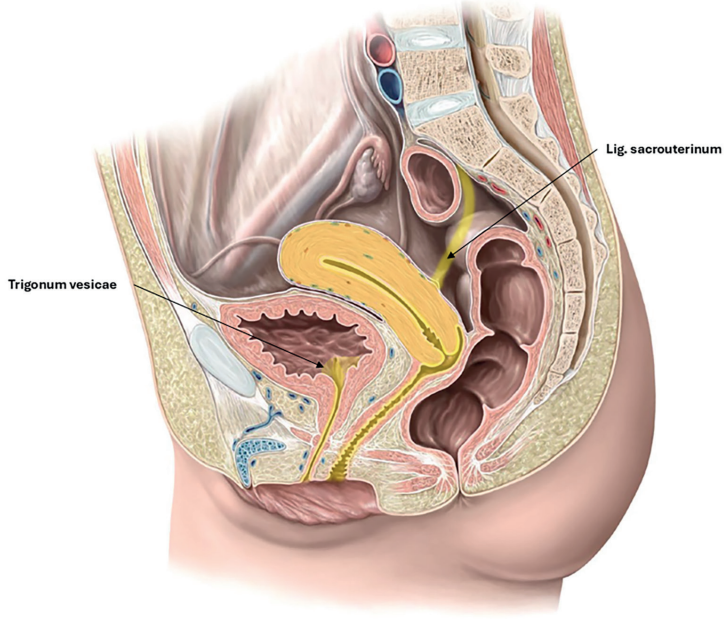

Figure 6. Distribution of estradiol receptors (ER) in the pelvis. ERs are primarily located in the uterosacral ligament, vaginal wall, endo-and myometrium, urethra, and trigonum vesicae

Theory". It seems reasonable to assume that the PUL and the lower trigone are (one of) the first genital structures affected by estrogen deficiency.[25]

With the increasing period of estrogen deficiency after menopause the elasticity of the trigone will continuously decrease leading to a laxity of the trigone which does not allow further stretching when the bladder fills. Therefore, the time interval between the sensation of urgency which is induced by the stretch receptors in the bladder wall and urine discharge also shortens continuously. The additional effect of the laxity of the USL will lead to a reduced suspension and a slight prolapse of the vagina. That laxity puts the meatus internus in a more horizontal axis especially when standing up (Figure 2). That assumption was confirmed by the clinical examination of the patient in standing position.

The hypothesis that estrogens are important for continence is supported by the observation that patients with HRT only became incontinent when they stopped HRT. Some of these patients stopped HRT at the age of 65 or 70 years. They remained continent until that age.

The reports in literature where no effect of HRT on UI was reported suffered from the fact that HRT only started after menopause when patients were suffering from menopausal symptoms.[25] Nevertheless, these studies demonstrate that the tissue remodelling after menopause is not reversible by estrogens. Therefore, HRT should be started at the first symptoms of SUI. If the patient accepts a suburethral tape in that situation it would be interesting to evaluate if the further development of continence/incontinence.

The "bridge allegory" of the Integral Theory led to the development of structures which replace the function of the ropes in front (PUL) and in the back (USL). The identical surgical procedures in every woman suffering from UUI allowed further insights in the etiology, pathogenesis and treatment of UI. The results obtained demand further scientific and clinical evaluation.

CONCLUSION

UI is a genetically predisposed disorder. It follows a symptomatically and chronological sequence starting with SUI leading to UUI after menopause.

That pathogenesis is hypothetically caused by the decline of estrogen levels during the pre-, peri- and postmenopausal phases of life. UI is based on the uncontrolled loss of urine through the meatus internus of the bladder. The meatus is the lower angle of the trigone of the bladder, the area between the orifices of the ureters and the meatus internus of the urethra. The trigone is the only part of the bladder which expresses ER, indicating that estrogen is needed for the physiological function of the trigone. This physiological function is elasticity in order to stretch that part of the bladder during filling and to contract at the meatus when stress is exerted.

With decreasing estrogen levels, the elasticity diminishes what leads to laxity of the PUL and USL in the genetically predisposed women.

Furthermore, when the bladder fills, the trigone continuously loses its elasticity leading to an ever-shorter interval between urgency and urine loss.

The clinical consequence is uncontrolled loss of urine after the urge sensation (UUI).

UUI can surgically be cured by the standardized replacement of the lax USL by laCESA or laVASA and the replacement of the PUL by a TOT 8/4. However, the CR decrease significantly after menopause during each decade thereafter. That indicates that the postmenopausal hypoestrogenic tissue remodelling probably at the trigone cannot be reversed by these surgical procedures anymore.

It was an important observation that patients who had a previous HRT starting before menopause developed UUI only when they stopped HRT. Therefore, early estrogen substitution can probably prevent the tissue remodelling leading to UUI.

HRT should start at the same age as SUI started in the mother. HRT should be continued lifelong. The methods of application, preparation, or dosage of the estrogen should be studied in future clinical trials by gynecological endocrinologists.

FOOTNOTES

Acknowledgments

The authors thank Dr. Ludwig, who, together with Dr. Morgenstern, developed and performed the laparoscopic surgical techniques (laCESA, laVASA). The authors also thank Ms. E. Neumann for data documentation and her always open ears for all the wishes and concerns of the patients.

DISCLOSURES

Financial Disclosure: The author declared that this study received no financial support.

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BRIEF REPORT

DOI: 10.34057/PPj.2025.44.02.2024-7-4
Pelviperineology 2025;44(2):50-53

Multi material thread lifting and platelet rich plasma for urethral support a new minimally invasive procedure for the treatment of stress urinary incontinence: Preliminary report

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Citation: Isaza PG, Luksenburg A, Palma P. Multi material thread lifting and platelet rich plasma for urethral support a new minimally invasive procedure for the treatment of stress urinary incontinence: preliminary report. Pelviperineology. 2025;44(2):50-53

ABSTRACT

Stress urinary incontinence (SUI) is one of the symptoms of pelvic floor dysfunction mainly due to the loss of urethral support that can alter the quality of life of women. Alternative methods for the approach of this condition are arising as minimally invasive and effective options for our patients. To evaluate the long-term effect of Multi material thread lifting and platelet rich plasma for urethrovaginal suspension as a minimally invasive alternative treatment for types II and III SUI in a group of patients. Twelve patients (age 53.38±5.1, range 45-65) with an urodynamic diagnosis of Type II-III SUI, basedf on valsalva leak point pressure, were subsequently enrolled into the study. Patients received one treatment of multi material threadlifting for urethral support along with platelet rich plasma injections. SUI was evaluated using the international consultation on incontinence questionnaire-short form (ICIQ-SF) before, at 6 months and 12 months after treatment. Multi material threadlifting for urethrovaginal suspension with platelet rich plasma injections treatment was associated with a significant improvement in ICIQ-SF scores. Improvements maintained up to the 12 months of follow-up, without the need for any further treatments. Our results suggest that multi material threadlifting for urethral support along with platelet rich plasma injections is an efficient minimally invasive and safe novel treatment strategy in patients with SUI. Further investigation to confirm the long-term effect that has been presented herewith is still warranted.

Keywords: Pelvic floor; sling; urinary stress incontinence

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Received: 21 April 2025 **Accepted:** 08 May 2025 **Publication Date:** 18 August 2025

INTRODUCTION

Stress urinary incontinence (SUI) is an important clinical problem that affects millions of women worldwide. Urine leakage occurs secondary to the increase in intra-abdominal pressure due to stress along with an anatomical defect.[1]

Management of SUI may be conservative or surgical. Despite the choice they have different cure rates and complications.

Surgical treatments in general are more expensive than the conservative ones.[1-3]

We present here a new minimally invasive treatment for SUI using a combination of platelet-rich-plasma (PRP) injections in the anterior vaginal wall, and the placement of polydioxanone (PDO) threads in the suburethral, space, reinforcing the urethropelvic ligaments (Figure 1).

MATERIALS AND METHODS

Twelve patients (age 53.38±5.1, range 45-65) with an urodynamic diagnosis of Type II-III SUI, basedf on Valsalva leak point pressure, were subsequently enrolled into the study. Patients received one treatment of multi material threadlifting for urethral support along with platelet rich plasma injections.

The summary of the procedure, described previously (4) was made in 2 steps:

Step 1: Injections of PRP in the Anterior Vaginal Wall

Blood (8 mL) are drawn using 4 mL tubes with 3.8% sodium citrate (GyCO, Deltalab.Spain). Centrifugation is then performed for 8 minutes at 1800 rpm. The separated plasma is drawn using 1 mm syringes. For each 1 mm syringe, 0.9 mL of the plasma is then mixed with 0.1 mL of calcium chloride (GyCO, Deltalab, Spain). The 1 mm syringes are connected to 30G × ½ (13 mm) needles. To facilitate the transvaginal injections of the PRP in the anterior vaginal wall the authors have developed a novel fenestrated speculum (Figure 2).

The rationale behind this fenestrated speculum is only to protect the urethra form injuries, but also provide stabilization for the insertion of the threads.

Platelet enriched autologous plasma is injected in the anterior vaginal wall stranding proximally to the uterus and moving towards the urethral meatus.

This is an important detail for bleeding may occurs mainly at the vaginal introitus. Bevel into the vaginal mucosa at an angle of 45 degrees. Approximately 0.2 mL of PRP is placed with each injection.

An average of 10 injections of PRP per side are used.

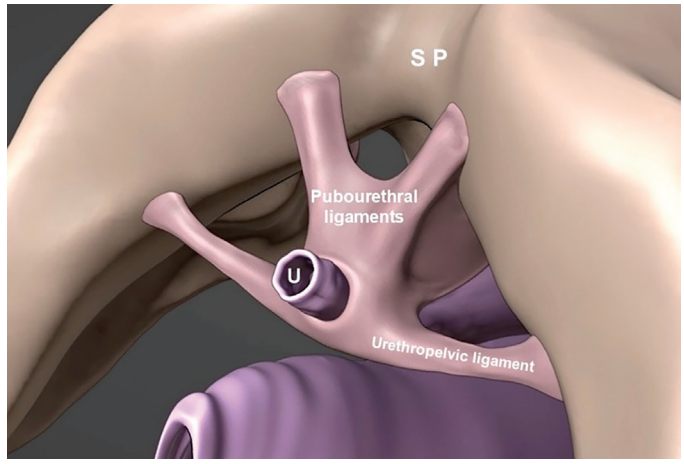


Figure 1. The urethropelvic ligaments are reinforced with polydoxane threads

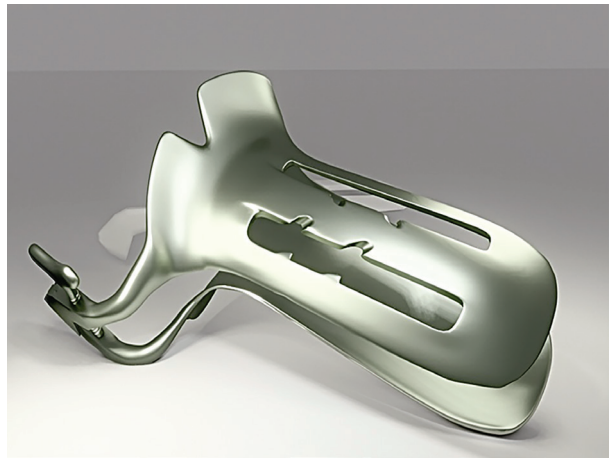


Figure 2. The fenestrated speculum has 2 lateral and longitudinal parallel fenestrations 7 mm wide and 65 mm long

Step 2: PDO Threads Placement

The mean time for the reabsorption of PDO threads is 6 months. The PDO thread is 45 mm long, 0.15 mm (4-0) thickness, and has a cork screw configuration mounted on a needle 25G × 30 mm (GyCO International, Shanxian Runte Medical International, Ltd., China).

The procedure is begun by performing 2 punctures lateral and inferior to the urethal meatus (Figure 3). A Foley catheter with a metallic guide inside is used to move the urethral upwards, avoiding urethral and bladder perforations. Besides the tips of the canula are blunt, making the procedure even safer (Figure 4). Once the urethra and bladder neck are moved upwards, the threads are introduced in the previous made punctures, first in a "X" format and next is an "A" shape creating a backboard support to the urethra (Figure 5).

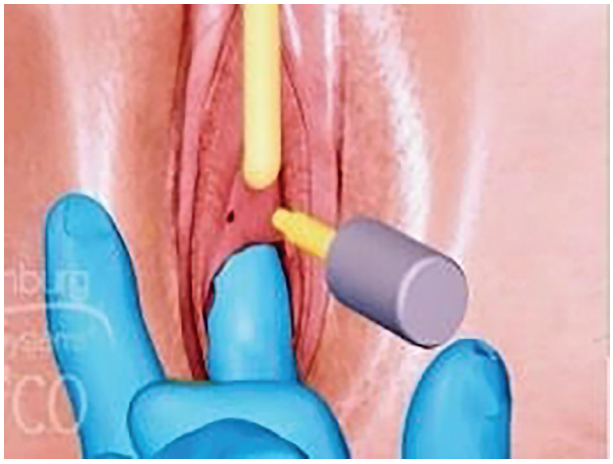


Figure 3. The procedure is begun by performing 2 punctures lateral and inferior to the urethral meatus

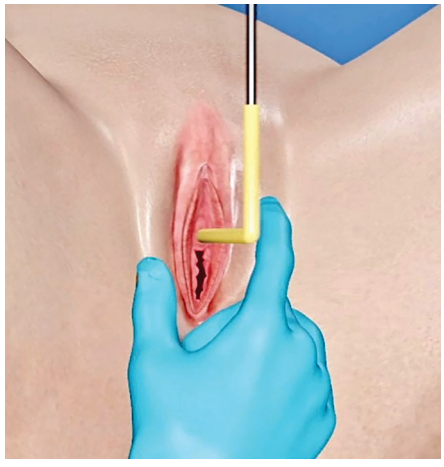


Figure 4. The Foley catheter with a metallic guide inside is used to move the urethral upwards

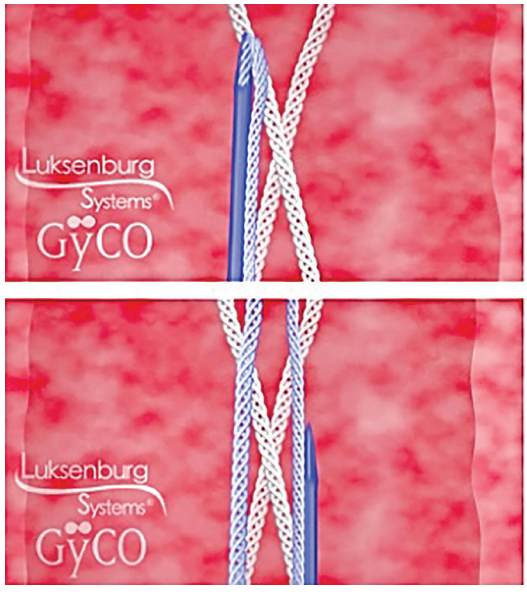


Figure 5. Notice that the suburethral threads are place first in an X shape and then in an A shape reinforcing the urethropelvic ligament

RESULTS

Multi material threadlifting for urethral support with platelet rich plasma injections treatment was associated with a significant improvement in ICIQ-SF scores. Improvements maintained up to the 12 months of follow-up (Graphic 1).

DISCUSSION

The weakening of the urethral supporting elements vaginal wall are 2 of the main causes of the urethral hypermobility and stress urinary incontinence.[1-6]

This minimally invasive technique presented here results in strengthening of the supporting elements of the urethra preventing the hypermobility.

The association of PRP injections in the vaginal wall along with the insertion of PDO threads in the suburethral space, creates a type of collagen mattress increasing the urethral support, so that under stress the urethral hypermobility is avoided.

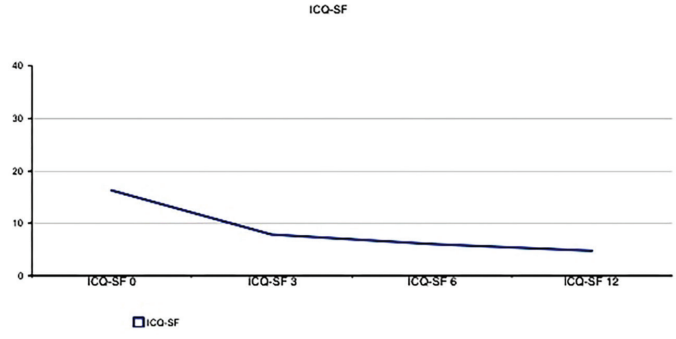
As a response to the PRP injections we noticed an increase in the blood flow, vascular permeability.

These findings allow for fibroblast and myofibroblasts activation that will lead to neocollagen production, that means better support to the urethra.

As already demonstrated, PRP has a modulating effect on the inflammatory process, avoiding undue fibrosis.[6,7]

The PDO threads implanted induce a mild foreing body inflammatory reaction around the them, leading to the desired reinforcement of the urethropelvic ligament.

The histologic findings following the PDO threads implants was characterized by the creation of a 3-dimensional collagen fibers, which resulted in the formation of a mesh-like structure around them, and that persisted after the reabsorption of the threads.



Graphic 1. Sgnificant improvement in ICIQ-SF was noted, corresponding to 75% of cure rate.
All patients improved and the results were sustained for 12 months. No urinary retention, *de novo* urgency or any type of complication were reported
ICIQ-SF: International consultation on incontinence questionnaire-short form

Study Limitations

One of the limitations of our study is the small number of patients. As any new procedure, randomized prospective studies are needed.

CONCLUSION

Based on our findings we can conclude that this minimally in office procedure is safe and effective.

At the moment a comparative prospective randomized study comparing this procedure with TOT sling is under way, so we can better understand the role of this new procedure in the urogynecological armamentarium.

FOOTNOTES

Contributions

Concept: P.G.I., A.L., Design: P.G.I., A.L., P.P., Data Collection or Processing: P.G.I., A.L., Analysis or Interpretation: P.G.I., A.L., P.P., Literature Search: P.G.I., A.L., P.P., Writing: P.G.I., A.L.

DISCLOSURES

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

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DOI: 10.34057/PPj.2025.44.02.2025-5-5
Pelviperineology 2025;44(2):54-59

Partially absorbable lightweight sub mid-urethral sling implant (serasis) for female stress urinary incontinence treatment - 355 operations

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Citation: Sumerova N, Neuman J, Fabian-Kovacs R, Neuman M. Partially absorbable lightweight sub mid-urethral sling implant (serasis) for female stress urinary incontinence treatment - 355 operations. Pelviperineology. 2025;44(2):54-59

ABSTRACT

Objectives: Serasis is a partially absorbable lightweight sub mid-urethral sling for treating female stress urinary incontinence (SUI). Its placement is considered less traumatic than other mid-urethral slings as, due to its nature of weaving and soft edges it causes less damage to the tissue, diminishing post-operative pain and the extent of tissue scarring. The aim of the study was to evaluate the efficacy and safety of treating SUI using the partially absorbable lightweight mid-urethral sling Serasis placed at the sub mid-urethra.

Materials and Methods: This is a retrospective study. Pre-operative, intra-operative and post-operative data was retrieved from patients' electronic files. The patients reported their subjective functional outcomes on the first post-operative day, one month, and four months after surgery. The reported intra- and post-operative complications, post-operative lower urinary tract symptoms, bowel symptoms, dyspareunia, functional results, were tabulated and assessed. Physical evaluation on the first post-operative month were tabulated as well.

Results: The study of SUI reporting female study population (n=355) had a mean age of 50.1±10.3 years, 4.5% had previous hysterectomy, 118 patients (33.2%) reported pre-operative overactive bladder. Concomitant anterior and posterior colporrhaphy was performed in 230 (64.8%) cases. No significant intraoperative complications were recorded. 95.9% of the patients were satisfied with the procedure at the 4-month follow-up (F/U). The recurrence rate was 3.7%. Ten patients were lost to F/U. There were 2 (0.4%) reported incidents of implant exposure in the 4-months F/U that were successfully treated surgically.

Conclusion: The Serasis partially absorbable lightweight sub mid-urethral sling for treating SUI is safe and efficient and carries a minimal risk of complications upon short term F/U period.

Keywords: Mesh; sling; urinary stress incontinence

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Received: 13 April 2025 **Accepted:** 04 June 2025 **Publication Date:** 18 August 2025

INTRODUCTION

In the past 3 decades, efforts have focused on creating less invasive and safer techniques that mimic the high success rates of colposuspension for curing stress urinary incontinence (SUI), with low rates of morbidity and shorter hospitalization and recovery time.[1] In the 1980s, there was a shift toward less invasive surgical treatment for SUI. Procedures based upon needle mediated suspensions reasonably were widely used as they were simple to perform and provided good short-term results. Medium- and long-term pain, dyspareunia, persistent urine incontinence, and erosion or exposure of the sutures led later to abounding these techniques.[2]

The next generation of anti-incontinence operations were the sub mid urethral sling (SMUS) era. Again, medium term pain, dyspareunia, persistent urine incontinence, and erosion or exposure after SMUS insertion raise concerns.[3] Yet, the evidence from randomized clinical trials regarding these longer-term outcomes is limited.[4]

As the objective of surgical SUI treatment in women is to regain continence while minimizing treatment related morbidity. With this perspective and given the known risks of complications associated with the common anti-incontinence surgical techniques today, we searched for safer SMUS that might help to reduce intra- and postoperative complications. The Serasis tape (Serag-Wiessner, Naila, Germany), knitted of partially absorbable material to form light-mesh of soft fabric, potentially causes less trauma and damage to the tissues, diminishing post-operative pain and the extent of tissue scarring was developed.[5]

The Serasis was placed as a trans obturator tape (TOT) implant. This technique of sling passage through the obturator foramens - close to the medial border, from the inside to the outside was described earlier (2003).[6] The outcomes of 107 consecutive patients show that this surgical procedure is fast, easy, precise, and feasible. Furthermore, this method prevents harm to the bladder and urethra, which eliminates the need for cystoscopy.

In 2022, a comparison of the Serasis and TVT-Abbrevo tapes demonstrated that being related to fewer adverse effects, the Serasis softly knitted partially absorbable tape might be a better option for treating female USI than TVT-Abbrevo (Ethicon, Johnson & Johnson, Summerville, USA) laser cut polypropylen.

The aim of this study was to assess the effectiveness and safety of using the Serasis lightweight mid-urethral sling to treat female SUI.

Our hypothesis was that the use of Serasis would lead to a decrease in the frequency and intensity of post-operative dyspareunia and other post-operative pain, as well as bowel and lower urinary tract symptoms.

MATERIALS AND METHODS

This is a retrospective study. Data was collected from electronic medical records prior to, during and after surgery. The inclusion criteria were clinical stress incontinence, and the exclusion criteria were previous pelvic irradiation and/or pelvic inflammatory disease. Patient's remote follow-up was performed on the first day following surgery, as well as one and four months later, patients' follow-up physical pelvic examinations and questionnaires form filling was conducted one month after surgery. The following were designated as outcome measures: Urinary and bowel symptoms, post-operative pain and dyspareunia levels, anatomical and functional cure rates, and the nature, rate and severity of post-operative complications. Patients were asked to rate pain or discomfort according to the visual analogue scale (VAS). The primary outcome measure was post-operative pain during the first month after surgery. Secondary outcomes were relief of SUI symptoms, dyspareunia or bowel discomfort, and the occurrence of post-operative complications during the first 4 months after surgery.

Being a retrospective study, the ethical committee waved us the need for informed consent. Helsinki Committee's approval 29:5:24, for Prof. Menahem Neuman, Assuta Medical Centers: We were convinced that your study about curing female USI with sub mid urethral sling placement is in accordance with the 1980 regulations of ethics of medicine and you can now proceed with your research. Your study no is 013-24-ASMC, version no 2. discussed on 12:4:24, approved on 29:5:24. Dr. Shiri Shulman, Assuta.

Statistical Analysis

Preoperative demographic and clinical characteristics: General demographic data of the Serasis patients (n=355) were provided with the use of mean, range, and standard deviation; continuous data such as age, and the discrete data of parity were given in this format. Other general, preoperative data included the categorical, nominal information of symptoms, prior surgical procedures, and concomitant diseases/conditions. These were displayed using frequency (n) and their respective proportions in percentages (%).

Postoperative outcomes: The postoperative complication data were represented as categorical, nominal data with frequency (n) and proportion as a percentage (%). Symptoms and conditions at the second and third follow-ups (one and four months, respectively) fell into this category, as did complication data at the first (one day), second and third follow-ups. Pain intensity (VAS) was treated as discrete data, so it was also displayed with a mean and range.

Of the aforementioned, the categorical data [namely, SUI, dyspareunia, overactive bladder (OAB), Bowel symptoms, Stage 1 apical prolapse, cystocele, and rectocele] were summarized in a combination-bar chart, where they were shown as proportions (%) before and after the Serasis procedure, with a trendline displaying the differences (Δ%). All of the postoperative ("after") data represent proportions of patients at the third (four month) follow-up event, with the exception of the cystocele and rectocele conditions, which represent the proportion of patients at the second (one month) follow-up event.

The statistical test used to demonstrate the differences in pre- and post-operative data regarding the symptoms and conditions, was the McNemar's test, which yielded the outcomes of the symptoms of SUI and OAB to be "extremely" and Bowel symptoms "very" significant, whereas the difference in dyspareunia proved "not significant". For the conditions apical prolapse (Stage 1), cystocele, and rectocele, the test also showed an "extremely significant" difference. A two-tailed *p*-value of 0.05 was regarded as significant.

RESULTS

Three hundred fifty-five women were included in the study and had the Serasis light-weight mid-urethral sling for treating SUI performed between October 2013 and December 2015. No intraoperative complications were recorded. Ten patients were lost to F/U. 95.9% of the patients were satisfied in the 4-month follow-up (F/U). The recurrence rate was 3.7%. There were 2 (0.6%) reported incidents of implant exposure in the 4-months F/U that were successfully treated surgically. The preoperative patient characteristics are listed in Table 1. The mean age of the study population at the time of the procedure was 50.1±10.3 years (range 29-79). All patients had urinary stress incontinence (SUI) symptoms prior to surgery. One hundred eighteen (33.24%) patients had OAB symptoms prior to surgery, and 16 (4.5%) patients had a previous hysterectomy. 78.6% of the patients had one of the following or a combination of apical, anterior and/or posterior pelvic organ prolapse (POP). Concomitant anterior and posterior colporrhaphy was performed in 230 (64.8%) cases. The mean duration surgery time was 18.3 min (range 10-25) with mean blood loss averaging at 22.1 mL (range 10-30).

Table 1. Patients preoperative demographic and clinical characteristics, total n=355

Demographic data (mean, range, SD)	**Mean**	**Range**	**SD**
Age	50.1	29-79	10.3
Parity	2.8	0-7	1.1
SUI duration	3 years, 1 month	1 months-30 years	4.0
Procedures/symptoms (n, %)	n	%	
SUI	355	100.0%	
Previous hysterectomy	16	4.5%	
Dyspareunia	17	4.8%	
OAB	119	33.2%	
Bowel symptoms	13	3.7%	
Apical prolapse			
0	170	47.9%	
1	185	52.1%	
Rectocele			
0	119	33.5%	
1	99	27.9%	
2	137	38.6%	
Cystocele			
0	76	21.4%	
1	74	20.9%	
2	204	57.5%	
3	1	0.3%	

SUI: stress urinary incontinence; SD: standard deviation; OAB: overactive bladder

Table 2. Success rate of USI, OAB, pain, dyspareunia, bowel symptoms, POP symptoms

	Preoperative			Postoperative			Calculations			
	Before (n)	%	Total (n)	After (n)	%	Total (n)	D (%)	*p*-values	Test done	Significance
SUI	355	100.0	355	20	5.6	355	94.4	<0.0001	McNemar's test	Extremely
Dyspareunia	17	4.8	355	15	4.2	355	0.6	0.8445	McNemar's test	Not
OAB	118	33.2	355	43	12.1	355	21.1	<0.0001	McNemar's test	Extremely
Bowel symptoms	13	3.7	355	2	0.6	355	3.1	0.0055	McNemar's test	Very
Apical POP	185	52.1	355	1	0.3	355	51.8	<0.0001	McNemar's test	Extremely
Cystocele	279	78.6	355	0	0.0	355	78.6	<0.0001	McNemar's test	Extremely
Rectocele	236	66.5	355	0	0.0	355	66.5	<0.0001	McNemar's test	Extremely

POP: pelvic organ prolapse; OAB: overactive bladder; SUI: stress urinary incontinence

The functional and anatomical data is shown in Table 2, comparing these parameters before and after surgery. The outcome measures, including urinary, bowel, and pain symptoms, and the subjective and objective success rates are shown in Figure 1. Significant reductions were observed with OAB symptoms after surgery, including urgency, frequency and nocturia, as well as urinary stress incontinence. The occurrence of adverse events and both subjective and objective success proves over-all positive results.

Despite a general decline in SUI and OAB symptoms, there were still 13 (3.7%) recurrence cases in 4 months follow-up. The unfavorable results rate was 2.5%, including 5 (1.4%) cases of surgery failure and 3 (0.9%) cases of urinary tract infection (UTI) in 4-month follow-up. All the complications are listed in Table 3. Three days of oral antibiotics were used to treat post-operative fever of unknown origin; hemostatic sutures were used to treat intraoperative bleeding; low hemoglobin was carefuly watched until spontaneous recovery; leg edema, vaginal bleeding and hematuria were resolved spontaneously; retropubic TVT was used for patients sufering SUI recurrence; surgical apical suspension was used to treat POP; analgetics were used to treat low back pain; and exposed tape segments as well as granulation tissue were resected, antibiotics were used to treat UTI.

At the 4-month follow-up, the patient's satisfaction rating was 95.9%.

At the postoperative pelvic examination, 1 month after the treatment, there was a significant improvement in SUI, apical, anterior and posterior defects (Figure 1). There was a significant positive correlation between anatomical and functional success rate, the correlation coefficient is significantly different from zero (p<0.0001). Functional outcomes are also associated with higher ratings for anatomical results.

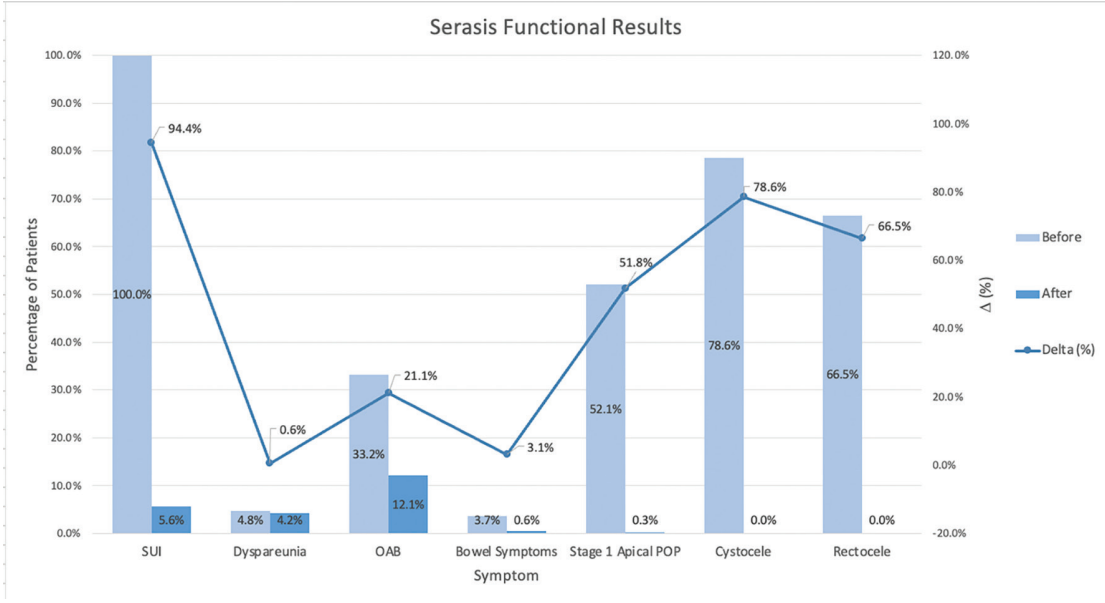

Figure 1. Postoperative functional results at 4th month follow-up
POP: pelvic organ prolapse; OAB: overactive bladder; SUI: stress urinary incontinence

Table 3. Complications rate		
	n	%
1 day after surgery		
Intra operative bleeding (>100 cc.)	1	0.3%
Low hemoglobin <10 gr %)	1	0.3%
Fever (>38.0)	2	0.4%
Leg edema	1	0.3%
1 month after surgery		
Vaginal bleeding	1	0.3%
Hematuria	1	0.3%
4 months after surgery		
SUI reccurrence	13	3.7%
UTI	3	0.9%
Vaginal tap exposure	2	0.6%
LBP	1	0.3%
Granulation tissue formation	1	0.3%
POP	2	0.6%

SUI: stress urinary incontinence; POP: pelvic organ prolapse; UTI: urinary tract infection; LBP: low back pain

DISCUSSION

Serasis is a partially absorbable light-weight mid-urethral sling for treating SUI, used here with the transobturator approach. Being gently weaved rather than laser cut and composed of soft fabric, its edges are soft – making the insertion significantly less traumatic than other mid-urethral slings, causing less damage to the tissue, diminishing post-operative pain and the extent of tissue scarring, as well less tap exposure occurrence rate. Both, pain intensity and duration were low, when compared to previous clinical reports. The fact that some patients had improved SUI, yet not completely cured explains the reported 95.9% patient satisfaction compared to the 94.4% SUI cure rate. The data reported here agrees with former comparison of Serasis to other TOT taps, showing that the Serasis related post-operative discomfort occurs less frequently and at lower levels.

We strongly believe that concomitant prolapse repair improves the patients centered subjective satisfaction of anti-incontinence surgery. Thus, concomitant anterior and posterior colporrhaphy was performed in 64.8% cases. POP surgery together with MUS were compared in an RCT by Van der Ploeg et al., which showed that POP surgery plus MUS improved post-operative USI.

Our study shows excellent results in terms of the post-operative success rate and the occurrence of subjective and objective side effects.

Long-term follow-up studies on efficacy and adverse effects following Serasis sling implantation are not available currently.

Study Limitations

Due to its descriptive and retrospective nature, the current study has a few limitations: The retrospective nature of the study, no control group in this descriptive trial to compare our surgical technique to, a rather short follow-up period and lack of use validated questionnaires to assess the outcome results. The strengths of the study are the large patient's group and the large data amount reported here.

CONCLUSION

The use of a partially absorbable, light-weight carefully weaved tape for anti-incontinence procedure results in reduced morbidity while preserving treatment effectiveness. This current study shows that the Serasis mid-urethral sling is a safe, efficient procedure that has a minimal risk of complications.

ETHICS

Ethics Committee Approval: Helsinki Committee's approval 29:5:24, for Prof. Menahem Neuman, Assuta Medical Centers: We were convinced that your study about curing female USI with sub mid urethral sling placement is in accordance with the 1980 regulations of ethics of medicine and you can now proceed with your research. Your study no is 013-24-ASMC, version no 2. discussed on 12:4:24, approved on 29:5:24. Dr. Shiri Shulman, Assuta.

Informed Consent: Being a retrospective study, the ethical committee waved us the need for informed consent.

FOOTNOTES

Contributions

Surgical and Medical Practices: M.N., Concept: N.S., M.N., Design: N.S., M.N., Data Collection or Processing: J.N., R.F-K., Analysis or Interpretation: N.S., J.N., R.F-K., Literature Search: N.S., Writing: M.N., N.S.

DISCLOSURES

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

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ORIGINAL ARTICLE

DOI: 10.34057/PPj.2025.44.02.2025-6-3
Pelviperineology 2025;44(2):60-66

The migration pattern of the mesh used in sling surgeries with respect to the anatomical approach

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Citation: Sipahioğlu H, Ateş S. The migration pattern of the mesh used in sling surgeries with respect to the anatomical approach. Pelviperineology. 2025;44(2):60-66

ABSTRACT

Objective: The aim of this study is to evaluate the time-dependent suburetral translocation of the mesh used in transobturator and retropubic sling procedures and its relation to surgery outcomes.

Materials and Methods: A total of 40 female patients undergoing surgery for stress urinary incontinence were enrolled into the study. The patients were allocated to either transobturator suspension (n=20) or retropubic suspension (n=20) group by random sampling method. They were evaluated after 24 hours of surgical intervention by transperineal ultrasonography. The craniocaudal and dorsoventral distances between the superior margin of the mesh and symphysis pubis or bladder neck both at rest and at mild straining were measured. Measurements was repeated on the postoperative 6th week, 6th month and 1st year and the patients were questioned in terms of lower urinary tract symptoms such as stress urinary incontinence, abnormal emptying, urgency, frequency, nocturia and pelvic pain.

Results: Transobturator and retropubic sling techniques provided cure in more than 90% of the patients. Lower urinary tract symptoms disappeared at the end of the first year in both groups.

Conclusion: Suburethral mesh translocated in time towards the caudal direction in both techniques. Retropubic approach is more effective in preventing urethral mobility.

Keywords: Retropubic sling; stress urinary incontinence; transobturator sling; transperineal ultrasonography

INTRODUCTION

Urinary incontinence is a frequent health problem encountered in females which unfavorably influences the quality of life. There are various options of conservative and surgical treatment modalities for stress urinary incontinence.[1,2] Most of the surgical techniques have been designed to support the urethra. The mid-urethral sling techniques (transobturator and retropubic) have been the first choice since the time they have been introduced as minimally invasive techniques in the surgical treatment of incontinence.[3-6] Although, suburethral sling procedures target midurethral placement of the mesh, studies based on various methods and perspectives reveal potential alterations in the

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Received: 01 January 2025 **Accepted:** 30 July 2025 **Publication Date:** 18 August 2025

position and mobility of the mesh.[7,8] In this study, we aimed to evaluate how the distance between the mesh, symphysis pubis and bladder neck in different planes effects the outcomes of surgery through transobturator and retropubic approach.

MATERIALS AND METHODS

Patients

A total of 40 female patients who had genuine stress urinary incontinence were enrolled into the study. The patients were divided into two groups by random sampling method. One of the groups underwent transobturator suspension (n=20) and the other group underwent retropubic suspension (n=20) surgery. Patients with pelvic organ prolapses in the anterior or posterior compartment and the patients with uncontrolled diabetes mellitus and/or hypertension were excluded from the study. The patients were informed about the procedures and their informed consents were obtained. All of the transobturator suspension and retropubic suspension procedures were performed by the same examiner (HS) under spinal anesthesia. Non-absorbable, monofilament, macroporous polypropylene mesh was used during these procedures. The patients were examined by transperineal ultrasonography (TPUSG) in the mid-sagittal plane within the first 5 minutes following micturition after 24 hours of surgery. On TPUSG, the suburethral mesh band was clearly observed as a hyperechogenic line in the suburethral midurethral region (Figure 1).

The craniocaudal and dorsoventral distances between the superior margin of the mesh and symphysis pubis or bladder neck were measured both at rest and at mild straining (Figure 2).

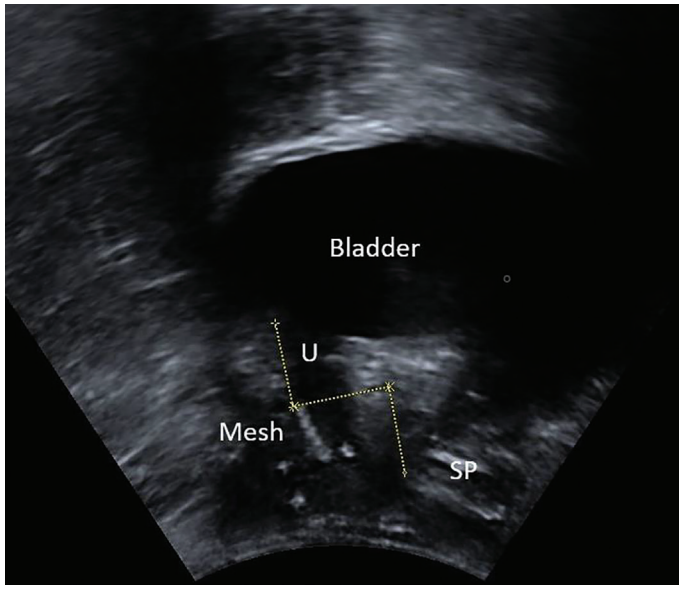

Figure 1. Mesh, SP - symphysis pubis, U - urethra and bladder at rest and at mild straining on TPUSG

TPUSG: transperineal ultrasonography

The measurements were repeated on the postoperative 6th week, 6th month and 1st year, and the patients were questioned regarding lower urinary tract symptoms (LUTSs) such as stress urinary incontinence, abnormal emptying, urgency, frequency, nocturia and pelvic pain. The ethical approval has been obtained.

Statistical Analysis

Suitability of the quantitative data for normal distribution was analyzed both graphically and by Shapiro-Wilk test. Descriptive statistics were presented as number and percentage for qualitative data and as mean ± standard deviation and median (minimum-maximum) for quantitative data. Chi-square test was used for the comparison of independent categorical variables, whereas pairwise comparison of the numerical variables was done using t-test in case the condition for normal distribution was met and using Mann-Whitney U test in case the condition for normal distribution was not met. Analysis of variance was used for the comparison of the repeated measures. Bonferroni post-hoc test was used when time-dependent difference was detected. The level of significance was predetermined to be $p<0.05$.

RESULTS

A total of 40 patients between the ages of 30 and 68 years were included into the study. General characteristics of the patients in the transobturator suspension and retropubic suspension groups are given in Table 1. There was no difference between the groups in terms of general characteristics.

The prevalence rates of LUTSs in the preoperative period and in the postoperative follow-up period are shown in Table 2. The symptom prevalence was similar between the two groups at all time points. Only urgency in the postoperative Day 1 and frequency in the postoperative 6th week were higher in the retropubic suspension group.

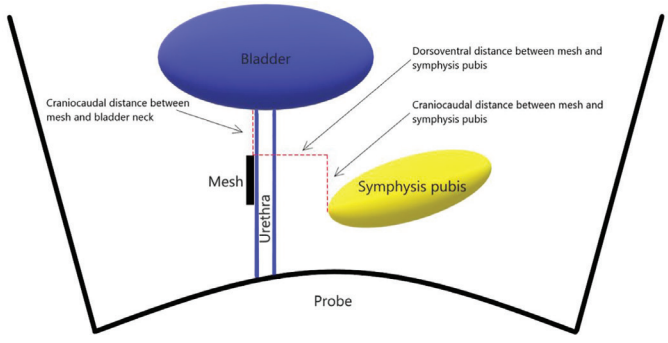

Figure 2. Schematic view of craniocaudal and dorsoventral distances between mesh and symphysis pubis or bladder neck

Stress urinary incontinence, which was present by 100% in both groups in the preoperative period, decreased in the postoperative Day 1 to 25% in the transobturator suspension group and to 35% in the retropubic suspension group. These rates were in turn 10% and 15% in the postoperative 6th week, and 5% and 10% in the postoperative 6th month. The last rates have been preserved also in the postoperative 1st year.

With regard to the measurements at rest and at mild straining during postoperative follow-up period, the craniocaudal and dorsoventral distances between the mesh and symphysis pubis and the craniocaudal distance between the mesh and bladder neck were compared between the two surgical techniques (Table 3). Only the dorsoventral distance between the mesh and symphysis pubis at mild straining was higher in the retropubic suspension group both in the postoperative Day 1 and in the postoperative 6th week. There was no difference between the groups in terms of the measurements at other time points.

Repeated measures analysis of variance was performed to investigate the change in the craniocaudal and dorsoventral distances between the mesh and symphysis pubis and between the mesh and bladder neck at rest and at mild straining according to time, surgical technique and time-surgical technique interaction.

Time-dependent change in the mean dorsoventral distance between the mesh and symphysis pubis at rest was not statistically significant (p=0.110). Likewise, effect of the surgical technique was not statistically significant either (p=0.755). Surgical technique-time interaction as well was found to be not statistically significant (p=0.280).

Time-dependent change in the craniocaudal distance between the mesh and symphysis pubis at rest was statistically significant (p<0.001). Bonferroni post-hoc test, which was performed to identify the time point the difference has arisen from, revealed statistically significant difference between the postoperative Day 1 measurement and 6th month (p=0.007) and 1st year (p=0.004) measurements and between the postoperative 6th week measurement and 1st year measurement (p=0.027). Surgical technique had no statistically significant effect on the outcomes (p=0.484). Surgical technique-time interaction was not statistically significant either (p=0.080).

Time-dependent change in the mean craniocaudal distance between the mesh and bladder neck at rest was not statistically significant (p=0.286). Likewise, the effect of surgical technique was not statistically significant (p=0.865). Time-surgical technique interaction as well was not found to be statistically significant (p=0.486).

Time-dependent change in the mean dorsoventral distance between the mesh and symphysis pubis at mild straining was statistically significant (p=0.009). Bonferroni post-hoc test, which was performed to identify the time point the difference has arisen from, revealed statistically significant difference between the postoperative Day 1 and 6th month (p=0.035) measurements. The surgical technique as well had statistically significant impact on the dorsoventral distance between the mesh and symphysis pubis at mild straining. The mean dorsoventral distance between the mesh and symphysis pubis at mild straining was nearly 2.84 mm higher in Group 1 than that in Group 2, and this difference was statistically significant (p=0.031). Surgical technique-time interaction was not found to be statistically significant (p=0.082).

Time-dependent change in the mean craniocaudal distance between the mesh and symphysis pubis at mild straining was found to be statistically significant (p=0.008). However, Bonferroni post-hoc pairwise comparison revealed no statistically significant difference. Therefore, it was concluded that measurements do not change by time. Surgical technique had no statistically significant impact on the measurement of craniocaudal distance between the mesh and bladder neck at mild straining (p=0.996). Surgical technique-time interaction was either not statistically significant (p=0.554).

Time-dependent change in the mean craniocaudal distance between the mesh and bladder neck at mild straining was found to be statistically significant (p=0.002). Bonferroni post-hoc test

Table 1. General characteristics of the patients

	Surgical technique		p
	Transobturator (n=20)	Retropubic (n=20)	
Age, year	49.15±10.80	47.35±8.74	0.556
BMI, kg/m^2	29.62±4.58	31.53±5.07	0.219
Parity	3 (1-5)	3.5 (2-5)	0.398
Number of cesarean section	0 (0-1)	0 (0-1)	1.000
Number of normal vaginal delivery	3 (1-5)	3.5 (1-5)	0.445

BMI: Body mass index. Data are presented as mean ± standard deviation or median (minimum-maximum), where appropriate

Table 2. Symptom prevalence during preoperative period and postoperative follow-up period			
	Surgical technique		
	Transobturator n (%)	Retropubic n (%)	*p*
Preoperative			
Stress urinary incontinence	20 (100.0)	20 (100.0)	1.000
Abnormal emptying	1 (5.0)	1 (5.0)	1.000
Urgency	6 (30.0)	5 (25.0)	0.723
Frequency	0 (0.0)	2 (10.0)	0.090
Nocturia	2 (10.0)	2 (10.0)	1.000
Postoperative Day 1			
Stress urinary incontinence	5 (25.0)	7 (35.0)	0.490
Abnormal emptying	2 (10.0)	2 (10.0)	1.000
Urgency	0 (0.0)	3 (15.0)	**0.036**
Frequency	4 (20.0)	6 (30.0)	0.465
Nocturia	2 (10.0)	2 (10.0)	1.000
Pelvic pain	5 (25.0)	2 (10.0)	0.206
Postoperative 6th week			
Stress urinary incontinence	2 (10.0)	3 (15.0)	0.632
Abnormal emptying	2 (10.0)	2 (10.0)	1.000
Urgency	2 (10.0)	3 (15.0)	0.632
Frequency	0 (0.0)	4 (20.0)	**0.014**
Nocturia	0 (0.0)	2 (10.0)	0.090
Pelvic pain	4 (20.0)	3 (15.0)	0.677
Postoperative 6th month			
Stress urinary incontinence	1 (5.0)	2 (10.0)	0.545
Abnormal emptying	1 (5.0)	0 (0.0)	0.235
Urgency	1 (5.0)	1 (5.0)	1.000
Frequency	0 (0.0)	1 (5.0)	0.235
Nocturia	0 (0.0)	0 (0.0)	1.000
Pelvic pain	1 (5.0)	0 (0.0)	0.235
Postoperative 1st year			
Stress urinary incontinence	1 (5.0)	2 (10.0)	0.545
Abnormal emptying	0 (0.0)	0 (0.0)	1.000
Urgency	0 (0.0)	1 (5.0)	0.235
Frequency	0 (0.0)	0 (0.0)	1.000
Nocturia	0 (0.0)	0 (0.0)	1.000
Pelvic pain	2 (10.0)	0 (0.0)	0.090

results revealed statistically significant difference between the postoperative Day 1 and 6th month measurements (p=0.017). The surgical technique had no statistically significant impact on the measurement of craniocaudal distance between the mesh and bladder neck at mild straining (p=0.871). Surgical technique-time interaction as well was not statistically significant (p=0.059).

DISCUSSION

Midurethral suspension techniques are used for the surgical treatment of stress urinary incontinence in females. These techniques enhance patient satisfaction owing to their minimally invasive natures, successful outcomes and low complication rates thus have been the first line surgical procedures in the

Table 3. Postoperative measurements at rest and at mild straining

	Surgical technique		*p*
	Transobturator Mean ± SD	Retropubic Mean ± SD	
Dorsoventral distance between mesh and symphysis pubis at rest, mm			
Postop Day 1	16.12±6.06	14.44±5.10	0.348
Postop 6th week	14.49±3.98	14.08±4.05	0.751
Postop 6th month	13.56±4.31	14.10±4.21	0.689
Postop 1st year	13.90±4.23	13.93±3.69	0.981
Craniocaudal distance between mesh and symphysis pubis at rest, mm			
Postop Day 1	14.73±4.14	12.52±4.60	0.119
Postop 6th week	12.73±3.77	12.19±4.03	0.663
Postop 6th month	11.68±3.01	11.59±4.03	0.937
Postop 1st year	11.64±3.07	11.40±4.00	0.952
Craniocaudal distance between mesh and bladder neck at rest, mm			
Postop Day 1	13.43±4.95	13.52±4.78	0.952
Postop 6th week	11.66±4.10	11.92±3.34	0.826
Postop 6th month	12.76±3.44	12.11±3.57	0.560
Postop 1st year	12.91±3.59	12.45±3.49	0.683
Dorsoventral distance between mesh and symphysis pubis at mild straining, mm			
Postop Day 1	18.31±5.73	13.91±5.08	**0.014**
Postop 6th week	16.28±3.92	13.30±4.38	**0.029**
Postop 6th month	14.99±3.92	13.16±4.27	0.165
Postop 1st year	15.38±3.71	13.24±4.18	0.095
Craniocaudal distance between mesh and symphysis pubis at mild straining, mm			
Postop Day 1	10.68±4.68	10.41±4.49	0.850
Postop 6th week	9.98±3.71	9.87±4.01	0.928
Postop 6th month	9.35±2.87	9.12±3.48	0.822
Postop 1st year	8.57±2.91	9.16±3.57	0.567
Craniocaudal distance between mesh and bladder neck at mild straining, mm			
Postop Day 1	12.36±4.97	13.42±4.15	0.469
Postop 6th week	11.30±4.13	11.16±3.73	0.910
Postop 6th month	11.83±4.18	10.68±3.76	0.366
Postop 1st year	12.29±4.06	11.76±3.79	0.672

SD: Standard deviation

last two decades.[9-14] Tension-free vaginal tape was developed in 1990s and performed by minimally invasive retropubic surgery via bottom-to-top approach. Thereafter, similar successful outcomes to that of retropubic suspension technique have been obtained with transobtorator technique, which was developed in 2000s.[15]

In the present study, symptom prevalence was generally similar between the two groups at all time points. Only urgency on the postoperative Day 1 and frequency in the postoperative 6th week were higher in the retropubic suspension group.

In the first year after surgery, abnormal emptying, urgency, frequency or nocturia was not observed in the transobturator suspension group, whereas urgency was determined in only one patient in the retropubic suspension group. Accordingly, LUTSs disappeared at the end of the first year in both groups. In the systematic review and meta-analysis performed by Sun et al.,[16] transobturator approach was found to be associated with lower risk of bladder perforation, retropubic/vaginal hematoma and long-term urination dysfunction but higher risk of femoral/inguinal pain. No statistically significant difference

was reported between the two approaches in terms of risk of other complications.

There were 2 patients suffering from pelvic pain in the postoperative 1st year in the transobturator suspension group but none in the retropubic suspension group. Although it was not statistically significant, this clinical difference between the two surgical techniques might have arisen from the differences in the anatomical localization of the mesh. Studies reported that pelvic pain is more common with transobturator suspension vs. retropubic suspension postoperatively.[17-19] Petri and Ashok[18] determined the complaint of persistent pain to be more prevalent in the transobturator vs. retropubic group during long-term follow-up period.

Time-dependent decrement in the craniocaudal distance between the mesh and symphysis pubis at rest was statistically significant in both surgical techniques. This decrement began immediately after the surgery and continued until the end of the 1st year. The decrease in this distance indicates translocation of the mesh in the caudal direction (downwards in the vertical axis). Meanwhile, the distance between the mesh and the bladder neck increased, although is not statistically significant. Tamma et al.[20] reported the distance between bladder neck and tape on Valsalva is higher in the objectively cured women 10 years after TVT-O. The fact that time-dependent change in the craniocaudal distance between the mesh and the symphysis pubis at rest was statistically significant and that it decreased in similar pattern to postoperative stress urinary incontinence rates have made us hypothesize that the mechanism providing efficacy in the suburethral suspension surgeries and the mechanism causing the mesh translocate in caudal direction are the same. Nevertheless, it should be kept in mind that both providing efficacy and time-dependent mesh mobility are influenced by numerous factors such as connective tissue, pelvic floor and surgical technique.

Evaluating the dorsoventral distance between the mesh and symphysis pubis and the craniocaudal distance between the mesh and the bladder neck at mild straining, it was observed that first they decreased in time and then began to increase again. However, it was concluded that only the decrements in the postoperative Day 1 and in the postoperative 6th month were found statistically significant. This strongly suggests that the patients were unable to strain enough during the evaluations performed immediately after the surgery because of their concern about feeling pain. In addition, comparing the groups in terms of dorsoventral distance between the mesh and symphysis pubis at mild straining, it was found to be higher in the transobturator suspension group vs. the retropubic suspension group (postop Day 1 and 6th week measurements are also statistically different). As this measurement at mild straining is an indicator of urethral mobility, it can be concluded that retropubic suspension is more effective than transobturator suspension in preventing urethral mobility. Similarly, Cavkaytar et al.[21] compared transobturator and retropubic approaches by using Q tip test and reported that retropubic approach is associated with lower urethral mobility.

TPUSG is reliable, useful and effective method in evaluating the biomechanical structure of the mesh and the surgery outcomes after sling operations as shown in recent studies.[22-24] Easy to perform, real-time imaging and patient compliance stand out as major benefits of TPUSG.

CONCLUSION

In conclusion, transobturator suspension and retropubic suspension techniques have provided a success rate greater than 90% in the treatment of stress incontinence. Abnormal emptying symptom disappeared at the end of the first year. Considering all TPUSG measurements concerning mesh localization, it was observed that the mesh placed without suburethral tension translocates in time in the caudal direction. When the two surgical techniques were compared, significant difference was determined only for the dorsoventral distance between mesh and symphysis pubis at mild straining. Recognizing that the midurethral mesh translocates in time towards to the distal urethra may contribute to the explanation of the mechanism that provides continence in the suburethral suspension surgeries. Further studies are required to determine clinical outcomes of the changes in the mobility and localization of the mesh. We think that the data on this subject would shed light on the development of surgical techniques.

ETHICS

Ethics Committee Approval: The ethics committee of the University of Health Sciences Türkiye, Etlik Zübeyde Hanım Gynecological Diseases Training and Research Hospital had accepted the study.

Informed Consent: The patients were informed about the procedures and their informed consents were obtained.

Acknowledgments

We sincerely thank Prof. Dr. Akın Sivaslıoğlu for his supervision, encouragement and guidance throughout this research.

FOOTNOTES

Contributions

Surgical and Medical Practices: H.S., Concept: H.S., S.A., Design: H.S., Data Collection or Processing: H.S., Analysis or Interpretation: H.S., S.A., Literature Search: H.S., S.A., Writing: H.S., S.A.

DISCLOSURES

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

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DOI: 10.34057/PPj.2025.44.02.2025-7-1
Pelviperineology 2025;44(2):67-70

A comparative analysis of two-year anatomical and functional outcomes of laparoscopic lateral suspension versus laparoscopic sacrocolpopexy: A retrospective cohort study

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Citation: Öztürk UK, Bağlar İ, Şanlıkan F, Keleş E, Yıldırım Köpük Ş, Toprak T. A Comparative analysis of two-year anatomical and functional outcomes of laparoscopic lateral suspension versus laparoscopic sacrocolpopexy: a retrospective cohort study. Pelviperineology. 2025;44(2):67-70

ABSTRACT

Objective: Laparoscopic sacrocolpopexy (LSC) is the current gold standard for the surgical management of pelvic organ prolapse. Laparoscopic lateral suspension (LLS), a more recently developed technique, has emerged as a viable alternative, obviating the need for sacral promontory dissection and featuring a shorter learning curve. This study aimed to compare the two-year outcomes of LLS and LSC in terms of anatomical success, quality of life, and complication rates.

Materials and Methods: This retrospective cohort study included 149 patients who underwent surgery for pelvic organ prolapse quantification (POP-Q) stage ≥2 apical prolapse between January 2020 and December 2022. Of these, 73 patients underwent LLS and 76 underwent LSC. Anatomical success was evaluated over a two-year follow-up period using POP-Q criteria. Quality of life was assessed using validated questionnaires: The pelvic floor distress inventory-20 and the pelvic floor impact questionnaire-7 (PFIQ-7). Patient-reported improvement was measured with the patient global index of improvement. Postoperative complications were classified according to the Clavien-Dindo system. Reoperation rates and urinary and sexual functions were also evaluated.

Results: The overall anatomical success rates were comparable between the groups, with 94.5% in the LLS group and 92.1% in the LSC group (p=0.52). The LLS group demonstrated a significantly higher rate of anterior compartment correction (89.0% vs. 76.3%; p=0.04) and superior quality of life scores on the PFIQ-7 (p=0.03). The minor complications (Clavien-Dindo grades I-II) was significantly lower in the LLS group compared to the LSC group (4.1% vs. 7.9%; p=0.04).

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Received: 05 July 2025 **Accepted:** 08 August 2025 **Publication Date:** 18 August 2025

Conclusion: LLS provides anatomical success rates comparable to LSC for the treatment of apical prolapse. Furthermore, LLS is associated with superior outcomes in the correction of anterior compartment prolapse and patient-reported quality of life, along with a lower risk of minor postoperative complications.

Keywords: Cystocele; enterocele; MeSH; pelvic floor

INTRODUCTION

Pelvic organ prolapse (POP) is a prevalent and distressing condition that significantly impairs the quality of life for a substantial number of women. The demographic trends of an aging population and rising rates of obesity are projected to increase the prevalence of POP and the corresponding demand for surgical intervention.[1] While numerous surgical techniques exist for the management of advanced POP, laparoscopic sacrocolpopexy (LSC) is widely regarded as the gold-standard procedure for apical prolapse repair, demonstrating durable long-term outcomes.[2,3] However, LSC is a technically demanding procedure, and the requisite dissection of the sacral promontory carries inherent risks of serious complications, including hemorrhage from the presacral venous plexus and neurovascular injury.[4]

In recent years, laparoscopic lateral suspension (LLS) has been introduced as a promising alternative to LSC. This technique avoids the complexities of sacral promontory dissection and is associated with a more favorable learning curve, making it an attractive option for pelvic floor surgeons.[5] Although several studies have compared the short-term outcomes of LLS and LSC, there remains a paucity of robust, comparative data on their medium-term anatomical success, complication profiles, and impact on patient-reported quality of life, particularly from large patient cohorts. The relative novelty of the LLS procedure further accentuates this evidence gap.

Therefore, the primary objective of this study was to conduct a comprehensive retrospective comparison of the two-year anatomical, functional, and safety outcomes in a large cohort of patients who underwent either LLS or LSC. By providing a robust dataset, this study aims to furnish clinicians with critical evidence to guide surgical decision-making in the management of apical pelvic organ prolapse.

MATERIALS AND METHODS

This retrospective cohort study was conducted at a tertiary-level gynecology center and included all patients who underwent surgical repair for POP between January 2020 and December 2022. The study protocol received approval from the Institutional Review Board of University of Health Sciences Türkiye, Kartal Dr. Lütfi Kırdar City Hospital (number: 2025/010.99/15/32, date: 30.04.2025) and was conducted in accordance with the principles of the Declaration of Helsinki. A total of 149 patients were included in the final analysis, of whom 73 had undergone LLS and 76 had undergone LSC.

Inclusion criteria were: (I) diagnosis of pelvic organ prolapse-quantification (POP-Q) stage ≥2 apical prolapse, (II) surgery performed by the same experienced surgical team, and (III) a minimum follow-up period of 24 months. Patients were excluded if they had a history of previous pelvic reconstructive surgery, active malignancy, advanced-stage endometriosis, or significant neurological disorders.

Anatomical outcomes were assessed at the 24-month follow-up visit using the POP-Q system. Anatomical success was defined as POP-Q stage ≤1 in all compartments. Functional outcomes and health-related quality of life (HRQoL) were evaluated using the validated pelvic floor distress inventory-20 and pelvic floor impact questionnaire-7 (PFIQ-7). Overall patient satisfaction was assessed using the patient global index of improvement (PGI-I), where patients rated their condition as "very much better" or "much better". Postoperative complications were systematically recorded and graded according to the Clavien-Dindo classification. Secondary outcomes included reoperation rates for prolapse recurrence, and assessment of *de novo* urinary or sexual dysfunction.

Statistical Analysis

All statistical analyses were performed using SPSS version 26.0 (IBM Corp., Armonk, NY). The normality of continuous data distribution was assessed using the Kolmogorov-Smirnov test. Normally distributed variables were presented as mean ± standard deviation, while non-normally distributed data were presented as median (minimum-maximum). Continuous variables were compared using Student's t-test or the Mann-Whitney U test, as appropriate. Categorical variables were analyzed using the chi-square test or Fisher's exact test. A p-value of <0.05 was considered statistically significant.

RESULTS

No significant differences were observed between the LLS and LSC groups with respect to age, body mass index, menopausal status, parity, preoperative POP-Q stage, or mean follow-up duration ($p>0.05$ for all). Detailed characteristics are presented in Table 1.

The two-year anatomical and functional outcomes are summarized in Table 2. Both procedures demonstrated high rates of overall anatomical success, with no significant difference between the groups (94.5% for LLS vs. 92.1% for LSC; p=0.52). The LLS group showed a significantly higher success rate in the correction of anterior compartment prolapse (point Ba ≤-1) compared to the LSC group (89.0% vs. 76.3%; *p*=0.04). Regarding HRQoL, patients in the LLS group reported significantly better scores on the PFIQ-7 questionnaire (15.4±3.1 vs. 17.9±3.7; *p*=0.03). While patient satisfaction rates were high in both groups, the difference was not statistically significant. Reoperation rates for recurrence were low and comparable between the groups.

Postoperative complications are detailed in Table 3. While there was no significant difference in the overall complication rate between the groups (*p*=0.59), the minor complications (Clavien-Dindo grades I-II) was significantly lower in the LLS group (4.1% vs. 7.9%; *p*=0.04). The rates of major complications (Clavien-Dindo grades III-IV) were low and statistically similar in both cohorts.

DISCUSSION

This study provides a comprehensive medium-term comparison of LLS and LSC, revealing that both procedures yield high rates of anatomical success for the treatment of apical prolapse. Our findings are consistent with the existing literature, where anatomical success rates for these procedures typically range from 81% to 94%.[6,7] For instance, a recent randomized controlled trial by Malanowska-Jarema et al.[3] reported short-term anatomical success rates of 90% for LLS and 81% for LSC. Our higher success rates of 94.5% for LLS and 92.1% for LSC may reflect our longer follow-up period and strict definition of anatomical success.

A key finding of our study is the superior efficacy of LLS in correcting concomitant anterior compartment prolapse. The significantly higher rate of anterior wall support (89.0%) in the LLS group is a notable advantage. This finding corroborates the results of a retrospective study by Yu et al.,[8] which also suggested an advantage for LLS in addressing anterior vaginal wall descent. This may be attributed to the vector of pull and the broad

Table 1. Demographic and baseline clinical characteristics of the study population

Characteristic	LLS group (n=73)	LSC group (n=76)	*p*-value
Age (years, mean ± SD)	58.4±7.1	59.2±6.9	0.47
BMI (kg/m², mean ± SD)	26.7±3.4	27.1±3.2	0.44
Postmenopausal status (%)	64.3%	68.4%	0.60
Parity (mean)	2.3±1.0	2.5±1.1	0.29
Preoperative POP-Q stage ≥3 (%)	71.2%	69.7%	0.84
Follow-up duration (months, mean ± SD)	25.4±1.8	25.8±2.1	0.20

LLS: Laparoscopic lateral suspension, LSC: Laparoscopic sacrocolpopexy, SD: Standard deviation, BMI: Body mass index, POP-Q: Pelvic organ prolapse-quantification

Table 2. Comparison of two-year anatomical and functional outcomes

Outcome	LLS group (n=73)	LSC group (n=76)	*p*-value
Anatomical success (POP-Q ≤ stage 1) (%)	94.5%	92.1%	0.52
Anterior compartment correction (%)	89.0%	76.3%	0.04
PFDI-20 scores (mean ± SD)	22.3±4.5	21.9±4.2	0.57
PFIQ-7 scores (mean ± SD)	15.4±3.1	17.9±3.7	0.03
PGI-I satisfaction (higher %)	93.2%	91.3%	0.66
Reoperation rate (%)	4.1%	3.9%	0.94

POP-Q: Pelvic organ prolapse-quantification, PFDI-20: Pelvic floor distress inventory-20, PFIQ-7: Pelvic floor impact questionnaire-7, PGI-I: Patient global impression of improvement, SD: Standard deviation, LLS: Laparoscopic lateral suspension, LSC: Laparoscopic sacrocolpopexy

Table 3. Comparison of postoperative complications

Complication (Clavien-Dindo classification)	LLS group (n=73)	LSC group (n=76)	*p*-value
Overall complication rate (%)	6.8%	9.2%	0.59
Grade I-II complications (%)	4.1%	7.9%	0.04
Grade III-IV complications (%)	2.7%	1.3%	0.53

LLS: Laparoscopic lateral suspension, LSC: Laparoscopic sacrocolpopexy

support provided by the lateral mesh placement in LLS, which may offer more effective elevation of the anterior vaginal wall compared to the posterior-apical pull of LSC.

Furthermore, our study demonstrated a statistically significant improvement in patient-reported quality of life, as measured by the PFIQ-7, in the LLS group. This suggests that the benefits of LLS extend beyond anatomical correction to a more tangible impact on patients' daily lives and social activities, a finding that aligns with previous reports on patient satisfaction following LLS.[9]

In terms of safety, our results indicate that LLS is associated with a significantly lower rate of minor postoperative complications. This finding is clinically relevant and likely reflects the less invasive nature of LLS, which avoids the deep pelvic dissection required for sacral promontory exposure in LSC. The higher incidence of minor complications in LSC is a known phenomenon, consistent with previous comparative studies and systematic reviews.[10,11]

The strengths of our study include its relatively large sample size compared to much of the published literature and its medium-term follow-up duration of two years. The comprehensive assessment, incorporating anatomical, functional, and safety outcomes, enhances the clinical applicability of our findings.

Study Limitations

Nevertheless, we acknowledge several limitations. The retrospective design introduces a potential for selection bias and information bias, although we attempted to mitigate this by ensuring baseline characteristics were well-matched between the groups. The lack of randomization is an inherent limitation.

CONCLUSION

In conclusion, this study demonstrates that LLS achieves two-year anatomical success rates comparable to the gold-standard LSC for the treatment of apical pelvic organ prolapse. However, LLS offers significant advantages in the correction of anterior compartment prolapse and results in superior patient-reported quality of life. Coupled with a significantly lower risk of minor postoperative complications, these findings position LLS as a safe, effective, and valuable surgical option that should be considered in the armamentarium for pelvic reconstructive surgery.

ETHICS

Ethics Committee Approval: This study was approved by the Institutional Review Board of University of Health Sciences Türkiye, Kartal Dr. Lütfi Kırdar City Hospital (number: 2025/010.99/15/32, date: 30.04.2025) and was conducted in accordance with the principles of the Declaration of Helsinki).

Informed Consent: Retrospective study.

FOOTNOTES

Contributions

Surgical and Medical Practices: U.K.Ö., İ.B., E.K., Ş.Y.K., T.T., Concept: U.K.Ö., F.Ş., E.K., T.T., Design: U.K.Ö., İ.B., F.Ş., Ş.Y.K., T.T., Data Collection or Processing: U.K.Ö., İ.B., E.K., Ş.Y.K., T.T., Analysis or Interpretation: U.K.Ö., F.Ş., E.K., T.T., Literature Search: İ.B., F.Ş., Ş.Y.K., T.T., Writing: U.K.Ö., F.Ş., E.K., Ş.Y.K.

DISCLOSURES

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

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DOI: 10.34057/PPj.2025.44.02.2024-9-3
Pelviperineology 2025;44(2):71-74

Management of a patient with recurrent prolapse after laparoscopic lateral suspension with laparoscopic sacrocolpopexy

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ABSTRACT

Pelvic organ prolapse (POP) is a pelvic floor disorder characterized by the protrusion of the anterior, posterior, or apical compartments of the pelvic floor into the vaginal lumen, along with adjacent organs such as the cervix, uterus, bladder, or rectum. Treatment options vary based on the severity of POP, the patient's age, sexual status, and any comorbid conditions. Laparoscopic sacrocolpopexy (LSC) is regarded as the gold standard for apical prolapse surgery, with a success rate ranging from 78% to 100%. Laparoscopic lateral suspension (LLS), which has a similar success rate and is less complex, offers a good alternative to LSC. However, long-term studies are still ongoing. LSC remains a viable option in cases where LLS initially succeeds but is followed by recurrences over time. In this case report, we present the management of a case with recurrence 40 months after LLS due to uterine prolapse.

Keywords: Laparoscopic sacrocolpopexy; laparoscopic lateral suspension; pelvic organ prolapse

INTRODUCTION

Pelvic organ prolapse (POP) is a pelvic floor disorder characterized by the protrusion of the anterior, posterior, or apical compartments of the pelvic floor into the vaginal lumen, along with adjacent organs such as the cervix, uterus, bladder, or rectum.[1,2] Its prevalence tends to increase with age, peaking at 1.5-1.8/1000 in women aged 60-69 years,[3] with 19% of women undergoing POP surgery by the age of 85.[4] Treatment options vary based on the severity of POP, the patient's age, sexual status, and any comorbid conditions.[5-7] Laparoscopic sacrocolpopexy (LSC) is regarded as the gold standard for apical prolapse surgery, with a success rate ranging from 78% to 100%.[8] LSC is a complex surgical technique that requires deep pelvic dissection, advanced laparoscopic suturing techniques and associated rare but serious complications (e.g., vascular injury, sacral nerve injury, etc.).[9,10] Therefore, there has been a search for simpler and

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Received: 24 September 2024 **Accepted:** 26 December 2024 **Publication Date:** 18 August 2025

less complicated surgical options. Recently, laparoscopic lateral suspension (LLS) with mesh has emerged as a viable alternative for apical prolapse surgery, as it avoids potential damage from sacral promontory preparation and extensive pelvic dissection. With this surgical technique, a T-shaped mesh is prepared by dissecting the vesicovaginal space. The anterior vaginal wall is then sutured to the cervix and isthmus. The lateral arms of the mesh are used to position the the external oblique muscle and over, peritoneum, and mesh is sutured to the anterior abdominal wall.[11,12]

In this case report, we present the patient with a case with recurrence 40 months after LLS due to uterine prolapse. We performed LSC, by creating a tunnel from the promontory to the rectovaginal space. Post-operative examination revealed that the prolapse regressed.

CASE REPORT

A 44-year-old woman presented with pelvic pain and a feeling of fullness in the vagina. She had a history of three vaginal deliveries. Ultrasound records revealed that the patient's uterus size was 80x50x40 mm due to a 60x62 mm intramural myoma located in the posterior corpus. POP-Quantification (POP-Q) staging was C point at -3 cm and D point at -2 cm before the LLS due to medical records. The patient had undergone LLS surgery four years prior. On vaginal examination, POP-Q staging showed C point at -2 cm and D point at -1 cm. Ultrasound evaluation revealed that the patient's uterus size had increased to 80x50x40 mm due to a 60x62 mm intramural myoma located in the posterior corpus, same as previous surgery. Intraoperatively, the LLS mesh was observed to be densely adherent to the anterior surface of the cervix (Figure 1). After the complete dissection of the hysterectomy and mesh, the vaginal cuff LLS mesh was re-fixed. Subsequently, LSC was performed by creating a tunnel from the promontory to the rectovaginal space (Figure 2). Post-operative examination revealed that point C and D were -6 according to POP-Q stage. In the third month follow-up, point C and D were observed at -8 cm.

DISCUSSION

LLS is a viable alternative to LSC, offering a similar postoperative success rate, fewer complications, and a shorter learning curve. In this case report, we discuss the management of a woman with recurrent prolapse after LSC and examine the advantages and disadvantages of LLS in comparison to LSC.

In prolapse surgery, as with all surgeries, a low incidence of preoperative complications can be a reason for preference. In a prospective randomized controlled study by Malanowska-Jarema

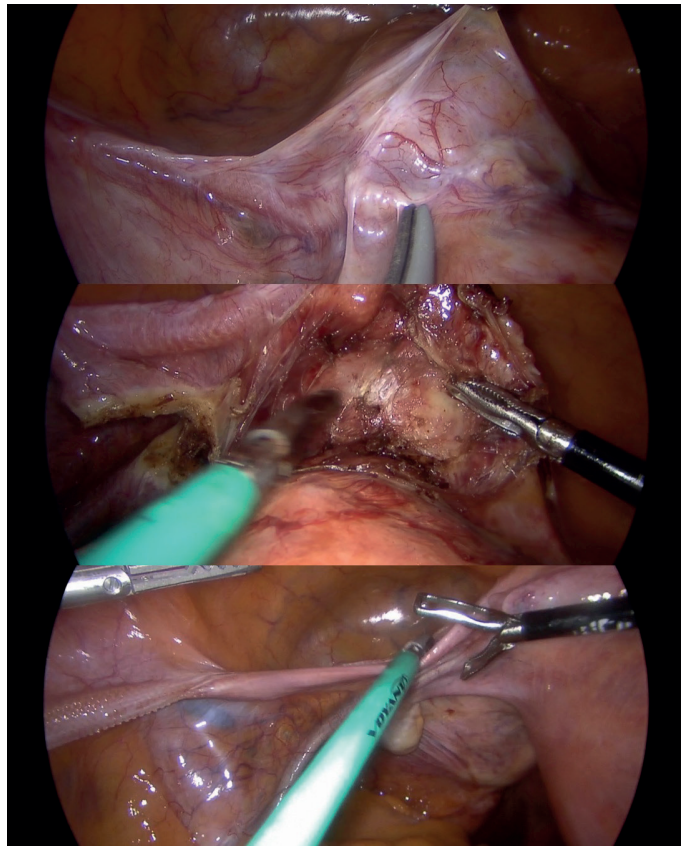

Figure 1. Dissection of lateral suspension mesh

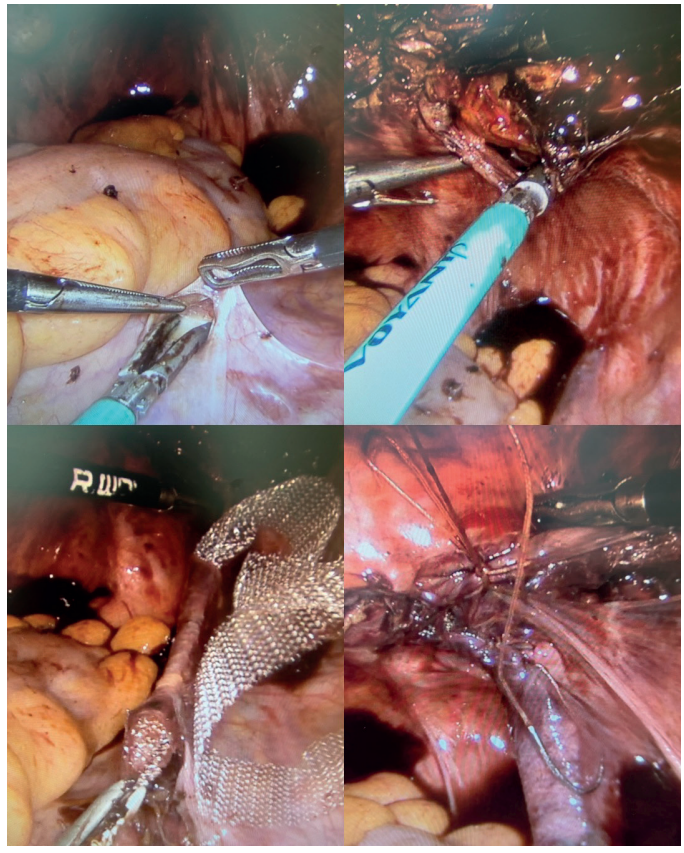

Figure 2. Preparation and placement of sacrocolpopexy mesh

et al.[13], the short-term outcomes of LSC and LLS were examined in a cohort of 93 patients. At the 12-month postoperative mark, anatomical results were compared with preoperative complications and parameters. The success rate of LSC for apical prolapse was reported as 81%, for anterior prolapse as 95%, and the success rate of LLS for apical and anterior prolapse was reported as 90-92%. The average operation time was reported as 160 minutes for LLS and 168 minutes for LSC. The average blood loss was reported as 100 mL for both procedures, and no preoperative complications were reported for either group included in the study.[13] In our case, LLS was preferred for several reasons: the initial complaint of prolapse, its less invasive and less complicated nature compared to LSC, a shorter hospitalization period, and a faster return to daily activities. The procedure was successful in post-operative period. But, we do not have enough data and time to talk about early and late term results.

In the study by Mancini et al.,[14] perioperative and postoperative results of cases that underwent LSC and LLS due to POP surgery were compared. In the preoperative evaluation of women participating in this study, advanced stage prolapse in the anterior compartment, apical compartment defect and recurrent POP cases were more in the LSC group. POP persistence was found to be better in all 3 compartments and in terms of *de novo* POP in the posterior compartment with LSC group. However, postoperative constipation was found to be increased in the LSC group. As a result of the study, it was found that the long-term results of LSC were successful compared to LLS.

Long-term outcomes of the surgical method used in the treatment of prolapse are one of the most important factors. Criteria for evaluating long-term success may include recurrence, method-related complications, sexual functions, and pelvic floor functions.[15] Studies on the long-term outcomes of the lateral suspension adapted to L/S by Dubuisson et al.[12] in 1997 are ongoing. In a study by Veit-Rubin et al.[16] involving 417 patients, the long-term outcomes of LLS were examined, with anatomical success rates found to be 91% for the anterior compartment, 93% for the apical compartment, and 85% for the posterior compartment. Mesh erosion rate has been reported as 4.3%, and the recurrence rate as 7.3%. 85% of patients were asymptomatic in the long term and reported satisfaction with their surgical procedure. In a study by Kumbasar et al.[17] involving 62 patients who underwent uterus-preserving LLS, a recurrence rate of 6% was observed during postoperative follow-up. The recurrence rates were reported as 3.2% for apical prolapse, 1.6% for anterior prolapse, and 4.8% for posterior prolapse.[15] In our case, although short-term success was achieved after the LLS procedure, the patient's prolapse recurred approximately three years after the operation. As demonstrated in other studies, the recurrence in our case is also thought to be due to multifactorial causes (such as age, weight, number of childbirths, socioeconomic status, comorbidities, constipation, etc.) in the long term. These studies also did not discuss the management of recurrence cases. In managing our recurrence case after LLS, we applied LSC surgery, which is considered the gold standard in pelvic organ prolapse surgery. The long-term follow-up of our case, in which we achieved successful short-term results, is ongoing.

CONCLUSION

Although the use of LLS surgeries, which are more successful in terms of complications and easier in terms of surgical technique, has increased today, it should not be overlooked that sacrocolpopexy surgeries, which are among the most reliable methods, still remain the gold standard. In cases where success is achieved with LLS, but recurrences occur in the long term, LSC is a reasonable choice. Personalized treatment, considering factors such as age, sexual status, and comorbidities in women undergoing recurrent POP surgery, will increase the chance of success and reduce the risk of recurrence.

ETHICS

Informed Consent: Consent was obtained or waived by all participants in this study.

FOOTNOTES

Contributions

Surgical and Medical Practices: A.G.K., E.T., Concept: S.Ç., Y.K.A., Design: B.K.K., Data Collection or Processing: B.K.K., Analysis or Interpretation: K.A.P., Y.K.A., Literature Search: K.A.P., Writing: K.A.P., S.Ç.

DISCLOSURES

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The author declared that this study received no financial support.

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DOI: 10.34057/PPj.2025.44.02.2024-8-3
Pelviperineology 2025;44(2):75-77

Conservative management of vulvar hematoma after oral sex in pregnancy

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Citation: Odabaş O, Köse Kıncı B, Kıncı MF, Çömez S, Akpak YK. Conservative management of vulvar hematoma after oral sex in pregnancy. Pelviperineology. 2025;44(2):75-77

ABSTRACT

Non-obstetric vulvar hematomas are extremely rare, and there are insufficient case reports and studies in the literature. As a result, clinicians have no clear agreement about their treatment. There are also no guidelines or treatment protocols. The treatment can be either conservative or surgical. For the most part, cases can be treated conservatively. In some cases, surgical treatment is required. In this case report, we present a conservative approach to treating a traumatic vulvar hematoma following oral sex during pregnancy.

Keywords: Trauma; vulvar hematoma; conservative treatment; oral sex

INTRODUCTION

The vulva comprises loose connective tissue and smooth muscle supplied by branches of the pudendal artery, which branches from the internal iliac artery. The labial branches of the internal pudendal artery are found in the superficial fascia of the anterior and posterior pelvic triangles. Injury to these labial branches can result in severe vulvar hematomas. At the same time, the vulva is protected from trauma by dense fatty tissue beneath the labium majus.[1]

Except for during labor and delivery, a traumatic vulvar hematoma is uncommon. Non-obstetric traumatic vulvar hematomas cause about 0.8% of all gynecologic emergencies.[2] Non-obstetric causes of traumatic vulvar hematoma are as follows: blunt trauma (most commonly bicycle, automobile trauma, etc.), violent coitus, acts of sexual assault, foreign body insertion into the vagina and vulvar surgery.[3]

In this case report, we describe the approach to a 28-week pregnant patient who developed vulvar hematoma after oral sex.

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Received: 13 August 2024 **Accepted:** 10 February 2025 **Publication Date:** 18 August 2025

CASE REPORT

A 32-year-old, gravida 1, parity 0.28+3 weeks pregnant woman presented with vulvar swelling after oral sex. On examination, an 8x6 cm vulvar hematoma was found on the left labia majora and labia minus, causing midline deviation, palpation pain, and covering the clitoris, urethra, and vagina (Image 1). The ultrasound revealed a single viable intrauterine fetus at 28-weeks.

Her vital signs remained stable, and there was no significant change in laboratory parameters during the follow-up. In our follow-up, we used IV paracetamol, cold compression, and *eau de goulard pet* treatment. The vulvar hematoma was large enough to close the urethra, so a bladder catheter was inserted. After 24 hours, the vulvar hematoma was found to be organized (Image 2), the bladder catheter was removed and the patient was discharged after the pain complaint regressed.

DISCUSSION

Vulvar hematoma is more common in obstetric conditions, occurring in 1/300 to 1/1000 deliveries.[4] Except in obstetric situations, traumatic vulvar hematomas are extremely uncommon. The known incidence of non-obstetric vulvar hematomas is around 3.7%. Non-obstetric traumatic vulvar hematomas cause about 0.8% of all gynecologic emergencies.[2]

There is no consensus on how to treat non-obstetric traumatic vulvar hematomas. They can be treated using either conservative or surgical methods. It is critical to take a conservative approach whenever possible. This lowers the risk of bacterial contamination. Conservative treatment, typically cold compresses and pain relief, is appropriate for pain control.[5] If the hematoma prevents urine output due to its size, a bladder catheter should be inserted. If there is a suspicion of sexual assault, it should definitely be addressed as a judicial case. Labiums, clitoris, hymen, perineum, and rectum should be examined individually. Antibiotics for prophylaxis are unnecessary. Hymen examination should definitely be included in the childhood and adolescent period.

Surgical treatment should be considered if there is a hematoma with expanding borders, significant pain that does not go away with pain medication, signs of infection (worsening of the clinical picture, increase in acute phase reactants, etc.), significant blood loss with associated hemodynamic instability, or conservative treatment fails.[3,6]

When surgery is planned, a long enough incision is made to observe the bleeding veins. If active bleeding vessel orifices are visible, they are ligated. The subsequent cavity formed is closed

Image 1. First presentation

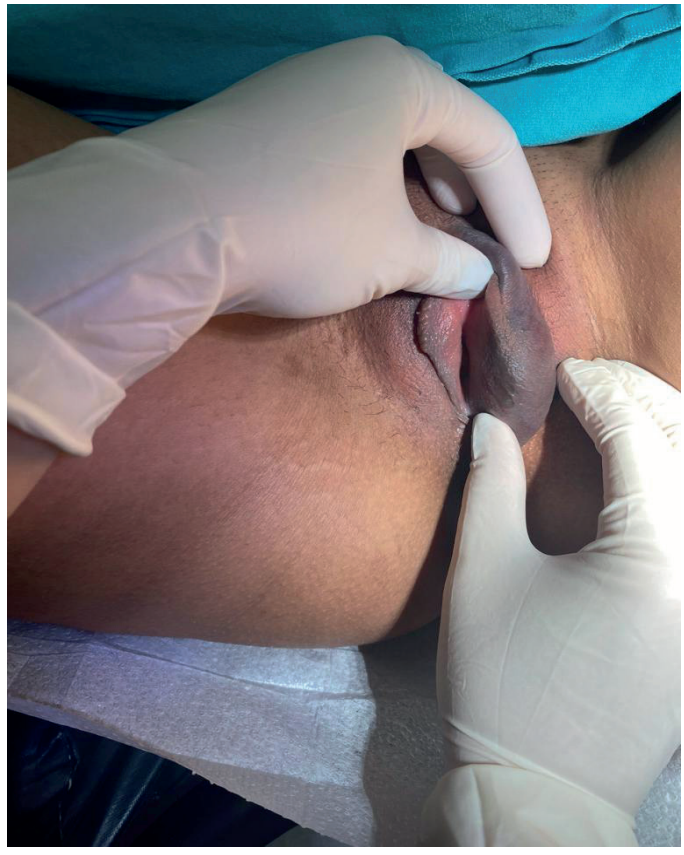

Image 2. Twenty-fourth hour post presentation

with sutures in the form of 8 or filled one by one. Absorbable monofilament sutures should be preferred. The incision should also be closed one by one when closing. A drain can be placed if necessary.[7] Vascular methods, such as embolization can be used in selected cases.[8]

CONCLUSION

Although non-obstetric vulvar hematomas are uncommon, they can have serious consequences if not properly diagnosed and treated. The neighbouring organs should also be evaluated. There are no guidelines for treatment protocols in the literature. Most cases can be treated conservatively at first, but surgical treatment should be considered if there is a hematoma with enlarging borders, clinical worsening (significant pain that does not go away, increase in acute phase reactants, etc.), significant blood loss, hemodynamic instability, or when conservative treatment is insufficient. There are insufficient studies or reviews on the topic in the literature. Studies are needed for the optimum approach.

ETHICS

Informed Consent: The patient and relatives gave informed consent to surgery and video recording

Acknowledgement: It was presented in 4th World Academy of Sexual Health (WASHE) Congress as oral presentation.

FOOTNOTES

Contributions

Surgical and Medical Practices: M.F.K., Concept: O.O., Y.K.A., Design: M.F.K., Data Collection or Processing: B.K.K., S.Ç., Analysis or Interpretation: B.K.K., S.Ç., Literature Search: O.O., Y.K.A., Writing: O.O., M.F.K.

DISCLOSURES

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

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DOI: 10.34057/PPj.2025.44.02.2025-4-2
Pelviperineology 2025;44(2):78-81

A rare case of thigh hematoma following retropubic transobturator tape procedure: A conservative management approach

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Citation: Yavaş Yücel Z, Ismayilov T. A rare case of thigh hematoma following retropubic transobturator tape procedure: a conservative management approach. Pelviperineology. 2025;44(2):78-81

ABSTRACT

Stress urinary incontinence (SUI) is a prevalent condition among postmenopausal women. Transobturator tape (TOT) has emerged as a standard surgical approach due to its favorable complication profile. However, rare complications such as vascular injury and thigh hematoma have been reported. We present a 49-year-old postmenopausal woman who developed a unilateral thigh hematoma following a retropubic TOT procedure performed for *de novo* SUI. The patient had undergone total laparoscopic hysterectomy and bilateral salpingectomy a year earlier. On postoperative day 1, she developed severe pain and swelling in the inner thigh. Magnetic resonance imaging revealed intramuscular hematoma involving the adductor, gemellus, and obturator muscles. Conservative management with elevation, topical heparinoid, and antibiotics led to complete resolution by week 7. Although rare, vascular injuries resulting in thigh hematoma can occur after TOT procedures. Prompt recognition, imaging, and conservative management can result in favorable outcomes. Surgical experience and anatomical familiarity are critical in minimizing such complications.

Keywords: Mesh; sling; vulvar pain

INTRODUCTION

Pelvic organ prolapse and stress urinary incontinence (SUI) are common health problems affecting women, particularly in the postmenopausal period. SUI is defined as involuntary leakage of urine during activities that increase intra-abdominal pressure, such as coughing or sneezing, without detrusor contraction.[1]

Over the years, various techniques have been developed to treat SUI, among which the mid-urethral sling (MUS) procedures have gained popularity. Since the early 2000s, transobturator tape (TOT) surgery has become the gold standard. Initially introduced by Delorme,[2] TOT was later modified to a retropubic approach in 2018.[3]

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Received: 19 April 2025 **Accepted:** 08 May 2025 **Publication Date:** 18 August 2025

Compared to retropubic MUS procedures, TOT is associated with a lower incidence of complications.[4] However, despite its favorable profile, complications such as vaginal perforation, hemorrhage,[5] mesh erosion, abscess formation, dyspareunia, and chronic pain[6] can still occur. Commonly reported intraoperative complications include bladder injury. In addition, rare cases of intramuscular hematoma have been described when the obturator membrane is traversed and bleeding extends between the obturator muscles.[7,8]

This report presents a rare case of thigh hematoma following retropubic TOT surgery, aiming to contribute to the existing literature on its identification and conservative management. Written and verbal informed consent was obtained from the patient for the use of their medical information for scientific and academic purposes.

CASE REPORT

A 49-year-old postmenopausal woman (G2P2) presented with *de novo* SUI nine months after undergoing total laparoscopic hysterectomy and bilateral salpingectomy. Following a comprehensive urogynecological evaluation, a retropubic TOT procedure was performed.

There were no intraoperative complications. However, at postoperative hour 24, the patient reported sudden-onset, progressively worsening pain and swelling on the inner aspect of the left thigh. Physical examination revealed a 4×4 cm area of erythema with tenderness. Ultrasonography raised suspicion of a hematoma, prompting further evaluation with contrast-enhanced magnetic resonance imaging (MRI) (Figures 1, 2).

MRI findings showed Grade 1 muscle strain with intramuscular hematoma originating from the adductor, gemellus, and obturator muscles and extending posteriorly along the left thigh. Additionally, subcutaneous edema was observed (Figure 3).

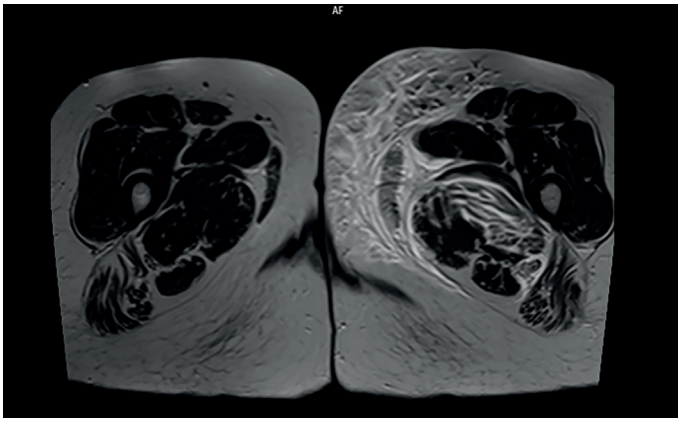

Figure 1. Magnetic resonance imaging of the left medial thigh revealing a well-defined hematoma

A multidisciplinary approach was adopted. Conservative management included leg elevation, topical heparinoid application, and intravenous ampicillin-sulbactam therapy. Interventional radiology was consulted for possible drainage; however, no invasive procedure was deemed necessary.

On postoperative day 13, due to elevated C-reactive protein levels and suspicion of secondary abscess formation, the antibiotic regimen was extended with oral therapy to complete a 21-day course. At the 7-week follow-up, the patient was asymptomatic, and complete resolution of the hematoma was confirmed on examination.

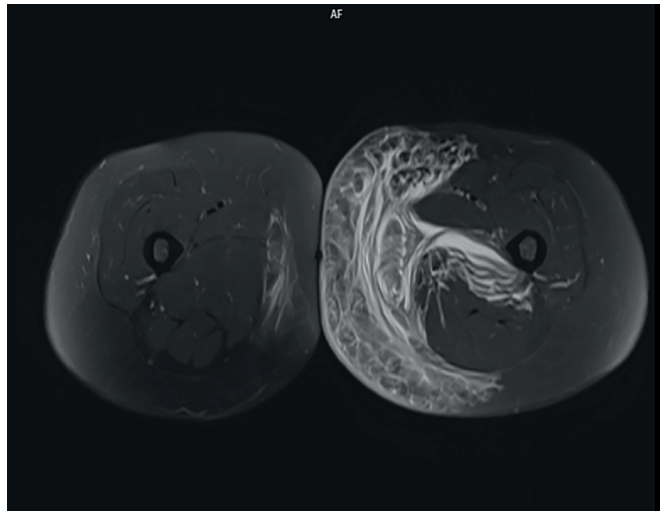

Figure 2. Radiological appearance of an organized hematoma on MRI
MRI: Magnetic resonance imaging

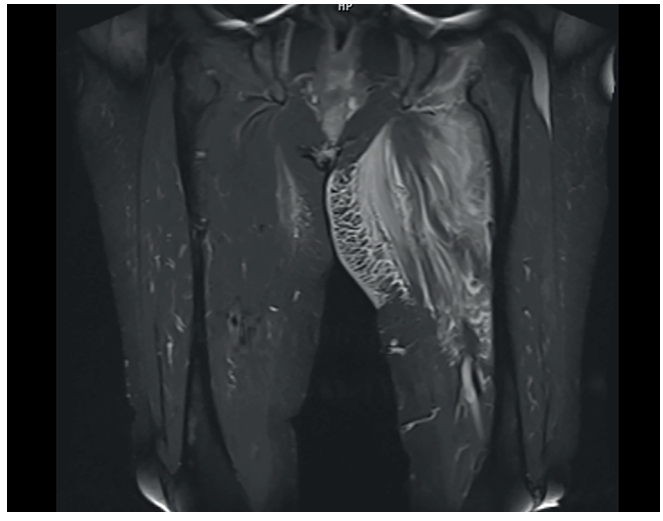

Figure 3. Coronal T2-weighted MRI of the pelvis and thighs showing a hyperintense, organized hematoma localized in the left medial thigh region
MRI: Magnetic resonance imaging

DISCUSSION

In TOT procedures, unlike retropubic MUS surgery, the needle passes through areas relatively distant from major vascular structures.[9] In their study, Delorme et al.[10] reported no vascular injuries related to TOT placement. In contrast, another study involving 94 patients undergoing retropubic MUS procedures reported a hematoma rate of 17%.[11]

Balachandran et al.[12] reported a hematoma incidence of only 0.33% among 2,091 MUS procedures, with average hematoma size ranging from 8 to 12 cm. Management strategies included laparotomy, vaginal, or suprapubic drainage depending on the clinical scenario.[12]

A review by Daneshgari et al.,[13] covering studies from 1995 to 2007, revealed complication rates of 10.5% to 31.5% in TOT procedures, with bladder perforation being the most frequent, and hematoma described as a rare complication. The hematoma rate was notably higher in the retropubic approach.[13]

Review of the literature shows that hematomas following TOT procedures are rarely encountered and are typically reported as isolated case reports.[14,15]

In our patient, there were no symptoms suggestive of vascular injury such as hypotension, tachycardia, or a drop in hemoglobin. The first clinical sign was acute, localized pain in the inner thigh on postoperative day one, which led to further investigation. The conservative management approach adopted in our case is consistent with strategies reported in similar case reports.[14,15]

CONCLUSION

Thigh hematoma is a rare but significant complication of TOT procedures. Awareness of anatomical landmarks, careful surgical technique, and prompt recognition of postoperative symptoms are essential for early diagnosis. Conservative management may be a safe and effective approach in the absence of hemodynamic instability or ongoing bleeding. Long-term follow-up is recommended to ensure complete resolution and to detect potential late complications. Proper documentation of such rare cases can contribute to better understanding and management strategies in urogynecological practice.

ETHICS

Informed Consent: Written and verbal informed consent was obtained from the patient for the use of their medical information for scientific and academic purposes.

FOOTNOTES

Contributions

Surgical and Medical Practices: T.I., Concept: Z.Y.Y., T.I., Design: Z.Y.Y., T.I., Data Collection or Processing: Z.Y.Y., Analysis or Interpretation: Z.Y.Y., T.I., Literature Search: Z.Y.Y., T.I., Writing: Z.Y.Y., T.I.

DISCLOSURES

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

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DOI: 10.34057/PPj.2025.44.02.2025-3-1
Pelviperineology 2025;44(2):82-85

Periclitoral abscess: Two case studies

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Citation: Erdoğan Atalay N, Çalışkan Ş. Periclitoral abscess: two case studies. Pelviperineology. 2025;44(2):82-85

ABSTRACT

Periclitoral abscesses are rare, with only a few cases reported in the literature. Although these abscesses are typically observed following surgical procedures such as female circumcision, spontaneous cases have also been documented. Despite various diagnostic and treatment approaches, recurrences are common. A 43-year-old patient applied with pain, sensitivity, and swelling on the left side of the clitoris, along with a mixed vaginal infection. Examination revealed a 2.5 cm abscess around the clitoris. The patient tested positive for human papilloma virus 18 and had a history of lichen sclerosus et atrophicus. She had previously undergone sling surgery, anterior colporrhaphy, and hysterectomy a year prior. She had received platelet-rich plasma and stromal vascular fraction treatment for lichen sclerosus and had been symptom-free for six months. Despite incision and empirical ciprofloxacin treatment for one week, the inflammation and abscess persisted. Complete excision of the abscess was performed, and tissue culture identified coagulase-positive *Staphylococcus aureus*. Sulbactam ampicillin (1 gram twice daily) was administered for one week based on the antibiogram results. A 43-year-old patient with diabetes mellitus and hypothyroidism, who had a copper intrauterine device for 11 years, applied with hardness, pain, and vaginal discharge on the left side of the clitoris. Examination revealed a deep-seated abscess extending from the clitoris to the urethra. The abscess was drained under local anesthesia, and empirical treatment with extended-spectrum sulbactam ampicillin (1 gram twice daily) was started. The patient was symptom-free for four months, but the abscess recurred at the same location. Drainage and excision were performed, and tissue culture revealed coagulase-negative *Staphylococci*. Consequently, clindamycin (300 mg twice daily) and gentamicin (800 mg twice daily) were prescribed for 10 days. The patient remained symptom-free for eight months. Periclitoral abscesses should be considered in cases of swelling, tenderness, and pain around the clitoris. Management may require not only incision and drainage but also excision and tissue culture for definitive diagnosis and antibiogram-guided therapy to prevent recurrence.

Keywords: Periclitoral abscess; tissue culture; perineal abscess; clitoris

INTRODUCTION

Periclitoral abscesses are rare, with few gynecological cases documented. Due to the limited number of cases, no standardized treatment protocol exists, resulting in a high recurrence rate.[1] Although the exact cause of abscess formation is unknown, it may be secondary to underlying conditions such as Crohn's disease.[2] Genital traumatic procedures, including female genital mutilation or circumcision, and pilonidal disease have been identified as potential causes of periclitoral abscesses.[3]

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Received: 13 March 2025 **Accepted:** 04 June 2025 **Publication Date:** 18 August 2025

Periclitoral abscesses typically present as localized, painful, and fluctuant inflammatory lesions around the clitoris. They are usually seen in women of reproductive age and are associated with vulvar pain, dysuria, vulvar swelling, and erythema.[4] This study presents the definitive diagnosis and management of two cases of persistent or recurrent periclitoral abscesses despite incision and empirical antibiotic therapy.

Materials and Methods

This retrospective study was approved by the Local Ethics Committee of Bolu Abant İzzet Baysal University (decision no: 2024/146). Two patients with periclitoral abscesses who visited a private clinic were evaluated in June 2024 after obtaining study permission. Patient files and examinations were reviewed from the pre-disease period through one year of follow-up after treatment. Both patients were informed about the use of their diagnosis, follow-up and treatments in scientific studies, and their informed consent was obtained.

CASE REPORTS

Case A

A 44-year-old, married, gravida 3, parity 3 (2 normal deliveries, 1 cesarean) female patient applied to our clinic in September 2022 with complaints of vaginal itching and genital condyloma. The patient had a history of hysterectomy due to uterine atony following a cesarean section in 2013. She also underwent cystocele surgery and sling surgery in 2018. The patient was treated for hypertension and was a tobacco user (1 pack per day). Cervical smear tests in July 2022 showed no intraepithelial lesions or malignancy.

Pelvic examination revealed a mixed-type vaginal infection and condyloma acuminatum on the vulva. A culture was obtained from the vaginal discharge. Transvaginal ultrasound showed no uterus due to hysterectomy, and the ovaries were normal. Metronidazole was prescribed for bacterial vaginosis, and imiquimod cream was used for condyloma. Human papilloma virus typing revealed types 16, 44, 18, 58, and 56. Despite treatment with fluconazole and weekly methylene blue applications, recurrent vulvovaginal candidiasis was noted, with *Candida glabrata* isolated and treated with amphotericin. The patient later developed dyspareunia and itching after regression of condyloma and candidiasis. Colposcopy and vulvar biopsy revealed a vaginal intraepithelial lesion stage 1. Nine months later, vulvar biopsy results from an external center indicated lichen sclerosus et atrophicus, and cervical smear results showed a low-grade cervical intraepithelial lesion. Atrophy was observed at the vaginal entrance with scar tissue on the vulva. Platelet-rich plasma and stromal vascular fraction treatments were applied.

Two months after treatment completion, the patient complained of a burning sensation in the vagina. An ulcerated area was found on the right side of the vaginal entrance, with painful swelling and erythema on the left side of the clitoris. Despite incision and drainage followed by empirical ciprofloxacin treatment, the abscess recurred. The abscess was completely excised, and tissue culture identified coagulase-positive *Staphylococcus aureus*. Sulbactam ampicillin (1 gram twice daily) was administered for one week based on the antibiogram. Histopathology of the periclitoral abscess showed fat necrosis and inflammatory granulation tissue formation. The patient has been symptom-free for six months (Figure 1).

Case B

A 43-year-old, married, gravida 4, parity 2, with 2 abortions, applied to a private clinic in December 2023 with complaints of palpable hardness, pain, and vaginal discharge in the clitoris. Her medical history included diabetes mellitus and hypothyroidism, for which she was taking levothyroxine sodium, metformin, and sitagliptin. She had used a copper intrauterine device (IUD) for contraception for 11 years.

Examination revealed a deep-seated abscess extending from the periclitoral region to the urethra. The cervix and vagina appeared normal, but the IUD string was not visible. Transvaginal ultrasound showed a normal uterus and oviducts, with the IUD in the uterine cavity. Incision and drainage of the abscess were performed under local anesthesia, and empirical treatment with extended-spectrum sulbactam ampicillin (1 gram twice daily) was initiated. The patient was symptom-free for four months, but the abscess recurred in the same location.

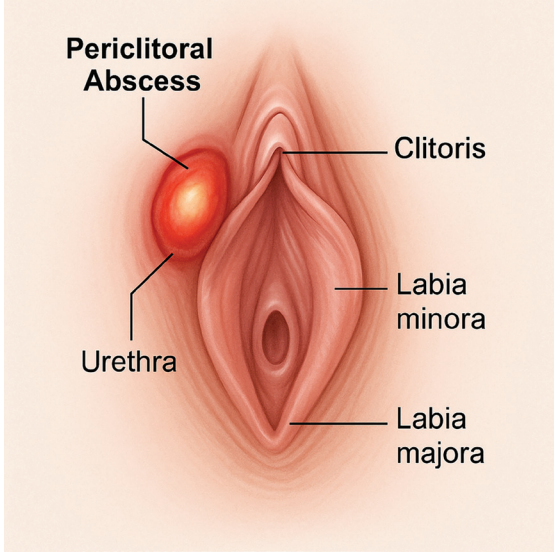

Figure 1. Case B periclitoral abscess

Hysteroscopic removal of the IUD, drainage, and excision of the abscess were performed. Tissue culture revealed coagulase-negative *Staphylococci*, so clindamycin (300 mg twice daily) and gentamicin (80 mg twice daily) were prescribed for 10 days. The patient has been symptom-free for eight months.

DISCUSSION

Periclitoral abscesses are rare and present with severe vulvar pain. Trauma and the presence of an infected pilonidal cyst are thought to be potential causes.[5] Reported cases are often complications of female circumcision. In pilonidal abscesses, sinus tracts or hair follicles are observed around or within the abscess. No sinus tracts were noted in our cases, thus excluding pilonidal abscess as the etiology.[6] The cause of spontaneous periclitoral abscesses is unclear, but infectious pathogens may contribute to abscess formation due to changes in the squamous skin layer.

Case A had lichen sclerosus of the vulva and recurrent vaginal infections. Lichen sclerosus is an inflammatory mucocutaneous disease primarily affecting postmenopausal women.[7] The association of lichen sclerosus with periclitoral abscesses has not been previously reported. It is hypothesized that periclitoral abscesses may result from subcutaneous passage of infectious agents due to mucocutaneous disorders in lichen sclerosus.

Previous studies have identified coagulase-positive *Staphylococcus*, *Streptococcus bovis*, *Diphtheriae* species, and *Bacteroides*species in abscess cultures.[8] Similarly, our study found coagulase-positive *Staphylococcus aureus*in Case A and coagulase-negative *Staphylococci* in Case B. *Actinomyces*spp. was reported in periclitoral abscess cultures, with a prevalence of 8-20% in IUD users.[9,10] Although typically asymptomatic and not requiring treatment, removal of the IUD and appropriate antibiotic therapy may be necessary in cases of pelvic actinomyces infection.[10,11] In Case B, the IUD was removed, and actinomyces was excluded from the abscess culture results.

A 2012 study reviewed 18 cases of periclitoral abscesses, with sizes ranging from 1-5 cm. Among the patients, six had pilonidal abscesses, one had ectopic breast tissue, and one had Crohn's disease. Spontaneous drainage or resolution was observed in eight patients, while others were treated with incision or excision. Recurrence was noted in most cases, and excision or marsupialization was used for definitive treatment.[5,8] Our cases also experienced recurrence, but total excision or marsupialization effectively managed the condition.

No optimal treatment method for periclitoral abscesses is established in the literature. Published studies are generally case reports, and treatment varies based on individual preferences, experiences, and patient characteristics.[6,8] Some recommend less invasive methods to avoid clitoral damage, while others advocate incision, drainage, and empirical antibiotics as the first-line treatment. Culture results are essential for appropriate antibiotic therapy, and preventing recurrences may require medication and marsupialization or excision based on culture findings. Initial treatments often involve spontaneous drainage or simple incision, but recurrence necessitates marsupialization or excision for effective management.[8]

CONCLUSION

A periclitoral abscess is a rare condition marked by severe pain and a high rate of recurrence. There is limited knowledge and experience regarding its etiology and treatment. Reports in the literature indicate that recurrence rates are high. Understanding the underlying causes and development of the abscess is crucial, as incision and drainage alone may not be sufficient. Total excision, tissue culture for definitive diagnosis, and antibiogram-guided antibiotic therapy may be necessary to prevent recurrence.

ETHICS

Informed Consent: Both patients were informed about the use of their diagnosis, follow-up and treatments in scientific studies, and their informed consent was obtained.

FOOTNOTES

Contributions

Surgical and Medical Practices: N.E.A., Ş.Ç., Concept: N.E.A., Design: N.E.A., Ş.Ç., Data Collection or Processing: N.E.A., Ş.Ç., Analysis or Interpretation: N.E.A., Ş.Ç., Literature Search: N.E.A., Ş.Ç., Writing: N.E.A., Ş.Ç.

DISCLOSURES

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

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DOI: 10.34057/PPj.2025.44.02.2024-12-2
Pelviperineology 2025;44(2):86-89

Sources and streams of multidisciplinary pelvic floor practice: Development and interdisciplinary application of integral theory system (ITS)

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Citation: Ding S. Sources and streams of multidisciplinary pelvic floor practice: development and interdisciplinary application of integral theory system (ITS). Pelviperineology. 2025;44(2):86-89

ABSTRACT

Since Professor Petros introduced the Integral Theory in 1990, this framework has evolved continuously, undergoing over three decades of clinical refinement to become a structured, systematic approach. Despite the significant clinical value it has shown in treating pelvic floor disorders, many practitioners in the field still have a limited understanding of its core principles. This article traces the development of integral theory system, examines its interdisciplinary challenges and opportunities, and highlights the central role of ligament repair, muscle balance, and neural regulation in treating pelvic floor disorders. By promoting interdisciplinary collaboration and advancing clinical applications, this article aims to foster the comprehensive development of pelvic floor medicine.

Keywords: Integral theory system; interdisciplinary cooperation; ligament repair; muscle balance; neural modulation

INTRODUCTION

Pelvic floor dysfunction is a complex issue impacting the health of millions of women worldwide. The diversity and intricacies of this condition have drawn considerable research attention over the past few decades. Traditional treatments often focus on addressing individual anatomical structures, frequently overlooking the interconnected and multi-level functionality of the pelvic floor as a whole. In 1990, Professor Petros introduced the Integral Theory, which states, “Prolapse, urinary stress, urge symptoms, abnormal bowel and bladder emptying, and certain forms of pelvic pain primarily arise from vaginal laxity or weakened supporting ligaments due to altered connective tissue”. This theory reframed the understanding of pelvic floor anatomy by emphasizing the synergistic roles of ligaments, muscles, fascia, and nerves. Since then, treatment approaches for pelvic floor disorders have shifted from single-disciplinary interventions to more comprehensive, multidisciplinary collaborations.

However, despite over three decades of development, many practitioners still face limitations in understanding and applying

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Received: 17 December 2024 **Accepted:** 21 April 2025 **Publication Date:** 18 August 2025

integral theory system (ITS). This article explores the evolution of ITS, identifies challenges in multidisciplinary applications, and suggests strategies to strengthen interdisciplinary collaboration, pinpoint blind spots and opportunities, and leverage effective tools to facilitate the widespread clinical adoption of ITS across disciplines in pelvic floor medicine.

1. Evolution and Interdisciplinary Challenges of the ITS

Since its introduction by Professor Petros in 1990, ITS has expanded from a hypothesis to a comprehensive system of practice, providing a robust theoretical foundation for various surgical techniques and achieving notable clinical results.

The author first encountered ITS at a multidisciplinary pelvic floor conference in 2011 and has since pursued in-depth study through continued communication with Professor Petros. Originally published in the Scandinavian Journal of Obstetrics and Gynecology as a supplement in 1990,[1] this framework detailed the origins of ITS, covering biomechanics, static anatomy, clinical imaging, diagnostic strategies, and surgical design. Notably, the mid-urethral sling, developed under this theoretical framework, became a breakthrough gold standard in treating stress urinary incontinence. However, many practitioners, including the author, often focus on specific methods derived from ITS without delving into its comprehensive framework.

Professor Petros's ongoing efforts to improve and apply ITS[2] clinically, as evidenced by the 2024 release of a new supplement published in Annals of Translational Medicine,[3] reinforce its scientific credibility and long-standing clinical value. Nonetheless, despite its widespread application in gynecology, ITS remains underutilized in fields such as urology and colorectal field. This limited interdisciplinary adoption restricts the broader application of effective treatment strategies. Strengthening cross-disciplinary understanding and application of ITS will be crucial for its future development.

2. This Limitation in Understanding Mainly Stems from the Following Aspects

First, in the thinking process, it is often difficult for practitioners to break through the inherent reductionist thinking mode. This makes the transition from static anatomy to functional anatomy and biomechanics quite challenging. Even learning as basic as mastering the terminology of static anatomy and pelvic floor structure anatomy can be a significant challenge for many. This mindset shift takes time and sustained effort.

Second, during the learning process, practitioners face the challenge of integrating knowledge at multiple levels. They not only need to master static anatomy knowledge, but also need to upgrade to the level of functional anatomy, dynamic anatomy and biomechanics, and comprehensively consider muscles, ligaments, nervous system, fascia and their interrelationships. This complex integration of thinking is challenging for many practitioners, resulting in numerous difficulties in learning and application. Overcoming this challenge requires systematic learning and practice.

In addition, because the integral theory originated from the field of gynecology, other related disciplines such as urology and colorectal field have not yet fully understood and applied. These disciplines may not fully appreciate the importance and impact of this theory on pelvic floor multidisciplinary practice and their own disciplines. This limitation of interdisciplinary application not only hinders the comprehensive promotion of the theory, but may also lead to missing some effective treatments in clinical practice. Therefore, strengthening exchanges and cooperation between different disciplines and promoting the application of theory in a wider range of fields will be an important direction for future development.

3. Perspectives on Ligament Repair, Muscle Balance, and Neural Regulation in ITS

3.1 The importance of ligament repair

In ITS, ligaments play a key role in pelvic floor structures repair deserves special attention. This emphasis is not meant to downplay the importance of muscles, fascia, and other structures but is based on the efficiency of anatomical repair. Biomechanically, ligaments, composed primarily of type I collagen, provide greater strength than muscles and fascia, making them crucial in addressing pelvic floor issues such as anterior rectal wall intussusception and prolapse.

(1) The relationship between collagen, vagina and ligaments

Collagen is a major component of human structures such as ligaments, fascia and muscles. Different tissues have different functional needs and therefore the composition and properties of their collagen.

Ligaments are mainly composed of type I collagen, accounting for approximately 70-80% of their total collagen. This collagen gives the ligament extremely high tensile strength and structural stability, allowing it to provide strong anatomical support. The breaking strain of the ligament is as high as 300 mg/mm^2, demonstrating its excellent strength.

In contrast, vaginal tissue is primarily composed of type III collagen, which gives the vagina its unique physiological properties. Type III collagen gives the vagina good ductility and elasticity while maintaining a certain tensile strength. Although

the vagina is not as strong as ligaments, its breaking strain is still 60 mg/mm², which is much higher than the 5 mg/mm² of the pelvic floor muscles. This structural characteristic is ideally suited to the physiological and functional needs of the vagina: It maintains sufficient strength while possessing the necessary elasticity to adapt to the birth process. More importantly, this property enables the vagina to effectively transmit the force generated by pelvic floor muscle contraction, playing a key role in pelvic floor function.

The unique structure of the vagina allows it to act as a "hammock" in the pelvic floor musculature. This structure can be compared to the elastic surface of a trampoline or the surface of a drum. It must have both strength and elasticity, and become the key link to transmit the force between muscles. If the drum surface is too hard, the sound of the drum will not travel far; if the trampoline is too hard, it will not bounce high. Similarly, the vagina needs to support the pelvic organs while effectively transmitting force during muscle contraction, thereby participating in the control of important physiological functions such as urination and defecation.

It is precisely because of these differences in structure and strength between the ligaments and the vagina that they can play their own unique and complementary roles in pelvic floor function and jointly maintain the normal physiological functions of the pelvic floor.

(2) Rethinking Surgical Approaches

This deeper understanding of ligament and vaginal structure calls for reevaluation of certain surgical techniques. For example, the practice of avoiding vaginal removal or mesh placement is based on this understanding.

When dealing with anterior rectal intussusception and prolapse, we should focus on the main source of the problem—the laxity of the uterosacral ligaments—rather than just the anterior rectal wall itself. Ligament damage can lead to passive elongation of the anterior rectal wall, leading to anterior rectal wall intussusception, prolapse, and enterocele. Therefore, the correct approach is to repair the uterosacral ligaments rather than placing a mesh in the rectovaginal septum or resecting the anterior rectal wall. Paying attention to strengthening or shortening the uterosacral ligaments during vaginal vault apex suspension surgery is an effective repair solution. Regardless of whether the transvaginal, transperineal or transabdominal approach is chosen, the purpose of repairing the ligaments can be achieved, thereby solving the prolapse problem. This approach not only restores the structural integrity of the pelvic floor, but also prevents prolapse of other organs, reducing the patient's need for future surgery.

Additionally, we should not overlook the important role of the perineal body as the third level of pelvic floor support. Perineal body laxity and dysfunction are closely related to the occurrence of rectocele and descending perineal syndrome. Therefore, when treating this type of pelvic floor disease, we can effectively improve the function of the perineal body by shortening and strengthening the suspensory deep transverse perineal ligament. This idea for the perineal body solves the problem of the anchor point for muscle contraction, relaxation and force generation, and is an indispensable part of the overall treatment strategy.

By fully considering all components of the pelvic floor support system, including ligaments, muscles, and the perineal body, we are able to tailor a more comprehensive and effective treatment plan for our patients.

3.2 Muscle strength and functional balance in pelvic floor

Muscle relaxation, tension, and mechanical balance are fundamental to pelvic floor function. For instance, in pelvic floor dyssynergic defecation sydrome, the internal anal sphincter and the pelvic floor muscle group are often typically tense, reflecting the inability of the visceral smooth muscle and pelvic floor striated muscle systems to effectively relax.

The striated muscles of the pelvic floor differ from striated muscles elsewhere in the body. They are mainly composed of type 1 muscle fibers that can tolerate sustained tension contraction, between smooth muscles and voluntary skeletal muscles. At the same time, the contractile force of the external anal sphincter and longitudinal muscle of anus acts downward. Additionally, the puborectalis and levator ani plates form a pair of interacting forces: one pulls the posterior rectal wall anteriorly and the other posteriorly. These forces, together with the pull-down force of the external sphincter and longitudinal muscle of anus, form a rotational resultant force. This torque is the key to closing the rectum. When this force cannot be relaxed in time, the anus will not open properly.

Based on this understanding, the ITS provides a new perspective on muscle balance and neural function regulation. Traditional methods mainly directly relax the internal anal sphincter, external sphincter, puborectalis muscle or levator ani muscle through rehabilitation training, botulinum toxin injection or surgical cutting. However, could we take another approach? That is, starting from the ITS, focusing on the relaxation and tension of the corresponding anterior pelvic antagonist muscles and ligaments, so as to achieve a more comprehensive rehabilitation?

3.3 Bidirectional neuromodulation

ITS introduces the idea that neuromodulation can be applied from a "top-down" or "bottom-up" perspective.Urge incontinence may be caused by premature excitation of the receptors, which may be caused by problems with the receptors themselves or by abnormalities in structures such as the ligaments, fascia, or vagina that support the receptors.

Modulation through the pudendal nerve, sacral nerve plexus, brain and central nervous system, and even the enteric nervous system are all possible intervention routes. This bidirectional regulation method is particularly important in the ITS of the pelvic floor because it not only focuses on local pathophysiological changes, but also emphasizes the impact of the systemic nervous system on local functions.

ITS provides us with a more whole picture perspective, allowing us to better understand and treat pelvic floor disorders. This holistic understanding helps us expand the ideas of treatment methods, so that when treating defecation problems, we can not only start from the posterior compartment, but also from the anterior compartment. For example, when treating fecal incontinence, both urinary and fecal incontinence problems may improve after repairing the pubourethral ligament. Likewise, posterior compartment symptoms may improve when urinary incontinence is treated, and anterior pelvic symptoms may decrease when constipation is treated. This cross-regional linkage effect shows that the ITS not only provides a direct treatment method, but also puts forward the idea of achieving therapeutic effects by dealing with opposing muscles or antagonist muscles.

CONCLUSION

The proposal of the ITS provides new ideas and methods for the treatment of pelvic floor diseases. By considering the overall function of ligaments, muscles, and nerves, this theory has not only been widely used in the field of gynecology, but also provided a solid theoretical foundation for interdisciplinary cooperation.

However, the promotion and application of theory still faces many challenges, especially in terms of cooperation and understanding between different disciplines. This article emphasizes the importance of ligament repair in clinical practice, especially when dealing with problems such as anterior rectal wall intussusception and prolapse and vaginal apical suspension, while noting the role of the perineal body in rectocele and descending perineal syndrome. Additionally, this article explores ways to improve pelvic floor disorders by modulating muscle balance and nerve function.

Through in-depth study and application of the ITS, we can deepen our understanding of anatomy and expand treatment strategies, providing patients with more comprehensive and effective care. Promoting interdisciplinary applications in future clinical practice will advance the field of pelvic floor medicine and enhance patients' quality of life.

FOOTNOTES

DISCLOSURES

Financial Disclosure: The author declared that this study received no financial support.

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