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).

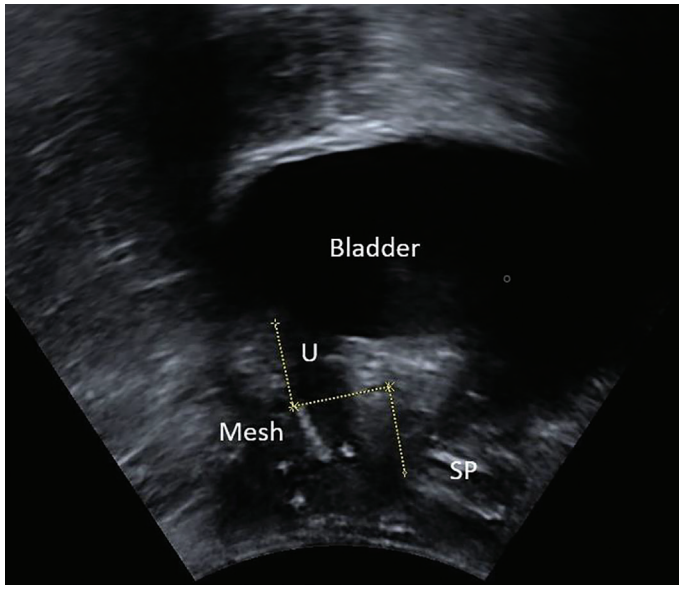

Figure 1. Mesh, SP - symphysis pubis, U - urethra and bladder at rest and at mild straining on TPUSG

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.

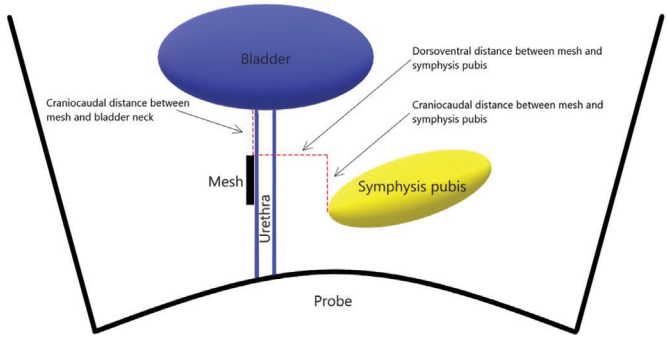

Figure 2. Schematic view of craniocaudal and dorsoventral distances between mesh and symphysis pubis or bladder neck

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		*p*
	Transobturator n (%)	Retropubic n (%)	
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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