

DOI: <https://dx.doi.org/10.18203/2320-1770.ijrcog20253527>

Original Research Article

Prospective observational study of inside-out versus outside-in transobturator tapes for female stress urinary incontinence at a tertiary care hospital of South Western railway

Jamuna Kanakaraya^{1*}, S. Kanakaraya², Naveen Kanakaraya³, Naren Kanakaraya⁴

¹Department of Obstetrics and Gynecology, Central Hospital, South Western Railway, Hubli, Karnataka, India

²Department of Surgery, Central Hospital, South Western Railway, Hubli, Karnataka, India

³Intern, Shri B. M. Patil Medical College Hospital and Research Centre, Vijayapura, Karnataka, India

⁴Intern, Shimoga Institute of Medical Sciences, Shivamogga, Karnataka, India

Received: 18 July 2025

Revised: 11 September 2025

Accepted: 01 October 2025

*Correspondence:

Dr. Jamuna Kanakaraya,

E-mail: jamunakanakaraya@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: To compare outcomes of transobturator tension-free vaginal tape using outside-in and inside-out approaches in women with stress urinary incontinence (SUI), and to identify risk factors for treatment failure.

Methods: A prospective observational study was conducted at Central Hospital, Hubli, from July 2007 to June 2022. A total of 223 women with SUI refractory to conservative management were enrolled; 129 underwent the inside-out (TVT-O) procedure and 94 underwent the outside-in (TOT) procedure. Patients were followed annually for at least 3 years (maximum 10 years). Subjective and objective cure rates, complications, quality of life (QoL), and psychological outcomes were assessed.

Results: At 5 years, subjective cure rates were 87% for TVT-O and 83% for TOT, while objective cure rates were 95.3% and 90%, respectively. Both techniques demonstrated significant improvements in QoL and Beck depression inventory scores. Dyspareunia was higher in the TVT-O group ($p=0.02$), but other complication rates were comparable. In 75 patients with 10-year follow-up, long-term success was maintained at 97%.

Conclusions: Both TVT-O and TOT techniques are safe and effective for treating female SUI, with durable long-term results. The choice of procedure should be guided by surgeon expertise and patient preference.

Keywords: Inside out, Mid urethral sling, Outside in technique, Patient satisfaction, Stress urinary incontinence, Trans obturator technique, Trans vaginal technique

INTRODUCTION

Stress urinary incontinence (SUI) is the most common subtype of urinary incontinence in women, characterized by involuntary leakage of urine during activities that increase intra-abdominal pressure, such as coughing or exertion. The prevalence of SUI varies worldwide, ranging from 4% to 50%, with higher rates in developing countries where underreporting remains a challenge.^{1,2} Beyond physical symptoms, SUI significantly affects women's quality of life and psychological well-being.^{3,4}

Conservative treatments include pelvic floor muscle training and pharmacotherapy, but surgery is often required for persistent cases.⁵ Mid-urethral sling (MUS) procedures are now the gold standard due to their minimally invasive nature and high success rates.⁶ The retropubic TVT, first described by Ulmsten, carried risks of bladder and vascular injury.⁷ Delorme introduced the outside-in transobturator tape (TOT), followed by De Leval with the inside-out approach (TVT-O), both of which reduced these risks.^{8,9} Evidence suggests

comparable outcomes between the two, though some differences in complications exist.¹⁰⁻¹²

This study aimed to compare the clinical outcomes, complications, and patient satisfaction of TVT-O versus TOT techniques in women with SUI.

Aims and objectives

This study was aimed at establishing a technique which would be minimally invasive, minimal morbidity, compare the success, complication and patient satisfaction of both inside out and outside in technique.

METHODS

Study design

It was a prospective observational study.

Study setting and period

This study took place at the department of obstetrics and gynecology, Central Hospital, Hubli, south western Railway; July 2007 - June 2022.

Study population

Women aged >18 years with clinically diagnosed SUI refractory to conservative therapy. Exclusion criteria included predominant urge incontinence, prior anti-incontinence surgery, pelvic malignancy, or refusal of consent. Of 276 screened, 223 were enrolled: 129 underwent TVT-O and 94 underwent TOT.

Surgical procedure

Both procedures were performed under anesthesia by experienced surgeons. TOT involved tape passage from groin to vaginal incision (outside-in), while TVT-O involved passage from vaginal incision to groin (inside-out). In both, a polypropylene tape was placed tension-free under the mid-urethra.

Study tools

Beck depression inventory (BDI) was used as a tool for psychological evaluation pre and post-surgery to track changes in symptoms over time. 21 items with a scale of 0 to 63 was used. Short form-36 (SF-36) consisting of 36 questions was used to measure quality of life in response to both techniques of surgery.

Outcome measures

Subjective cure (absence of leakage), objective cure (negative stress test), complications (Clavien-Dindo classification), psychological outcomes (Beck depression inventory), and QoL (SF-36).

Statistical analysis

Data analyzed using SPSS (version 23). Continuous variables compared with Student's t-test, categorical variables with Chi-square/Fisher's exact test. Significance set at $p < 0.05$.

Ethical considerations

All patients were counselled, pre procedure information sheet was provided to all patients regarding SUI, treatment options, surgical techniques, requirement of anesthesia, pre and post operative tests and follow up strategy. Informed consent was taken.

RESULTS

The aim of our study was to draw a comparison between the clinical outcomes of female stress urinary incontinence (SUI) patients who underwent either the outside-in trans obturator tape (TOT) or inside-out transobturator tape (TVT-O) procedures. A total of 223 patients with Stress urinary Incontinence were included in our study, outcome assessed were clinical cure. Subjective cure was characterized by the absence of urine loss during physical activity in women. Objective cure was defined as the absence of urine leakage during a stress test induced by coughing. Other outcomes assessed were DeNovo OAB, voiding dysfunction and groin pain (Tables 4 and 5).

At 5 years follow-up subjective cure was 87% (TVT-O) versus 83% (TOT); objective cure was 95.3% (TVT-O) versus 90% (TOT). At 10-year follow-up ($n=75$), success was maintained at 97%. Mean operative time was 12 minutes. Dyspareunia was significantly higher in TVT-O ($p=0.02$), but other complication rates were similar (Tables 1 and 2). Residual urine volumes were low and comparable. Both groups showed significant improvements in depression scores and QoL domains (Table 3).

As shown in Table 1, there were no significant differences in age or BMI between the TOT and TVT-O groups ($p=0.35$ and $p=0.55$, respectively), indicating comparability of baseline characteristics.

As shown in Table 1, there were no significant differences between the TOT and TVT-O groups with respect to menopausal status ($p=0.19$), history of previous surgery ($p=0.38$), or preoperative detrusor overactivity ($p=0.22$), indicating comparability of baseline clinical characteristics.

Clavien Dindo classification (CDC) was used to rank the severity of post operative complications. Urgency was noticed in both groups which were statistically similar. Dyspareunia was slightly higher in the TVT O group but was not statistically significant (Table 2).

Table 1: Demographic characteristics.

	TOT (n=94)	TVT O (n=129)	P value
	Mean±SD	Mean±SD	
Age	53.3±8.47	55.1±6.98	0.35
BMI	30.5±2.26	50.7±1.95	0.55
Menopause	83	45	0.19
Previous surgery	45	25	0.38
Preoperative detrusor over activity	45	28	0.22

Table 2: Post operative complications- Clavien-Dindo classification (CDC).

	Grade	TOT	TVT O	P value
Difficulty in urination	I	4	8	0.08
vaginal/inguinal pain	I	34	17	0.66
dyspareunia	II	26	28	0.02*
urgency	III	45	20	0.86
post operative detrusor over activity	III	48	22	0.74

*Significance of <0.05 level in Chi square test.

Table 3: Residual volume of urine.

	TOT			TVT O			P value
	Median	25p	75p	Median	25p	75p	
Residual volume of urine	19.5	12	25	20	11.75	24.5	0.89

Postoperative complications are summarized in Table 2. There was no significant difference between the TOT and TVT-O groups with respect to difficulty in urination ($p=0.08$), vaginal/inguinal pain ($p=0.66$), urgency ($p=0.86$), or postoperative detrusor overactivity ($p=0.74$). However, dyspareunia was significantly more common in the TVT-O group compared to the TOT group ($p=0.02$).

As shown in Table 3, the median residual urine volume was comparable between the TOT (19.5 ml) and TVT-O (20 ml) groups, with no statistically significant difference ($p=0.89$).

Table 4: Subjective cure rate.

	TOT (n=94)	TVT O (n=129)	P value
Same	15	17	0.55
Better	48	87	
Worse	4	5	
None	27	20	

Table 5: Objective cure rate.

	TOT (n=94)	TVT O (n=129)	P value
Negative	71	104	0.86
Mild	15	14	
Average	4	8	
Heavy	4	3	

The TOT procedure (outside-in tape) showed a subjective cure rate of 83%, whereas the TVT-O procedure (inside-out tape) displayed a superior cure rate of 87%. In terms of objective assessment, the TOT procedure achieved a cure rate of 90%, whereas the TVT-O procedure boasted a higher cure rate of 95.3%. In the TOT group, 2.7% ($n=1$) experienced DeNovo overactive bladder (OAB), and 5.4% ($n=2$) developed voiding dysfunction. Conversely, in the TVT-O group, 1.3% ($n=2$) experienced DeNovo OAB, 2.6% ($n=4$) developed voiding dysfunction, and 0.6% ($n=1$) reported groin pain (Tables 4 and 5).

Patients in both groups reported high subjective cure, with TVT-O showing a higher proportion of improvement than TOT, though the difference was not statistically significant ($p=0.55$).

Both groups achieved high objective cure rates, with TVT-O showing a slightly higher proportion of negative stress tests than TOT; however, the difference was not statistically significant ($p=0.86$).

Both TOT and TVT-O groups showed significant improvement in psychological wellbeing and quality of life after surgery. TVT-O patients had slightly higher BDI scores postoperatively, with differences in depression, physical pain, life energy, and mental health reaching statistical significance. Other domains such as physical performance, role inhibition, general health perception, and social performance improved similarly in both groups without significant differences.

Table 6: Beck depression inventory BDI.

	TOT (n=94)			TVT O (n=129)			P value
	Median	25p	75p	Median	25p	75p	
BDI	12	12	13	14	12	15	0.015*
Physical performance	80	75	80	80	75	81.3	0.28
INRDPP (1)	80	75	85	75	65	85	0.9
INRDEP (2)	75	75	80	80	80	80	0.08
Physical pain	71	71	71	66	66	71	<0.01**
General perception of health	70	65	70	65	65	70	0.40
Life energy	68	68	68	68	63	68	0.0003
Social performance	60	60	60	60	60	60	0.54
Mental health	75	75	75	70	70	71	<0.0009

*<0.05 level below significance in Mann Whitney U test, **<0.01 level below significance in Mann Whitney U test. INRDPP-Inhibition in role due to physical problems, INRDEP-Inhibition in role due to emotional problems.

DISCUSSION

Since their introduction in the mid-1990s, mid-urethral slings (MUS) have become the gold standard for treating female stress urinary incontinence (SUI) due to their high efficacy and minimally invasive nature. Initial retropubic TVT procedures achieved cure rates of 80-90% but carried higher risks of bladder and vascular injury.⁷ To reduce these complications, Delorme introduced the outside-in transobturator tape (TOT) in 2001, followed by De Leval's inside-out approach (TVT-O) in 2003.^{8,9} Both techniques aim to minimize complications while maintaining efficacy.

In our study, the subjective cure rates were 87% for TVT-O and 83% for TOT, while objective cure rates were 95.3% and 90%, respectively. These results are comparable to those reported by Novara et al, who found success rates ranging between 84-90% in a systematic review.⁶ Similarly, Latthe et al in a meta-analysis observed no significant difference in objective cure rates between inside-out and outside-in approaches, though TVT-O showed slightly fewer complications.¹¹

The long-term durability of MUS procedures has been emphasized in the literature. In our 10-year follow-up cohort, success was maintained at 97%, which aligns with the Cochrane review by Ford et al, reporting sustained cure rates at 10 years or more.²⁰ This suggests that both TVT-O and TOT remain effective in the long term, supporting their continued use as first-line surgical treatments for SUI.

Regarding complications, we observed higher rates of dyspareunia in the TVT-O group ($p=0.02$). This finding is consistent with Serati et al, who reported increased rates of postoperative sexual dysfunction in some TVT-O cohorts.¹² On the other hand, voiding dysfunction and urgency were comparable between groups, consistent with results from Abdel-Fattah et al and Huang and Yang, who

found no significant differences in storage or voiding symptoms between the two approaches.^{13,14}

Importantly, our study demonstrated significant improvements in quality of life (QoL) and psychological well-being, as reflected by SF-36 and BDI scores. This is in line with findings by Liapis et al and Richter et al, who highlighted not only the functional benefits of MUS but also the positive impact on mental health and social functioning.^{15,16}

Our results confirm that both TOT and TVT-O are safe, effective, and durable procedures. The choice between the two techniques should be guided by surgeon expertise and patient preference, as emphasized by Schimpf et al and Sung et al, who found comparable overall patient satisfaction in both groups.^{18,19}

This study proves that there is increase in quality of life, improvement in psychological status, low complication rates post-surgery. In both the groups there is significant improvement in the depression scale evaluation when compared to pre operative psychological status. Quality of life was significantly improved post procedure in both groups in our study. Though the satisfaction rate is high in both groups in our study, the survey needs to be evaluated at all points to state about high satisfaction rate as this survey is a subjective evaluation. Subjective evaluation is the only limitation in this study (Table 6).

The learning curve for surgeon is less when compared to other SUI surgeries like Bursch colposuspension. The average time taken in our study was 12 mins. Post procedure cystoscopy is not required as in retro pubic TVT. Though the learning curve is less, the operating surgeon should have mastered pelvic anatomy else the complication rate is expected to be high. At the end of five year post operative follow up the rate of recovery was 83 to 90% in outside in technique and 87 to 95.3% recovery

in inside out technique respectively. 10 years follow up in 75 cases showed success rate of 97%.

This study can be used as evidence-based study since the study has compared both methods in terms of efficiency, reliability, complication, patient satisfaction for both short and long terms.

However, limitations include single-center design, lack of randomization, and reliance on patient-reported outcomes. Larger multicenter randomized controlled trials are needed to confirm these findings.

CONCLUSION

Regardless of the technique used trans obturator sling surgery provides high success rate in the treatment of SUI although TVT O demonstrates slightly better outcomes when compared to TOT. Success rates, patient satisfaction, QOL post surgery were found to be similar in both inside out and outside in technique. Our study is comparable to similar studies available in literature. Ultimately it is the surgeon's preference and patient's choice in selecting the technique as both techniques have similar success rates.

Recommendations

Long term follow up of cases 5 years to 10 years is recommended. More multi centric trials and randomized control trials are recommended to get a stronger analytical report.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

- Milsom I, Altman D, Lapitan MC, Nelson R, Sillén U, Thom D. Epidemiology of urinary incontinence (ICUD-EAU). *Neurourol Urodyn*. 2017;36:1816-25.
- Reigota RB, Pedro AO, Machado VSS, Costa-Paiva L, Pinto-Neto AM. Prevalence of urinary incontinence and associated factors in women aged 50 years or older. *Rev Bras Ginecol Obstet*. 2016;38:433-9.
- Dufour S, Wu M. Conservative care of urinary incontinence in women. *CMAJ*. 2012;184:1095-101.
- Abrams P, Andersson KE, Birder L, Brubaker L, Cardozo L, Chapple C, et al. Fourth International Consultation on Incontinence. Recommendations of the International Scientific Committee: Evaluation and treatment of urinary incontinence, pelvic organ prolapse, and fecal incontinence. *Neurourol Urodyn*. 2010;29:213-40.
- Hay-Smith J, Dumoulin C. Pelvic floor muscle training versus no treatment, or inactive control treatments, for urinary incontinence in women. *Cochrane Database Syst Rev*. 2006;CD005654.
- Novara G, Artibani W, Barber MD, Chapple CR, Costantini E, Ficarra V, et al. Updated systematic review and meta-analysis of the comparative data on colposuspensions, pubovaginal slings, and midurethral tapes in the surgical treatment of female stress urinary incontinence. *Eur Urol*. 2010;58:218-38.
- Ulmsten U, Henriksson L, Johnson P, Varhos G. An ambulatory surgical procedure under local anesthesia for treatment of female urinary incontinence. *Int Urogynecol J Pelvic Floor Dysfunct*. 1996;7:81-5.
- Delorme E. Transobturator urethral suspension: Mini-invasive procedure in the treatment of stress urinary incontinence in women. *Prog Urol*. 2001;11:1306-13.
- De Leval J. Novel surgical technique for the treatment of female stress urinary incontinence: Transobturator vaginal tape inside-out. *Eur Urol*. 2003;44:724-30.
- Silva WA. Treatment of stress urinary incontinence with transobturator sling: Surgical technique and results. *Int Braz J Urol*. 2004;30:207-16.
- Latthe PM, Singh P, Foon R, Tooze-Hobson P. Two routes of transobturator tape procedures in stress urinary incontinence: a meta-analysis with direct and indirect comparison of randomized trials. *BJU Int*. 2010;106:68-76.
- Serati M, Ghezzi F, Cattoni E, Braga A, Torella M, Salvatore S, et al. Tension-free vaginal tape-obturator for treatment of pure urodynamic stress urinary incontinence: Efficacy and adverse effects at 10-year follow-up. *Eur Urol*. 2017;71:437-44.
- Abdel-Fattah M, Ramsay I, Pringle S. Lower urinary tract injuries after transobturator tape insertion by different routes: a large retrospective study. *BJOG*. 2006;113:1377-81.
- Huang WC, Yang JM. Effect of transobturator suburethral tape procedure on voiding function: one-year follow-up study. *J Urol*. 2003;170:2327-30.
- Liapis A, Bakas P, Creatsas G. Efficacy of inside-out transobturator vaginal tape (TVT-O) at 3 years follow-up. *Eur J Obstet Gynecol Reprod Biol*. 2008;136:87-90.
- Richter HE, Albo ME, Zyczynski HM, Kenton K, Norton PA, Sirls LT, et al. Retropubic versus transobturator midurethral slings for stress incontinence. *N Engl J Med*. 2010;362:2066-76.
- Long CY, Hsu CS, Wu MP, Liu CM, Wang CL, Tsai EM. Comparison of tension-free vaginal tape and transobturator tape procedure for the treatment of stress urinary incontinence. *Curr Opin Obstet Gynecol*. 2009;21:342-7.
- Schimpf MO, Rahn DD, Wheeler TL, Patel M, White AB, Orejuela FJ, et al. Sling surgery for stress urinary incontinence in women: a systematic review and meta-analysis. *Am J Obstet Gynecol*. 2014;211:71.e1-27.
- Sung VW, Schleinitz MD, Rardin CR, Ward RM, Myers DL, Clarke AE, et al. Comparison of retropubic vs transobturator approach to midurethral slings: a

systematic review and meta-analysis. *Am J Obstet Gynecol.* 2007;197:3-11.

20. Ford AA, Rogerson L, Cody JD, Aluko P, Ogah J. Mid-urethral sling operations for stress urinary incontinence in women. *Cochrane Database Syst Rev.* 2017;7:CD006375.

Cite this article as: Kanakaraya J, Kanakaraya S, Kanakaraya N, Kanakaraya N. Prospective observational study of inside-out versus outside-in transobturator tapes for female stress urinary incontinence at a tertiary care hospital of South Western railway. *Int J Reprod Contracept Obstet Gynecol* 2025;14:3840-5.