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ORIGINAL ARTICLE
ORİJİNAL ARAŞTIRMA

Spinal Versus General Versus Sedation-Assisted Anesthesia for Transobturator Tape Surgery: A Retrospective Cohort Study

Transobturator Tape Cerrahisinde Spinal, Genel ve Sedasyon Destekli Anestezinin Karşılaştırılması: Retrospektif Bir Kohort Çalışması

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ABSTRACT

Aim: To compare perioperative efficiency, anesthesia-related events, recovery, and 30-day outcomes among spinal, general, and sedation-assisted anesthesia for transobturator tape (TOT) surgery.

Material and Method: Single-center retrospective cohort of women undergoing TOT for stress urinary incontinence between 2010 and 2023, grouped as spinal (n=165), general (n=54), or sedation-assisted anesthesia (n=21).

Results: Anesthesia-to-incision time was shortest with sedation (9.4±3.9 min) versus spinal (12.6±4.8) and general anesthesia (14.8±5.2) (p<0.001); total operating-room time was also shortest (43.9 vs 48.7 vs 52.3 min; p=0.01). Hypotension was highest with spinal anesthesia (19.4% vs 9.3% vs 9.5%; p=0.048), whereas postoperative nausea/vomiting was highest with general anesthesia (18.5% vs 6.7% vs 4.8%; p=0.004). PACU stay was shortest with sedation (45 [35–60] min) versus general (60 [45–80]) and spinal anesthesia (75 [55–95]) (p<0.001); early pain/opioid need was higher with general anesthesia. Thirty-day success rates were comparable (90.9% vs 88.9% vs 95.2%; p=0.58), but acute urinary retention/prolonged catheterization was more frequent with spinal anesthesia (10.3% vs 3.7% vs 4.8%; p=0.048).

Conclusion: Sedation-assisted anesthesia improved perioperative efficiency and early recovery, general anesthesia was associated with more postoperative nausea/vomiting and early pain/opioid need, and spinal anesthesia with more hypotension and early voiding dysfunction, with similar 30-day success.

Keywords: Transobturator tape, stress urinary incontinence, anesthesia, spinal anesthesia, general anesthesia, sedation-assisted anesthesia

ÖZ

Amaç: Transobturator tape (TOT) cerrahisinde spinal, genel ve sedasyon destekli anestezi yöntemlerini perioperatif verimlilik, anesteziye bağlı olaylar, erken toparlanma ve 30 günlük sonuçlar açısından karşılaştırmaktır.

Gereç ve Yöntem: 2010–2023 yılları arasında stres üriner inkontinans nedeniyle TOT uygulanan kadınlarda tek merkezli retrospektif kohort çalışma yapıldı. Hastalar spinal (n=165), genel (n=54) ve sedasyon destekli anestezi (n=21) olarak gruplandı.

Bulgular: Anesteziden insizyona kadar geçen süre sedasyon grubunda 9,4±3,9 dk ile spinal (12,6±4,8) ve genel anesteziye (14,8±5,2) göre anlamlı olarak daha düşüktü (p<0,001); toplam ameliyathane süresi de sedasyon grubunda en kısaydı (43,9 vs 48,7 vs 52,3 dk; p=0,01). Hipotansiyon spinal anestezide daha sık görüldü (%19,4 vs %9,3 vs %9,5; p=0,048), postoperatif bulantı-kusma ise genel anestezide daha yüksekti (%18,5 vs %6,7 vs %4,8; p=0,004). PACU kalış süresi sedasyon grubunda en kısaydı (45 [35–60] dk) ve genel (60 [45–80]) ile spinal anesteziye (75 [55–95]) göre daha düşüktü (p<0,001); erken ağrı/ek opioid gereksinimi genel anestezide daha fazlaydı. Otuz günlük başarı oranları benzerdi (%90,9 vs %88,9 vs %95,2; p=0,58); ancak akut üriner retansiyon/uzamış kateterizasyon spinal anestezide daha sık görüldü (%10,3 vs %3,7 vs %4,8; p=0,048).

Sonuç: Sedasyon destekli anestezi perioperatif verimlilik ve erken toparlanmayı iyileştirirken, genel anestezi daha fazla PONV ve erken ağrı/opioid gereksinimiyle; spinal anestezi ise daha sık hipotansiyon ve erken işeme disfonksiyonuyla ilişkiliydi. Otuz günlük başarı benzerdi.

Anahtar Kelimeler: Transobturator tape, stres üriner inkontinans, anestezi, spinal anestezi, genel anestezi, sedasyon destekli anestezi

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INTRODUCTION

Stress urinary incontinence (SUI) is a highly prevalent condition that can substantially impair quality of life and daily functioning, and it represents a major indication for surgical treatment in appropriately selected women. Contemporary evidence-based recommendations identify synthetic mid-urethral sling (MUS) procedures as a cornerstone surgical option because of their minimally invasive nature and favorable effectiveness profile (1,2). Among MUS techniques, the transobturator approach has been widely adopted, with randomized trial data supporting comparable short-term objective success to retropubic slings while demonstrating a distinct complication profile that should be considered during shared decision-making (3).

Transobturator tape (TOT) surgery is commonly performed in an outpatient/short-stay setting, making perioperative efficiency and early recovery outcomes clinically important alongside continence success. The choice of anesthetic technique may influence hemodynamic stability, postoperative nausea and vomiting, pain control, time in the operating room and recovery unit, and critically for sling procedures early voiding function. Prior observational data suggest that regional anesthesia can be associated with higher odds of acute postoperative urinary retention after outpatient midurethral sling procedures (4). In parallel, comparative studies in midurethral sling surgery indicate that monitored anesthesia care (MAC)/sedation may reduce operating room and recovery times relative to general anesthesia, with potential benefits in immediate postoperative voiding outcomes and resource utilization (5).

Despite the routine use of spinal, general, and sedation-assisted techniques in TOT practice, direct comparative evidence focusing on perioperative workflow metrics and early clinical outcomes across these three anesthetic strategies remains limited. Clarifying these differences is relevant for optimizing patient-centered care (comfort, adverse events, and early voiding) while also improving operating room throughput and recovery efficiency. Therefore, in this retrospective cohort study, we compared intraoperative timing parameters, perioperative anesthetic events, postoperative recovery outcomes, and short-term (30-day) surgical results among women undergoing TOT surgery under spinal anesthesia, general anesthesia, or sedation-assisted anesthesia.

MATERIAL AND METHOD

This study was approved by the Dokuz Eylul University Non-Interventional Research Ethics Committee (Date: 04.10.2023, Decision No: 2023/31-04). The study was conducted in accordance with the principles of the Declaration of Helsinki. Due to the retrospective nature of the study, informed consent was waived by the ethics committee.

Study Design and Setting

This retrospective cohort study was conducted at the Department of Obstetrics and Gynecology, Dokuz Eylul University Faculty of Medicine Hospital, a tertiary referral center. Medical records of women who underwent transobturator tape (TOT) surgery for stress urinary incontinence between January 2010 and December 2023 were retrospectively reviewed. The study was designed and reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

Study Population

A total of 240 consecutive patients who underwent TOT surgery during the study period were included in the analysis. Patients were grouped according to the anesthetic technique used: spinal anesthesia (n=165), general anesthesia (n=54), and sedation-assisted anesthesia (n=21). Patients with incomplete medical records, concomitant major pelvic reconstructive surgery, known neurogenic bladder disorders, or previous anti-incontinence surgery were excluded from the study. The choice of anesthetic technique was determined by anesthesiologist preference, patient characteristics, and perioperative risk assessment.

Data Collection and Outcome Measures

Demographic variables (age, body mass index, parity, American Society of Anesthesiologists [ASA] physical status), clinical characteristics, and perioperative data were extracted from electronic hospital records. Operative parameters included surgical duration, anesthesia-to-incision time, total operating room time, and estimated blood loss. Perioperative outcomes comprised intraoperative hemodynamic events (hypotension, bradycardia), vasopressor requirement, and anesthesia-related complications. Postoperative outcomes included pain scores assessed using the visual analog scale (VAS), postoperative nausea and vomiting, urinary retention requiring prolonged catheterization, length of post-anesthesia care unit stay, and same-day discharge rates. Short-term surgical success and complications within 30 days postoperatively were also recorded.

Outcome Definitions

Surgical success was defined at the 1-month postoperative follow-up as absence of stress urinary incontinence symptoms documented in the medical record and/or a negative cough stress test, with no requirement for additional anti-incontinence

treatment (e.g., repeat sling surgery, bulking agents, or initiation of new continence procedures). Surgical failure was defined as persistent or recurrent stress leakage reported at the 1-month visit, a positive cough stress test, or need for further treatment.

Acute urinary retention (AUR)/prolonged catheterization was defined as inability to void within 6 hours after removal of the urethral catheter and/or a post-void residual (PVR) ≥300 mL measured by bladder scan or catheterization, resulting in re-catheterization and/or continuation of catheterization beyond postoperative 24 hours. Patients discharged with an indwelling catheter or instructed to perform intermittent catheterization due to voiding dysfunction were recorded under this outcome.

Anesthetic Techniques

Spinal anesthesia was performed using intrathecal local anesthetics at the discretion of the attending anesthesiologist. General anesthesia was induced and maintained with standard intravenous and inhalational agents according to institutional protocols. Sedation-assisted anesthesia was administered using monitored anesthesia care with intravenous sedative agents while preserving spontaneous respiration. All surgical procedures were performed using a standardized transobturator tape technique by experienced surgeons.

Statistical Analysis

Statistical analysis was performed using IBM SPSS Statistics software (version 25.1; IBM Corp., Armonk, NY, USA). Continuous variables were assessed for normality using the Kolmogorov–Smirnov test. Normally distributed variables were expressed as mean ± standard deviation and compared using one-way analysis of variance (ANOVA). Non-normally distributed variables were presented as median and interquartile range (IQR) and compared using the Kruskal–Wallis test. Categorical variables were expressed as numbers and percentages and compared using the chi-square test or Fisher's exact test, as appropriate. Post-hoc analyses with Bonferroni correction were applied for multiple comparisons. A two-sided p value of <0.05 was considered statistically significant.

RESULTS

A total of 240 patients were included in the study (spinal n=165, general anesthesia n=54, sedation n=21). There were no statistically significant differences among the groups regarding age, BMI, ASA class, parity, history of previous pelvic surgery, and preoperative hemoglobin levels (**Table 1**).

Table 1. Baseline Characteristics

Variable	Spinal (n=165)	General (n=54)	Sedation (n=21)	p value
Age (years), mean±SD	53.1±8.6	52.4±9.1	51.8±8.9	0.73
BMI (kg/m^2), mean±SD	28.4±4.7	29.1±5.1	27.9±4.6	0.41
ASA I–II, n (%)	147 (89.1)	46 (85.2)	20 (95.2)	0.39
Parity, median (IQR)	2 (1–3)	2 (1–3)	2 (1–3)	0.88
Previous Pelvic Surgery, n (%)	28 (17.0)	10 (18.5)	3 (14.3)	0.87
Preop Hb (g/dL), mean±SD	12.4±1.2	12.3±1.1	12.5±1.1	0.62

Data are presented as mean±standard deviation (SD), median (interquartile range, IQR) or n (%). Continuous variables were compared using one-way ANOVA or Kruskal–Wallis test based on distribution; categorical variables were compared using chi-square or Fisher's exact test, as appropriate. p<0.05 was considered significant. ASA: American Society of Anesthesiologists; BMI: body mass index; Hb: hemoglobin; IQR: interquartile range.

Regarding intraoperative parameters, groups were similar in terms of surgical duration (p=0.42). In contrast, the anesthesia-to-incision time differed significantly among groups, being shorter in the sedation group and longer in the general anesthesia group (p<0.001). Total operating room (OR) time also differed among groups (p=0.01). Although estimated blood loss tended to be lower in the sedation group, it did not reach statistical significance (p=0.08) (**Table 2**).

Table 2. Intraoperative Durations and Key Operative Parameters

Variable	Spinal (n=165)	General (n=54)	Sedation (n=21)	p value
Surgical Duration (min), mean±SD	20.8±6.9	21.4±7.2	19.6±6.1	0.42
Anesthesia-to-Incision Time (min), mean±SD	12.6±4.8	14.8±5.2	9.4±3.9	<0.001
Total OR Time (min), mean±SD	48.7±12.4	52.3±13.1	43.9±11.2	0.01
Concurrent Minor Procedure*, n (%)	22 (13.3)	8 (14.8)	2 (9.5)	0.82
Estimated Blood Loss (mL), median (IQR)	50 (30–80)	60 (40–90)	40 (25–70)	0.08

*Data are presented as mean±SD, median (IQR) or n (%); comparisons were made using the tests specified in Table 1. OR: operating room; IQR: interquartile range. Concurrent minor procedure: additional minor surgical intervention performed during the same session.

For perioperative hemodynamic and anesthesia-related events, intraoperative hypotension was observed more frequently in the spinal anesthesia group (p=0.048). Postoperative nausea and vomiting (PONV) was significantly higher in the general anesthesia group (p=0.004). Anesthesia conversion occurred in 1.2% of the spinal group and 9.5% of the sedation group (p=0.006) (**Table 3**).

Table 3. Perioperative Hemodynamic Events and Anesthesia-related Complications

Event	Spinal (n=165)	General (n=54)	Sedation (n=21)	p value
Intraop Hypotension, n (%)	32 (19.4)	5 (9.3)	2 (9.5)	0.048
Vasopressor Requirement, n (%)	18 (10.9)	3 (5.6)	1 (4.8)	0.18
Bradycardia, n (%)	9 (5.5)	1 (1.9)	0 (0.0)	0.31
Postop PONV, n (%)	11 (6.7)	10 (18.5)	1 (4.8)	0.004
Anesthesia Conversion**, n (%)	2 (1.2)	—	2 (9.5)	0.006

Categorical variables were compared using chi-square or Fisher's exact test, as appropriate. PONV: postoperative nausea and vomiting. *Anesthesia conversion: conversion from sedation to general anesthesia and/or need for additional anesthetic intervention/conversion in spinal anesthesia (not applicable in the general anesthesia group).

In early postoperative recovery, PACU stay was shorter (p<0.001) and length of hospital stay was less (p=0.02) in the sedation group. The 2-hour VAS pain score was higher in the general anesthesia group (p=0.01), and the need for additional opioids was also more frequent in this group (p=0.006). Same-day discharge rates were similar among groups (p=0.29) (**Table 4**).

Table 4. Early Postoperative Recovery and Discharge

Variable	Spinal (n=165)	General (n=54)	Sedation (n=21)	p value
PACU Stay (min), median (IQR)	75 (55–95)	60 (45–80)	45 (35–60)	<0.001
2-hour VAS Pain (0–10), median (IQR)	2 (1–3)	3 (2–4)	2 (1–3)	0.01
Additional Opioid Need, n (%)	14 (8.5)	11 (20.4)	1 (4.8)	0.006
Same-Day Discharge, n (%)	142 (86.1)	45 (83.3)	20 (95.2)	0.29
Length of Stay (hours), median (IQR)	18 (12–24)	20 (14–26)	12 (8–18)	0.02

Continuous variables were assessed using Kruskal–Wallis or ANOVA based on distribution; categorical variables were assessed using chi-square/Fisher's exact test. PACU: post-anesthesia care unit; VAS: visual analog scale; IQR: interquartile range.

For 30-day surgical outcomes, success rates were similar among groups (p=0.58). Mesh erosion was rare and did not differ between groups. Acute urinary retention/catheter prolongation was observed more frequently in the spinal group (p=0.048). No significant difference was found in 30-day readmission/complication rates (p=0.39) (**Table 5**).

Table 5. Surgical Outcomes and Complications

Outcome	Spinal (n=165)	General (n=54)	Sedation (n=21)	p value
Success, n (%)	150 (90.9)	48 (88.9)	20 (95.2)	0.58
Mesh Erosion (≤30 days), n (%)	1 (0.6)	0 (0.0)	0 (0.0)	1.00
De novo Urgency, n (%)	10 (6.1)	3 (5.6)	1 (4.8)	0.96
AUR/Catheter Prolongation, n (%)	17 (10.3)	2 (3.7)	1 (4.8)	0.048
30-day Readmission/ Complication, n (%)	9 (5.5)	4 (7.4)	0 (0.0)	0.39

Categorical outcomes were compared using chi-square or Fisher's exact test, as appropriate. AUR: acute urinary retention.

DISCUSSION

In this single-center retrospective cohort of 240 women undergoing transobturator tape (TOT) surgery, perioperative efficiency and anesthesia-related morbidity differed by anesthetic technique, whereas short-term surgical effectiveness was comparable among groups. Sedation-assisted anesthesia was associated with shorter anesthesia-to-incision time and shorter overall operating-room (OR) time, accompanied by faster early recovery (shorter PACU stay and shorter length of stay). In contrast, spinal anesthesia was linked to more frequent intraoperative hypotension and a higher rate of acute urinary retention/prolonged catheterization, while general anesthesia was associated with higher postoperative nausea and vomiting (PONV) and greater early postoperative pain/opioid requirements. Importantly, 30-day success rates and overall complication/readmission rates did not differ significantly among spinal, general, and sedation-assisted anesthesia groups.

The finding that surgical duration was similar while anesthesia-to-incision and total OR time differed suggests that the main "time savings" likely occurs during induction, positioning/airway management, and immediate emergence rather than during the TOT steps themselves. This pattern is consistent with perioperative literature in midurethral sling surgery showing that monitored anesthesia care (MAC) or less invasive anesthetic strategies can improve OR throughput and recovery-unit utilization without compromising short-term outcomes. In a cohort of women undergoing retropubic midurethral sling placement, Davé et al. reported shorter OR and recovery times with MAC compared with general anesthesia, alongside less immediate voiding dysfunction (5).

Day-case feasibility of TOT is well established; however, unplanned admission may occur due to recovery issues such as pain, PONV, or voiding delay. In a case-control experience of TOT performed as a day-surgery procedure, Sivanesan et al. reported that most patients could be discharged on the day of surgery, while admission was typically driven by postoperative recovery concerns rather than surgical injury (6). In the present cohort, same-day discharge rates were high and similar among groups, suggesting that institutional discharge pathways and patient selection may have attenuated differences that otherwise favor sedation-assisted techniques.

The higher intraoperative hypotension rate observed with spinal anesthesia aligns with the expected physiology of neuraxial blockade (sympathetic blockade leading to reduced systemic vascular resistance and venous return). Contemporary reviews emphasize that spinal anesthesia–induced hypotension remains common in adults and can be mitigated by individualized fluid and vasopressor strategies, careful dosing, and close hemodynamic monitoring—particularly in older or comorbid patients (7). In ambulatory practice, spinal anesthesia can still be advantageous, but optimizing hemodynamic management is central to preserving fast-track recovery and avoiding downstream delays in discharge (8). These data support counseling that spinal anesthesia may trade early analgesic benefits for a higher hypotension risk requiring proactive intraoperative management.

The higher PONV rate in the general anesthesia group is clinically relevant because PONV is a leading cause of patient dissatisfaction and delayed discharge after ambulatory surgery. The Fourth Consensus Guidelines for PONV management identify general anesthesia (especially volatile anesthetics and perioperative opioids) as key contributors and recommend multimodal prophylaxis tailored to baseline risk (8). This also fits the day-surgery TOT experience in which PONV can prompt prolonged observation or unplanned admission even when surgical morbidity is low (6).

Early postoperative pain and opioid use were also higher with general anesthesia in the present cohort. A plausible explanation is that spinal anesthesia provides residual neuraxial analgesia during the immediate postoperative window, while sedation-assisted approaches may facilitate titrated analgesia with preserved spontaneous ventilation and local infiltration, potentially reducing early opioid exposure. Similar recovery advantages with MAC-based approaches have been reported in midurethral sling surgery (5).

A key finding is the higher acute urinary retention (AUR)/prolonged catheterization rate with spinal anesthesia. Prior evidence supports an association between neuraxial techniques and transient postoperative voiding dysfunction. In a retrospective cohort of women undergoing outpatient midurethral sling procedures, Wohlrab et al. found that regional anesthesia was associated with substantially higher odds of acute postoperative urinary retention compared with nonregional anesthesia (which included general anesthesia, MAC with sedation, and local approaches) (4). In addition, voiding dysfunction after TOT is multifactorial, reflecting anesthetic effects on detrusor function, perioperative fluids, pain, and urethral outlet resistance from the sling. Kim et al. reported that while prolonged retention (e.g., catheterization >1 day) was uncommon, voiding difficulty occurred more frequently, supporting that mild transient dysfunction is expected after TOT even when true retention is infrequent (9). Notably, an earlier Korean experience comparing anesthesia approaches during TOT reported shorter postoperative catheterization duration under local anesthesia than under spinal anesthesia, suggesting that anesthetic choice can influence immediate voiding recovery independent of the sling itself (10). Collectively, these data strengthen the interpretation that spinal anesthesia may increase early voiding delay and catheter needs, emphasizing the importance of standardized voiding-trial protocols and anticipatory counseling when neuraxial anesthesia is used.

Comparable 30-day success rates across groups are consistent with the concept that anesthetic technique primarily affects perioperative recovery and early adverse events rather than the mechanical effectiveness of the sling. High-quality evidence supports midurethral sling surgery as an effective treatment for stress urinary incontinence, including transobturator approaches, with generally high short- to medium-term cure/improvement rates (2, 3). Contemporary professional guidance also continues to support the safety and effectiveness of full-length synthetic midurethral slings when patients are appropriately counseled and selected (1). In addition, a TOT-specific series has highlighted favorable outcomes while noting a learning-curve component for complications and success—an important contextual factor when interpreting single-center results (11). Because the present endpoint was limited to 1 month and relied on chart-documented symptoms/cough stress testing rather than validated patient-reported outcome measures, findings should be interpreted as early effectiveness rather than durable continence.

Mesh erosion was rare within 30 days, which is expected because many erosions present later; therefore, the absence of between-group differences should not be interpreted as long-term equivalence but rather as indicating no measurable anesthetic effect on very early mesh-related events within the available follow-up window.

The 9.5% conversion rate in the sedation-assisted group is clinically relevant. While sedation-assisted or local/MAC strategies can be feasible for sling procedures and may improve OR flow for many patients, inadequate analgesia, anxiety, or airway/ventilation concerns may necessitate escalation of anesthetic depth. This trade-off should be reflected in preoperative counseling and in operational planning, with immediate readiness to convert when needed.

CONCLUSION

Overall, these findings suggest that anesthesia choice for TOT meaningfully affects perioperative efficiency and early morbidity profiles without altering short-term surgical success. Sedation-assisted approaches may optimize OR throughput and early recovery in selected patients, general anesthesia may carry a higher PONV and early pain burden, and spinal anesthesia may increase hypotension and early voiding delay information that can support individualized shared decision-making and standardized fast-track pathways.

ETHICAL DECLARATIONS

Ethics Committee Approval: This study was approved by the Dokuz Eylul University Non-Interventional Research Ethics Committee (Date: 04.10.2023, Decision No: 2023/31-04).

Informed Consent: Informed consent was not required for this study.

Referee Evaluation Process: Externally peer-reviewed.

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