DOI: 10.34057/PPj.2026.45.01.76486
Pelviperineology 2026;45(1):47-51

Intraoperative evaluation of the effectiveness of sling positioning

Sandip MAITI[1], Diana Lidia Leija AGUILAR[1], Francisco Javier Castro APODACA[2]

[1]Center for Advanced Pelvic Medicine, Doctors Hospital Auna, University of Monterey, Nuevo León, Mexico
[2]Department of Gynecological Urology, Autonomous University of Sinaloa, Culiacan, Sinaloa Faculty of Nutrition and Gastronomy Science, Sinaloa, Mexico; Civil Hospital of Guadalajara, Autonomous University of Guadalajara, Guadalajara, Jalisco, Mexico

Citation: Maiti S, Aguilar DLL, Apodaca FJC. Intraoperative evaluation of the effectiveness of sling positioning. Pelviperineology. 2026;45(1):47-51

ABSTRACT

Stress urinary incontinence is a common condition in women, and the prevalence increases as age increases. Since the introduction of suburethral tapes, they have become the surgical treatment of choice, with success rates of up to 97%. Despite this, up to 20% may have failures or complications. A determining factor is the position of the tape to avoid these complications, which is why intraoperative ultrasound is essential, resulting in an effective tool to improve postoperative results in the placement of suburethral tapes, so its systematic use must be standardized to minimize complications and avoid subsequent reoperations.

Keywords: Stress urinary incontinence; suburethral sling; diaphragm; intraoperative ultrasound

INTRODUCTION

Urinary incontinence is a common condition in women, with stress urinary incontinence predominating, which can negatively impact different aspects of the lives of people who suffer from it.[1] The prevalence of urinary incontinence increases with age, with a prevalence rate of 20 to 30% in young adults, with a peak around middle age with a prevalence of 30 to 40%, and a steady increase in old age of 30 to 50%.[2] Complications related to the different types of approach are bladder perforation, bleeding, and bruising, which are usually more common in the retropubic approach.[2,3] Other complications associated with suburethral tapes include emptying dysfunction, tape infection and erosion, and long-term chronic pain, dyspareunia, and *de novo* urge urinary incontinence.[4]

Among the related factors that have been investigated to explain these complications, the position of the tape has received significant attention due to its potential impact on post-surgical outcomes.[5] This is where intraoperative ultrasonographic evaluation in tape placement becomes invaluable in improving short- and long-term postoperative outcomes.[6]

Figure 1 shows a schematic image that represents the position that the tape should maintain with respect to the urethra, the distance to the urethra, the distance to the SP (GAP SLINGPUBIS) and the type of vector and shape.

Address for Correspondence: Francisco Javier Castro Apodaca, Department of Gynecological Urology, Autonomous University of Sinaloa, Culiacan, Sinaloa Faculty of Nutrition and Gastronomy Science, Sinaloa, Mexico; Civil Hospital of Guadalajara, Autonomous University of Guadalajara, Guadalajara, Jalisco, Mexico
E-mail: francisco.castroapodaca@uas.edu.mx **ORCID ID:** orcid.org/0000-0002-1857-1595
Received: 11 August 2025 **Accepted:** 07 October 2025 **Publication Date:** 24 April 2026

Copyright© 2026 The Author(s). Published by Galenos Publishing House on behalf of International Society for Pelviperineology.
This is an open access article under the Creative Commons AttributionNonCommercial 4.0 International (CC BY-NC 4.0) License.

CASE REPORT

This is a 57-year-old female patient, who presented stress urinary incontinence of 10 years of evolution. Within her gynecological-obstetric history, 3 pregnancies stand out, which were vaginal deliveries with a product of maximum weight of 3500 kg, questionnaires were applied to evaluate urinary incontinence international incontinence consultation questionnaire with a result of 15 points (severe incontinence), as well as pelvic ultrasound (USG) highlighting urethral hypermobility 3.96 with an open urethrovesical angle 186° rotation of the urethra 79°, urethral hypermobility, Q tip 50°. It was decided to place a suburethral tape, evaluating its intraoperative placement with USG. Prior to the procedure, the patient was placed in a lithotomy position and evaluation of urethral mobility parameters was performed. The procedure is initiated under sensory block to allow the valsalva (V) maneuver to be carried out during the procedure. Suburethral tape (Steema TOT®) was placed with the "8/4" technique, USG of the pelvic floor was performed with Mindray I9 equipment, using a 6 Hz 2D transducer with images of the pelvic floor (Figure 2A, B, Figure 3), corroborating the correct placement of the tape, observing the position of the tape at a distance from the veiscal neck at rest (R) of 1.77 mm and V 1.23 mm with respect to the meatus in R at 0.86 mm and V at 1.1 mm, the distance of the urethra with respect to the tape in R at 0.52 mm and V at 0.35 mm. Correction of urethral hypermobility was observed after tape placement compared to preoperative parameters (urethral hyperlaxity 2.28 with an open urethrovesical angle of 172°, urethral rotation of 51°), hemostasis was verified, leakage was negative by cough test, and the surgical procedure ended without incident. The patient was discharged 3 hours after spontaneous urination. The patient was scheduled 10 days postoperatively, the position of the sling was assessed, and complications such as urethral obstruction and mobility were detected by translabial USG. At the post-30-day appointment, the USG is performed again to evaluate the tape by looking at the sling at a distance from the bladder neck of R of 2.53 mm and V 1.69 mm, with respect to the meatus in R at 1.35 mm and V at 1.29 mm, the distance of the urethra with respect to the urethral tape in R at 0.38 mm and V at 0.23 mm and the distance of the urethra in R at 0.38 mm and the distance of the urethra at R at 0.38 mm and the distance of the urethra at 0.33 mm and the distance of the urethra at R at 0.38 mm and V at 0.23 mm and the distance of the urethra at R at 0.38 mm and the distance of the urethrale band at R at 0.38 mm and the distance of the urethra at R at 0.38 mm and the distance of the urethra at R at 0.38 mm and the distance of the urethra of the urethra of the sling R 1.57 mm and V 1.49 mm. Follow-up was by USG and at 6 months after surgery she is dry without any change in the sling profileometry.

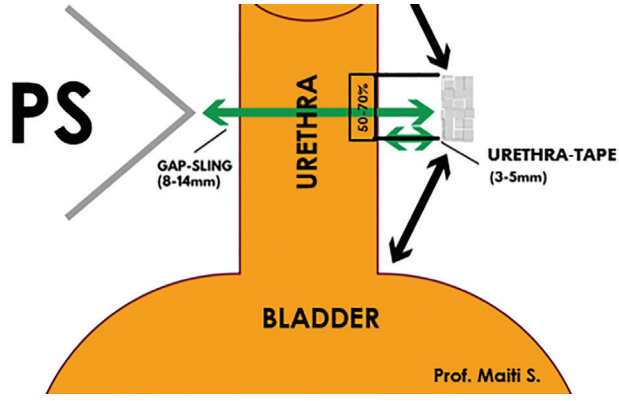


Figure 1. Schematic representing the position that the tape should maintain with respect to the urethra

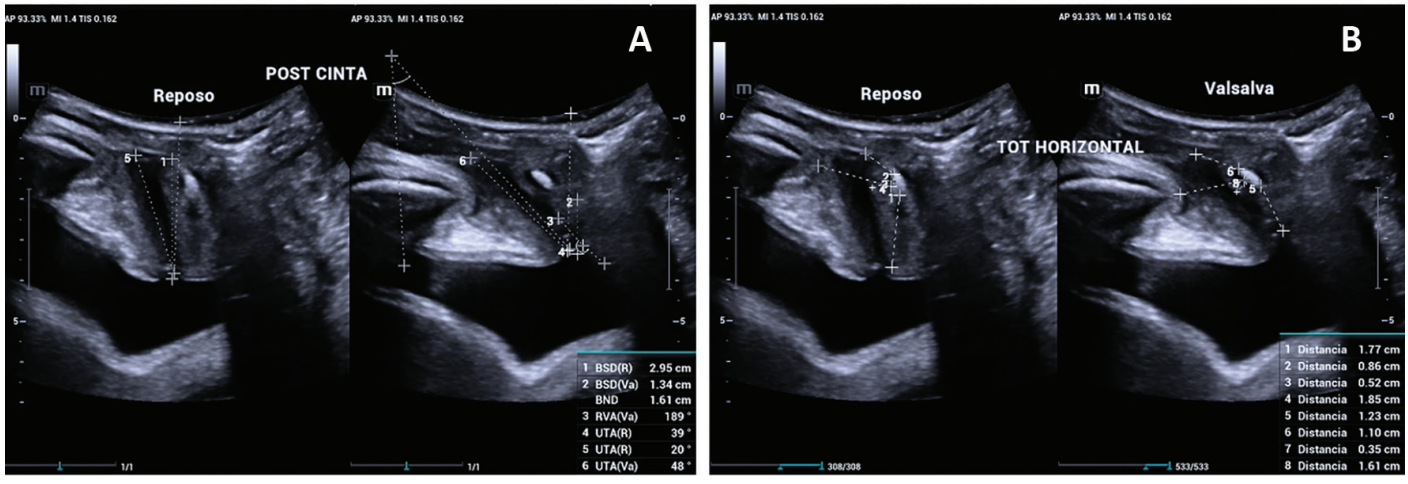


Figure 2. A) Transoperative ultrasonographic images of urethral mobility at rest and valsalva, observing immediate improvement in the descent of the bladder neck in Valsalva and improvement in the stability of the pubouretral ligament. **B)** Transoperative ultrasonographic images performed profilometry of the tape, corroborating the distance of the tape within normal parameters and ruling out post-application urethral compression

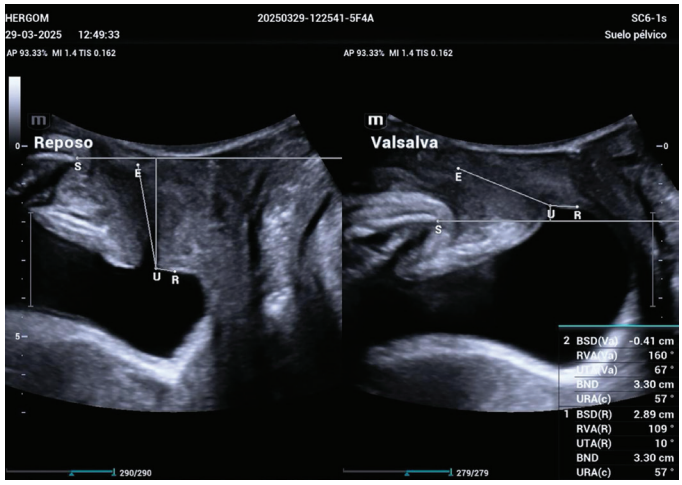


Figure 3. Ultrasonographic images of urethral mobility at rest and valsalva prior to surgery

DISCUSSION

Urinary incontinence is a problem with a high prevalence in women, despite this, few seek care from specialists, due to the mistaken belief that it is a normal part of women's aging.

Since the first description of the Petros-Ulmsten comprehensive theory in 1993, which describes an anatomical defect of the anterior vaginal wall as a cause of stress urinary incontinence and overactive bladder, as well as the use of mid-urethral straps to reinforce the functioning of the puburithral ligaments and levator ani muscles.[7]

Currently, both retropubic and transobturator suburethral tapes have similar rates of long-term efficacy, reaching up to 97% and 85%, respectively.[3] Despite being safe to drive, it is not exempt from complications or failures, which are reported in up to 20% of cases.[5] Complications related to the different types of approach are bladder perforation, bleeding, and hematomas, which are usually more common in the retropubic approach.[2,3]

The primary requirement to avoid lower urinary tract symptoms such as frequency, urgency, nocturia, slow flow, terminal drip emptying and urinary retention, is with a correct placement of the tape, since an incorrect position or displacement of the tape can be the cause of the aforementioned complications, reporting rates ranging from 7.6% to 10%.[4] Other complications associated with suburethral tapes include infection, tape erosion and long-term chronic pain, dyspareunia, and *de novo* urge urinary incontinence.[4] The incidence of urgency urinary incontinence and persistent and *de novo* urgency is reported around 15% and 30%, respectively, after this type of procedure.[7]

Among the factors explaining these complications, the position of the tape has received significant attention due to its potential impact on post-surgical outcomes.[5] This is where intraoperative ultrasonographic evaluation in tape placement acquires great value to improve postoperative results in the short and long-term.[6]

The correct placement of the suburethral tape is essential to optimize results and reduce complications and one way to achieve this is through the transoperative USG assessment of the pelvic floor to visualize the correct positioning of the tape, identify and correct the position if necessary, as well as help identify possible complications early.[6,8,9] However, ultrasonographic evaluation should be standardized and unified for better postoperative outcomes.[6,10]

The recommended intraoperative USG measurements are to measure the urethral length and place the tape in relation to the length of the tape in a percentage between 50% and 60% (+10%); 3 and 5 (+1.5) mm, the recommended sling-urethra distance and the distance between the tape and the pubic symphysis (Gap-sling) is 8 to 14 mm; and the shape of the tape in V should be flat or C-shaped and not V-shaped for this it is recommended to use the pubic symphysis as a reference point, evaluating the placement of the tape in the middle sagittal plane at rest and V.[11,12]

A complete evaluation, including a pelvic USG, preoperative, intraoperative and postoperative testing immediately after the placement of suburethral tapes, are key tools to optimize continence and reduce complications related to lower urinary symptoms as well as bladder emptying dysfunction, as well as avoid subsequent surgical interventions for persistent incontinence, improving the safety and efficiency of the procedure. Therefore, the systematic implementation of intraoperative testing is recommended to optimize functional outcomes in urinary incontinence surgery and improve surgical success.[13]

As mentioned by Illiano et al.,[14] in factors associated with surgical their study, which aimed to evaluate dynamic translabial USG to know the failure, in which, they reported that the participants who presented incontinence after the placement of the mesouretral sling, it was due to the fact that it was located at the proximate or distal level of the urethra, which caused a discordant mobility with asymmetry in the arm and funnel of the bladder neck, concluding that an inadequate position of the sling due to errors in the technique is a cause of failure in anticontinence surgery (p=0.0001). Although Illiano et al.,[14] did not perform intraoperative translabial USG as in this case report, they emphasize the importance of proper placement of the mesouretral sling to avoid new-onset urinary incontinence, therefore, this case report is aimed at avoiding these errors when performing the assessment of the mesouretral sling at the

surgery moneto allowing the correct position to be evaluated more objectively.

Tan et al.,[15] conducted research with 100 patients to evaluate the association between translabial USG features in 4D-TLUS of the retropubic mesourethral sling and pelvic floor symptoms, reporting an 89% patient-reported success rate after surgery, 2% had mesh exposure, while the rest had pain symptoms; they observed a sifnificative association between surgical success and a gap of the urethral sphincter when performing the V maneuver of 10-12mm (p=0.001); highlighting that a gap narrower or closer to 10 mm is associated with voiding symptoms (p=0.036).[15] With respect to the present clinical case in which translabial USG is performed transoperatively, this allows us to perform a measurement during the procedure between the pubic symphysis, the tape and the angle between the pubis and the tape in reporso and with the V maneuver, this does not allow us to achieve a success in the treatment of retropubic pain syndrome. By placing the appointments under direct visualization we can maintain the separation between the pubis and the tape.

CONCLUSION

Intraoperative USG for real-time mesourethral tape placement (TOT or TVT) represents a valuable tool that could optimize clinical outcomes. This is not currently a standardized or widely used procedure. Its use ensures a more precise placement of the tape, highlighting its importance, since placing it in an incorrect position could lead to complications such as urethral obstruction, bladder perforation, voiding dysfunction or persistence/recurrence of incontinence.[15]

In the same way, the intraoperative use of USG allows confirming the adequate tension of the tape, it also facilitates clinical follow-up, by allowing the objective evaluation of the position and dynamic behavior of the tape over time;[14] the systematic incorporation of USG in these procedures is not only desirable, but should be part of standardized surgical protocols.

The systematic use of intraoperative USG for the correct placement of mesourethral tape would contribute to homogenizing surgical techniques and clinical results between the different centers, reducing operative variability. Therefore, standardizing the use of pelvic USG during mesourethral tape placement not only has the potential to improve surgical outcomes and reduce complications, but also represents a step toward safer, more accurate, and evidence-based surgery.

ETHICS

Informed Consent: Written informed consent was obtained from the patient prior to submission and publication of this case report.

FOOTNOTES

Contributions

Surgical and Medical Practices: S.M., D.L.L.A., Concept: S.M., D.L.L.A., F.J.C.A., Design: S.M., D.L.L.A., F.J.C.A., Data Collection or Processing: S.M., D.L.L.A., Analysis or Interpretation: S.M., D.L.L.A., F.J.C.A., Literature Search: S.M., D.L.L.A., F.J.C.A., Writing: S.M., D.L.L.A., F.J.C.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.

REFERENCES

1. Hunskaar S, Lose G, Sykes D, Voss S. The prevalence of urinary incontinence in women in four European countries. BJU Int. 2004; 93: 324-30.
2. Sears S, Rhodes S, McBride C, Shoag J, Sheyn D. Complications following retropubic versus transobturator midurethral synthetic sling placement. Int Urogynecol J. 2023; 34: 2389-97.
3. Hunskaar S, Burgio K, Diokno A, Herzog AR, Hjälmås K, Lapitan MC. Epidemiology and natural history of urinary incontinence in women. Urology. 2003; 62(4 Suppl 1): 16-23.
4. Kuuva N, Nilsson CG. A nationwide analysis of complications associated with the tension-free vaginal tape (TVT) procedure. Acta Obstet Gynecol Scand. 2002; 81: 72-7.
5. Seklehner S, Laudano MA, Xie D, Chughtai B, Lee RK. A meta-analysis of the performance of retropubic mid urethral slings versus transobturator mid urethral slings. J Urol. 2015; 193: 909-15.
6. Zwierzchowska A, Tomasik P, Horosz E, Barcz E. Sonography as a diagnostic tool in midurethral sling complications: a narrative review. J Clin Med. 2024; 13: 2336.
7. Qu P, Hai N, Lv Z, Yang J. Midurethral sling position and surgical outcome: a meta-analysis. Medicine (Baltimore). 2024; 103: e36115.
8. Chan L, Tse V. Pelvic floor ultrasound in the diagnosis of sling complications. World J Urol. 2018; 36: 753-9.
9. Marcelissen T, Van Kerrebroeck P. Overactive bladder symptoms after midurethral sling surgery in women: risk factors and management. Neurourol Urodyn. 2018; 37: 83-8.

10. Naumann G, Aigmüller T, Bader W, et al. Diagnosis and therapy of female urinary incontinence. Guideline of the DGGG, OEGGG and SGGG (S2k-Level, AWMF Registry No. 015/091, January 2022): part 1 with recommendations on diagnostics and conservative and medical treatment. Geburtshilfe Frauenheilkd. 2023; 83: 377-409.
11. Shek KL, Dietz HP. Ultrasound imaging of slings and meshes in urogynecology. Ultrasound Obstet Gynecol. 2021; 57: 526-38.
12. Yang JM, Yang SH, Huang WC, Tzeng CR. Correlation of tape location and tension with surgical outcome after transobturator suburethral tape procedures. Ultrasound Obstet Gynecol. 2012; 39: 458-65.
13. Ludwig S, Stumm M, Mallmann P, Jager W. TOT 8/4: a way to standardize the surgical procedure of a transobturator tape. Biomed Res Int. 2016; 2016: 4941304.
14. Illiano E, Trama F, Li Marzi V, et al. Translabial ultrasound: a noninvasive technique to evaluate technical errors after transurethral failure. Int Urogynecol J. 2022; 33: 1023-30.
15. Tan YH, Frazer MI, Hughes I, Wong V. Correlation between translabial ultrasound parameters and outcomes in retropubic mid-urethral slings: can we predict success? World J Urol. 2021; 39: 163-8.