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DISCOVERY
SCIENTIFIC SOCIETY

Comparison of intraoperative and postoperative complications in the treatment of stress urinary incontinence after TVT and TOT procedures a literature review

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ABSTRACT

Introduction and purpose: Stress urinary incontinence can negatively impact quality of life, leading to decreased self-esteem, difficulties in intimate relationships, and increased social distance. Over the years, various treatment strategies for SUI have been implemented and improved, including multiple devices, medications, and surgeries (TVT, TOT). SUI is a symptom complex that causes leakage of urine, often without a clear etiology. The objective of this study is to evaluate and compare the perioperative and postoperative side effects of stress urinary incontinence treatment using two methods, TVT and TOT.

Keywords: TOT; TVT; SUI; stress urinary incontinence; complications; Transobturator Tape Technique; Tension-Free Vaginal Tape Technique

1. INTRODUCTION

In contemporary society, where the populace is aging at a rapid pace, an increasingly prevalent condition is stress urinary incontinence. This affliction has the potential to significantly diminish one's quality of life, leading to a decrease in self-esteem, difficulties in intimate relationships, and an increase in social isolation. As such, it is crucial to address this issue with utmost seriousness to ensure that those impacted by it can lead fulfilling lives (Lukacz et al., 2017; Wood and Anger, 2014; Luber, 2004). It is considered that the prevalence of women suffering from Stress Urinary Incontinence (SUI) in the age range of 15 to 64 years is estimated to be between 10% and 55% (Liedl, 2004). Uncontrolled

leakage of urine can occur during situations of increased intra-abdominal pressure, such as physical exertion, coughing, laughing, or lifting heavy objects (Abrams et al., 2003; Minassian et al., 2003).

The etiology of these changes is attributed to the degeneration of certain collagen fibers that constitute the stabilizing apparatus of the urogenital system, excessive mobility of the urethra, or dysfunction of the external urethral sphincter. Factors contributing to these changes in women include natural childbirth, instrumental deliveries, or vacuum extraction, which may weaken the pelvic floor muscles (Yang et al., 2022). Obesity, chronic diseases associated with persistent cough (such as smoking and lung diseases), connective tissue disorders, as well as years of high-level sports activities, can all have an impact on an individual's health. Age and previous surgeries in the pelvic floor area also affect stress urinary incontinence (Arrue et al., 2021). According to some sources, this issue affects white women more frequently (Thom et al., 2006; Townsend et al., 2010).

International standardized questionnaires such as the King's Health Questionnaire (KHQ) and the International Consultation on Incontinence Modular Questionnaire (ICIQ-SF) are used for diagnosis and assessment of changes and progression (Kieres et al., 2021). This disorder requires a multifaceted approach for effective treatment. Fortunately, behavioral therapy, medication, and surgery provide a comprehensive toolkit for clinicians to leverage in managing the condition. These interventions have proven efficacy and are widely utilized in clinical practice. The choice of approach depends primarily on the advancement of the disease. Stamey classification helps in selecting the most accurate choice (Table 1). Ryu et al., (2014), Ulmsten et al., (1996) introduced the TVT tape procedure in 1996 as a less invasive alternative to the Burch colposuspension method. The success rate of the operations ranged from 86% to 88% (Novara et al., 2007; Ogah et al., 2009). The surgeons developed the TOT procedure to reduce the risk of injury to the bladder and intestines.

Table 1 Degrees of urinary incontinence (Dannecker et al., 2010)

Stamey classification			
0	I	II	III
Absent	Occurs during coughing, sneezing, laughter	Walking, sitting, standing up	Total urinary incontinence, unrelated to physical activity

Transobturator Tape Technique (TOT)

The transobturator tape (TOT) technique involves inserting a synthetic tape to support the urethra for treating urinary incontinence. The basic steps in the TOT technique include:

- Preparation for the procedure: Doctors usually administer general or local anesthesia to the patient.
- Then insert a Foley catheter and make an approximately 2 cm midline incision in the vaginal vestibule, along with the palpation assessment of bony structures. Making small bilateral incisions in the vaginal area, approximately 1 cm above the clitoris and 2 cm lateral to it toward the pudendal cleft.
- The synthetic tape is gently guided through the incision in a transobturator manner, passing through the upper branch of the pubic bone until encountering the first resistance, which is the obturator membrane, further through the pelvic fascia to the pre-prepared part of the vagina.
- End of the procedure: After placing the tape and removing the protective sleeves, the incisions are usually closed with stitches or clips.
- The TOT technique supports the urinary system structures while minimizing the risk of damaging surrounding tissues. Post-surgery, patients may experience some discomfort or soreness at the incision sites, and a recovery period may be recommended, including avoiding heavy exercises and lifting weights (Onuk, 2019).

Tension-Free Vaginal Tape Technique (TVT)

- Preparation for the procedure: Doctors usually administer general or local anesthesia to the patient.
- Then make two incisions approximately 4 cm above the pubic symphysis and 2.5 cm lateral to the midline, followed by an approximately 3 cm incision in the vaginal vestibule at least 1 cm away from the urethral meatus in the midline.
- The surgeon inserts a catheter into the urethra and directs it in the opposite direction of the intended puncture to reduce the risk of iatrogenic bladder damage. Then, introduce the needle with the trocar through the pre-prepared part of the vaginal wall towards the earlier incisions in the suprapubic area. Cystoscopy should be performed to assess whether the continuity of the bladder wall has been violated during the procedure. Perform a similar procedure on the other side.

Placement of the tape: Place the tape in a manner that supports the urethra. It passes more centrally under the urethra compared to TOT (Zubke et al., 2004; Martan et al., 2007).

Aim of the study

The study aims to compare the perioperative and postoperative side effects of the treatment of stress urinary incontinence using TVT and TOT methods (inside-out, outside-in).

2. MATERIALS AND METHODS

To provide a comprehensive review of the subject matter, we meticulously examined numerous papers and ranked them based on their relevance and the level of evidence they presented. We utilized the PubMed, Cochrane Library, Elsevier, and Google Scholar databases, which employ current and up-to-date treatment protocols for SUI. When searching for articles, we used the following terms: TOT; TVT; stress urinary incontinence; complications. The inclusion criteria consisted of abstracts and full-text formats, comprising clinical trials and review articles written in English. The studies were meticulously examined and involved due to applicability to the subject of this review. The selected papers were categorized according to the grade of evidence. Our search using the specified keywords yielded 78 abstracts and full texts, which we scrutinized to eliminate duplicates and any irrelevant works. After careful analysis, we selected 7 articles that offered the most insightful perspectives on complications arising from TOT and TVT procedures (Figure 1).

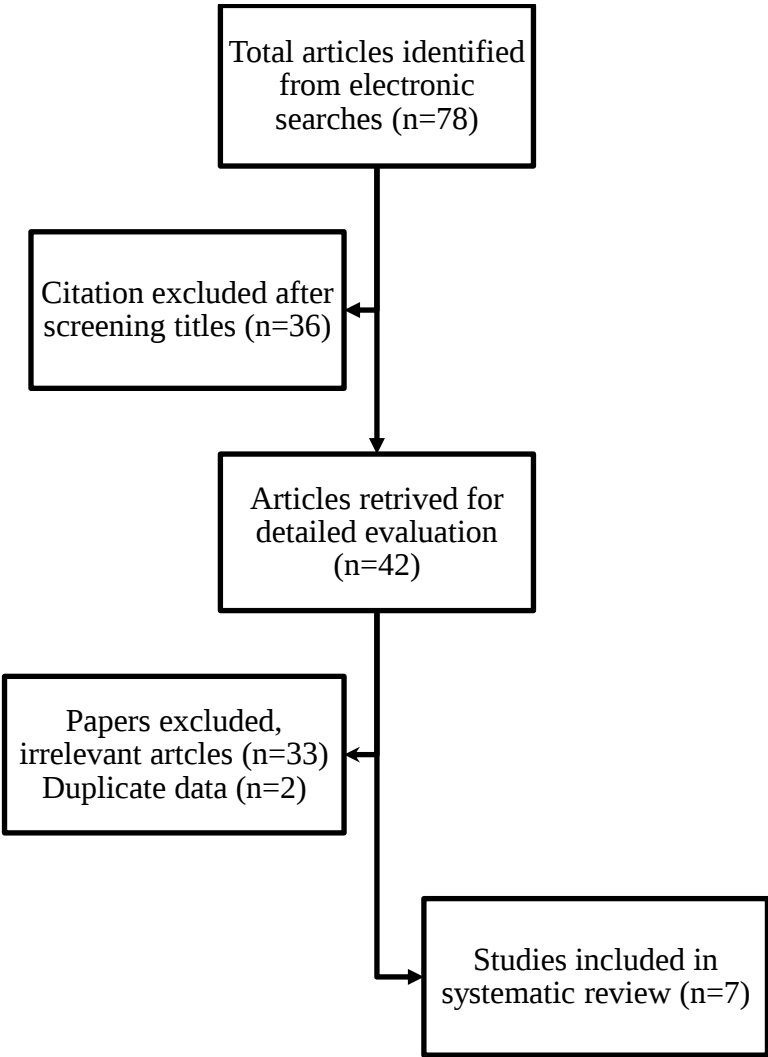


Figure 1 Study selection process for systematic review of TOT and TVT complications.

3. RESULTS AND DISCUSSION

The most common complications during or after TOT and TVT tape implantation surgery include damage to the bladder wall, including perforation, urinary retention, urinary incontinence, hematomas, urinary tract infections, and dyspareunia (Boustead, 2002; Elisabetta et al., 2007). In a review conducted in 2017, encompassing 28 randomized controlled clinical trials (RCTs) and comparing 15,855 patients, the side effects of TOT and TVT treatments were among those assessed. The risk of intraoperative bladder injury or vaginal wall perforation (4.8% vs. 1.6%, respectively; OR 2.4; 95% CI 1.51–3.90; $p = 0.0002$), pelvic hematoma (1.7% vs. 0.3%, respectively; OR 2.61; 95% CI 1.41–4.82; $p = 0.002$), urinary tract infections (10% vs. 7.9%, respectively; OR 1.31; 95% CI 1.02–2.68; $p = 0.04$), and lower urinary tract symptoms (LUTS) during the voiding phase (9.2% vs. 5.7%, respectively; OR 1.66; 95% CI 1.2–2.3; $p = 0.002$) were significantly higher with TVT. Concerning vaginal erosion as a complication, an increased risk was observed following TOT surgery, especially in the outside-to-in technique (1.8% vs. 2.8%, respectively; OR 0.64; 95% CI 0.44–0.92; $p = 0.002$).

However, we didn't notice significant differences regarding the storage phase of LUTS and potential reoperations (Fusco et al., 2017). The Cochrane Library study, conducted by a team of scientists, found that there was no significant difference in the frequency of perioperative complications between the TOT and TVT groups in trials reporting overall rates of such complications. Although no significant differences were found in the overall analysis, when examining individual complications, statistically significant disparities were observed. Serious vascular injuries, such as obturator hematomas, or damage to internal organs, such as intestinal perforation, were reported in 28 trials involving 4676 women, with TOT occurring much less frequently (RR 0.33, 95% CI 0.19 to 0.55). Upon analyzing the incidence of bladder wall perforation or urethral damage, the TOT group exhibited significantly lower complication rates. (RR 0.13, 95% CI 0.08 to 0.20).

Researchers evaluated postoperative voiding dysfunction (POVD) rates in 37 trials involving 6200 participants. These results showed significantly lower rates in the TOT group (RR 0.53, 95% CI 0.43 to 0.65). In the case of de novo postoperative urinary incontinence, no statistically significant difference was found in 31 studies (4923 patients) (RR 0.98, 95% CI 0.82 to 1.17). Researchers obtained a similar result when analyzing vaginal erosions, which may result from improper vaginal wall suturing, extensive incisions, infections, or tape twisting (RR 1.13, 95% CI 0.78 to 1.65). The last complication, significantly impacting the assessment of quality of life (QoL), was postoperative pain (groin area), which was more common in women after TOT surgery (RR 4.12, 95% CI 2.71 to 6.27). After TOT surgery, patients experienced less suprapubic pain compared to those who underwent TVT surgery (RR 0.29, 95% CI 0.11 to 0.78). Typically, these symptoms resolve within six months of the procedure (Ford et al., 2015).

Based on one of the studies published in The New England Journal of Medicine, investigators proved in 597 female patients, among whom 298 were qualified for TVT surgery, that 15 of them experienced iatrogenic perforation of the urinary bladder. Additionally, there was a statistically significant increase in the risk ($P=0.02$) of post-micturition urine retention (100 ml or more), urinary tract infections ($P=0.04$) and serious adverse event ($P=0.003$). The frequency of neurological disorders, including the most common postoperative weakness in the lower limbs, was also higher in individuals who underwent TOT ($P=0.01$) (Richter et al., 2010). The research conducted by a group of scientists from the University Hospital in Ulm on a group of 873 patients (306 TVT/567 TOT) included patients requiring surgical treatment who did not achieve satisfactory results after conservative treatment. The group of individuals qualified for the TOT procedure was characterized by a statistically higher percentage of older individuals ($p<0.001$), with increased BMI ($p<0.001$) and elevated ASA score ($p<0.001$).

Intraoperative complications occurred in 3% of patients, mainly after the TVT procedure ($p=0.009$), and included bladder injuries (TVT 2.6%, TOT 0.2%) ($p=0.001$). There were no significant differences in cases of blood loss exceeding 50 ml and anesthesia-related adverse events. Postoperative complications occurred in 19.4% of individuals. The most common complication was post-void residual volume, affecting 13.3% of patients but without statistical significance between the groups. Postoperative bleeding occurred in less than 1% of cases but was significantly more frequent among individuals after the TVT procedure (2.3% vs 0.2%; $p=0.002$). Lower urinary tract infections and postoperative pain occurred equally frequently in both groups of patients. Summing up researchers observed a significantly lower risk of complications after the TOT (Schütze et al., 2023).

The analysis of consecutive randomized controlled clinical trials confirmed that adverse events, such as bladder injuries (OR 0.12; 95% CI 0.05–0.33) and voiding difficulties (OR 0.55; 95% CI 0.31–0.98), were less common, while groin/thigh pain (OR 8.28; 95% CI 2.7–25.4), vaginal injuries, or mesh erosion (OR 1.96; 95% CI 0.87–4.39) were more common after tape insertion via the TOT route (Latthe et al., 2007). In a review comparing 28 articles from 2004 to 2015 related to SUI (Stress Urinary Incontinence) and involving 2,505 patients

treated with the TVT method and 2,477 with the TOT method, only 11 studies considered complications associated with the aforementioned therapeutic methods. Combined studies showed a lower probability of side effects after TOT treatment than TVT, albeit without statistical significance (RR, 0.86; 95% CI: 0.64–1.16). Considering blood loss during both types of surgeries, reduced blood loss was also observed with the TOT method, though without statistical significance compared to TVT (MD, -0.29; 95% CI: -0.71 to 0.14) (Huang et al., 2018).

Doctors from Mackay Memorial Hospital demonstrated in a retrospective study involving 87 patients that there were no statistically significant differences in perioperative complications, including damage to the bladder, urethra, and intestines, as well as major intraoperative sutures. They noticed the prolonged catheterization time (>7 days) in patients after TVT surgery, but the results were on the borderline of statistical significance (9% vs. 0%, $p = 0.051$) (Lin et al., 2018). Based on the analyzed studies, surgical treatment with the TOT method carries a lower risk of perioperative complications, possibly linked to shorter hospitalization and improved QoL — the results and analysis of the research we presented in (Figure 2).

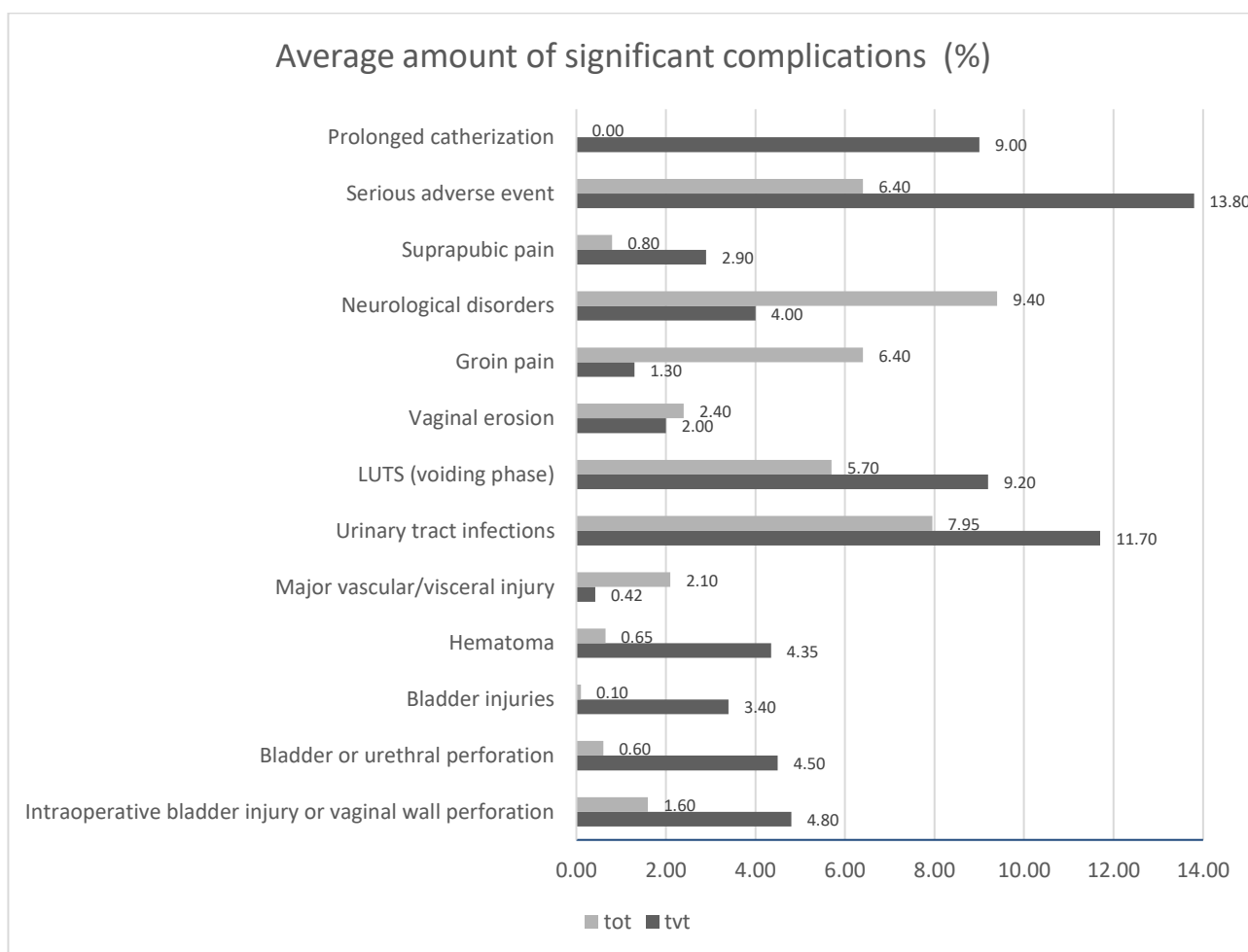


Figure 2 Average amount of significant complications (%)

4. CONCLUSION

Based on the analysis of selected studies conducted over the past decade, disparities in intra- and postoperative complications were observed. With the increasing number of individuals grappling with the issue of stress urinary incontinence, literature is witnessing a growing number of analyses that differentiate the frequency of complications following TOT and TVT treatments. Due to variations in method and the potential risk of damaging adjacent structures, it is crucial to select the appropriate technique for each patient, which, in turn, affecting their Quality of Life (QoL). The majority of adverse events are associated with bladder wall damage, hematomas,

potential bleeding exceeding >200 ml, urinary tract infections, transient urinary retention, vaginal wall erosion, or the occurrence of de novo urgency.

Author's Contribution

Michał Obrębski: Conceptualization, writing - rough preparation, writing - review and editing

Maria Rybicka: Conceptualization, methodology

Anna Seroka: Resources, writing - rough preparation

Aleksander Górny: Visualization, investigation

Justyna Chwiejczak: Methodology, data curation

Karolina Szczerkowska: Resources, investigation

Jakub Langa: Formal analysis, data curation

Maria Mitkowska: Visualization, formal analysis

Anna Wójcik: Resources, supervision

Julita Młynarska: Investigation, methodology

Jan Kościan: Supervision, Conceptualization

Łukasz Ciulkiewicz: Investigation, methodology

Informed consent

Not applicable.

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Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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