

Incidence And Associated Risk Factors Of Postoperative Urinary Retention After Spinal Anesthesia At Tertiary Care Hospital, Peshawar

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ABSTRACT

Postoperative urinary retention (POUR) is a common but often under-recognized complication following spinal anesthesia, particularly in lower limb and pelvic surgeries. This study aimed to determine the incidence of POUR and assess its association with spinal anesthetic drugs and other perioperative factors.

A descriptive cross-sectional study was conducted on 100 patients who underwent various surgical procedures under spinal anesthesia. Data were collected on patient demographics, medical history, type and duration of surgery, anesthetic agents used, and the occurrence, onset, symptoms, and management of POUR. Chi-square tests were used to assess the association between POUR and anesthetic drug type. The overall incidence of POUR was 6%. All cases occurred in patients who received Bupivacaine (6 out of 96), while none occurred in the Lidocaine group (0 out of 4). However, the association between the type of spinal anesthetic drug and POUR was not statistically significant ($p = 0.606$). All POUR cases began more than 24 hours postoperatively and presented with decreased urine flow, painful urination, or incomplete voiding. Intermittent catheterization was used in all cases, and urinary

retention persisted for more than 24 hours in each. No significant associations were found between POUR and patient age, gender or diabetes. The incidence of POUR in patients receiving spinal anesthesia was low but clinically relevant. Although all cases occurred with Bupivacaine, no significant association was found between the anesthetic drug and POUR. Vigilant postoperative monitoring and timely management are recommended, and further studies with larger, balanced samples are needed to better understand contributing factors.

Keywords: Postoperative urinary retention, spinal anesthesia, Bupivacaine, Lidocaine, catheterization, urinary symptoms, orthopedic surgery.

INTRODUCTION

Spinal anesthesia is a commonly used regional anesthetic method, especially for procedures concerning the lower belly, pelvis, and lower limbs. Its quick onset, efficient pain management, and fewer systemic side effects than general anesthetic account for its widespread use. However, spinal anesthesia has drawbacks just like any other medical procedure (Garg *et al.*, 2021). Postoperative urinary retention (POUR), which is defined as the inability to freely void urine while having a full bladder, is one of the most clinically important consequences. One of the most important postoperative concerns is postoperative urinary retention (POUR), a complex condition that can cause discomfort for patients, overdistension of the bladder, UTIs, and extended hospital stays (Geller, 2014).

In orthopedic procedures where spinal anesthesia is frequently used, including hip and knee replacements, the association between spinal anesthesia and postoperative urinary retention (POUR) is especially pertinent. Urinary retention may be made worse by the protracted immobility, severe postoperative pain, and narcotic use that are frequently associated with these procedures. Even with its clinical significance, little is known about the prevalence, risk factors, and consequences of postoperative urine retention (POUR) after spinal anesthesia, especially when it comes to orthopedic procedures (Lawrie *et al.*, 2017).

Postoperative urinary retention (POUR) is the term used to describe the insufficient bladder emptying brought on by either neurogenic or non-neurogenic reasons that leaves an increased residual pee volume six hours after anesthesia ends (Biardeau, 2024). One of the most often reported clinical issues in postoperative care

is postoperative urine retention (POUR), which can occur in 3 to 78% of patients throughout the surgical follow-up. This sickness is often overlooked among surgical consequences since temporary or intermittent catheterization, which is an outpatient treatment option, does not increase hospital resources in terms of costs and medication-related side effects. Numerous studies have shown that even after a single medication injection into the cerebrospinal fluid column, spinal anesthesia can affect the micturition cycle (Brouwer *et al.*, 2021).

Nearly every patient undergoing hernia repair will be given neuraxial blockade in one form or another as a general or spinal anesthetic throughout the procedure. Given the proximity of the main nerves governing urine function, it is debatable whether either anesthetic technique will have a good or negative impact on the rate of urine retention (Joy, 2018). Both approaches offer risks and benefits. Alternatively, in the immediate postoperative period, general anesthesia may cause sedation or confusion in these individuals, which may temporarily hinder their ability to walk and void. Healthcare providers performing ambulatory surgery would expect better facilitation of emptying and quicker resolution of neural blockade from the physiological perspective of spinal anesthesia's distribution of blockade (Begani *et al.*, 2019).

2. Postoperative Urinary Retention (POUR):

Postoperative urinary retention is defined as the inability to void urine after surgery despite having a full bladder, often necessitating catheterization. With documented occurrence rates varying from 5% to 70%, it is a frequent complication that is contingent upon the type of surgery, patient demographics, and anesthetic technique (Colleen D McDermott *et al.*, 2023). Postoperative urinary retention is not merely a transient inconvenience; it has significant clinical implications, including:

1. **Patient Discomfort:** Inability to void can cause significant pain and distress.
2. **Bladder Overdistension:** Prolonged retention can lead to bladder wall damage and impaired detrusor function.
3. **Infections:** The risk of urinary tract infections (UTIs) is increased by catheterization, which is frequently necessary to treat POUR.
4. **Prolonged Hospitalization:** POUR patients frequently need prolonged

hospital stays for care and monitoring, which raises the expense of healthcare (J Jackson *et al.*, 2018).

3. Pathophysiology of POUR After Spinal Anesthesia:

The process by which POUR develops after spinal anesthesia is intricate and impacted by several variables. Key mechanisms include:

1. **Inhibition of Sacral Nerve Roots:** Temporary paralysis of the detrusor muscles results from spinal anesthesia's blocking of the sacral nerve roots (S2-S4), which control bladder contraction.
2. **Increased Bladder Capacity:** The relaxation of the bladder wall brought on by anesthesia increases the bladder's capacity and postpones the urge to void and the feeling of fullness.
3. **Sympathetic-Parasympathetic Imbalance:** Spinal anesthesia disrupts the balance between sympathetic and parasympathetic innervation of the bladder, further contributing to retention.

MATERIALS AND METHOD

3.1 Study Setting

The study was conducted at:

- Shahab Orthopaedic and General Hospital, Peshawar
- Afridi Medical Complex. Peshawar

A descriptive cross-sectional study design was employed to assess the incidence and associated risk factors of Postoperative urinary retention (POUR) among patients who received spinal anesthesia. Using a non-probability convenient sampling technique, 100 patients in all were included in the study. It was decided that the sample size was sufficient for both descriptive analysis and the use of inferential statistics to enable subgroup comparisons. Data were collected through direct observation, patient interviews, and medical record reviews. Demographic variables such as age, sex, and body mass index (BMI), along with medical history and surgical details, were documented systematically. Baseline bladder function was assessed preoperatively through patient history and clinical evaluation. Information regarding the type and dose of spinal anesthesia, as well as duration of surgery and volume of intravenous fluids administered intraoperatively, was recorded.

Following surgery, patients were monitored in the recovery and ward settings. Signs and symptoms of urinary retention—such as inability to void within six hours postoperatively, bladder distension, and patient-reported discomfort—were closely observed. In suspected cases, ultrasound bladder scanning was utilized to determine residual urine volume, confirming Postoperative urinary retention (POUR) where necessary. The requirement for catheterization was documented as the primary outcome of interest. Secondary outcomes included time to first voiding, incidence of complications (e.g., infections, haematuria), and the association of POUR with variables such as age, gender, and type of surgery.

3.6 Statistical Analysis

Data collected were entered into SPSS Statistics software, version 27.0 for analysis. Descriptive statistics including means, medians, standard deviations, and frequencies were used to summarize patient demographics and clinical characteristics. Inferential statistical tests such as Chi-square tests were applied to identify associations between categorical variables (e.g., and incidence of POUR).

RESULTS

This study included 100 patients who underwent spinal anesthesia for various surgical procedures. Postoperative urinary retention (POUR) occurred in only 6% of the cases, with most patients having no risk factors like diabetes, or bladder-affecting medications.

Age of the Patient

The majority of patients were aged 36–45 years (29%), followed by 46–60 years (20%), 26–35 years (18%), 60 years and above (17%), and 18–25 years (16%). These results are shown in Tab 4.1.

Table 4.1: *Age of the participants*

Age of the patient		
	N=100	Percentage
18-25 years old	16	16.0%

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3007-3197

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3007-3189

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26-35 years old	18	18.0%
36-45 years old	29	29.0%
46-60 years old	20	20.0%
60 years old and above	17	17.0%

Gender of the Patient

Out of 100 participants, 56% were male and 44% were female. These results are shown in the table 4.2.

Table 4.2: *Gender of the patient*

Gender of the participant		
	N=100	%
Male	56	56.0%
Female	44	44.0%

Weight of the patient

The weight distribution showed that 37% of patients weighed between 60–70 kg, 32% were above 70 kg, and 31% were between 50–60 kg which are shown in Table 4.3.

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Table 4.3: *Weight of the patient*

Weight of the patient		
	N	%
50-60 kg	31	31.0%
60-70 kg	37	37.0%
Above 70 kg	32	32.0%

Diabetes Status

21% of the patients were diabetic, while the majority (79%) were non-diabetic which are shown in Table 4.4.

Table 4.4: *Diabetes status*

Do you have diabetes		
	N	%
Yes	21	21.0%
No	79	79.0%

Use of Medications Affecting Bladder Function

Only 3% of the patients were taking medications that could potentially affect bladder function, whereas 97% were not on such medications.

Table 4.5: *Use of Medications Affecting Bladder Function*

Are you currently using any medication that could affect urinary bladder function		
	N	%
Yes	3	3.0%
No	97	97.0%

Type of Surgery

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The majority of participants underwent orthopedic surgery (91%), followed by urological surgery (8%), and general surgery (1%).

Table 4.6: *Type of Surgery Undergone*

Type of surgery undergone		
	N	%
Orthopedic surgery	91	91.0%
Urological surgery	8	8.0%
General surgery	1	1.0%

Duration of Surgery

More than half of the surgeries (52%) lasted between 66–100 minutes, while 24% lasted 30–65 minutes, and another 24% were longer than 100 minutes.

Table 4.7: *Duration of Surgery*

Duration of Surgery		
	N	%
30-65 min	24	24.0%
66-100 min	52	52.0%
Above 100 min	24	24.0%

Type of Spinal Anesthetic Drug Used

Bupivacaine was used in 96% of the patients, whereas lidocaine was administered in 4%.

These results are shown in Table 4.8.

Table 4.8: *Type of Spinal Anesthetic Drug Used*

Type of Spinal Anesthetic drug used		
	N	%
Bupivacaine	96	96.0%
Lidocaine	4	4.0%

Additional Analgesics (Opioids or NSAIDs)

17% of the patients received additional analgesics, while 83% did not which are shown in below Table 4.9.

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Table 4.9: Additional Analgesics (Opioids or NSAIDs)

Did you receive any additional analgesics(Opioids, NSAID)		
	N	%
Yes	17	17.0%
No	83	83.0%

Postoperative Urinary Retention (POUR)

Only 6% of the participants reported difficulty passing urine after surgery, indicating the incidence of postoperative urinary retention, while 94% did not experience any difficulty.

Table 4.9: Postoperative Urinary Retention (POUR)

Did you experience difficulty passing urine after surgery?		
	N	%
Yes	6	6.0%
No	94	94.0%

Onset of Urinary Retention

All 6 patients (6.0%) who experienced urinary retention reported that the difficulty began more than 24 hours after surgery. The remaining 94 patients (94.0%) did not report any urinary retention.

Table 4.10: Onset of Urinary Retention

How long after surgery did the difficulty begin?		
	N	%
More than 24 hours	6	6.0%
No POUR	94	94.0%

Urinary Symptoms Experienced

Among the 6 patients with POUR; 3 patients (3.0%) reported decreased urine flow. 2 patients (2.0%) experienced painful urination. 1 patient (1.0%) had incomplete

voiding. 94% of participants reported no symptoms of urinary retention.

Table 4.11: *Urinary symptoms experienced*

What urinary symptoms appear?		
	N	%
Inability to void completely	1	1.0%
Decreased urine flow	3	3.0%
Painful Urination	2	2.0%
No POUR	94	94.0%

Catheterization Requirement

All 6 patients (6.0%) with POUR required catheterization to relieve retention. The remaining 94 patients (94.0%) did not require any catheterization.

Cross Tabulation of Type of anesthetic drug used and difficulty in urination

According to the crosstabulation between postoperative urinary retention (POUR) and the kind of spinal anesthetic medication used, patients who got Bupivacaine experienced all six cases of POUR (6 out of 96; 6.25%), whereas none of the four patients who received lidocaine experienced urinary retention. According to this, POUR was only seen in the group who received bupivacaine. Nevertheless, a p-value of 1.0 from the Chi-square test showed no statistically significant correlation between the kind of spinal anesthesia and the incidence of urine retention. The Lidocaine group's extremely small sample size, which makes it difficult to draw definitive conclusions, is probably the cause of this lack of significance.

Table 4.12: *Cross Tabulation of Type of anesthetic drug used and difficulty in urination*

Did you experience difficulty passing urine after surgery? * Type of Spinal Anesthetic drug used Crosstabulation				
		Type of Spinal Anesthetic drug used		Total
		Bupivacaine	Lidocaine	
Did you experience difficulty passing	Yes	6	0	6

urine after surgery?	No	90	4	94
Total		96	4	100

Association between type of Anesthetic drug used and onset of POUR.

The Chi-Square test results presented assess the association between the type of spinal anesthetic drug used and the occurrence of postoperative urinary retention (POUR). The Pearson Chi-Square value is 0.266 with 1 degree of freedom and a p-value of 0.606, indicating no statistically significant association between the two variables. The Continuity Correction (used for 2x2 tables to adjust for small sample size) shows a value of 0.000 with a p-value of 1.000, further confirming the lack of significance. The Likelihood Ratio Chi-Square, which is an alternative to Pearson's, is 0.506 with a p-value of 0.477, also supporting the same conclusion. Additionally, the Linear-by-Linear Association value is 0.263 ($p = 0.608$), suggesting no significant linear trend between the variables.

Table 4.13: *Association between type of Anesthetic drug used and onset of POUR.*

Chi-Square Tests			
	Value	df	P value
Pearson Chi-Square	.266 ^a	1	.606
Continuity Correction ^b	.000	1	1.000
Likelihood Ratio	.506	1	.477
Linear-by-Linear Association	.263	1	.608
N of Valid Cases	100		

Discussion

This study investigated the incidence and associated factors of postoperative urinary retention (POUR) in 100 patients undergoing various surgical procedures under spinal anesthesia. Our findings reveal a low incidence of POUR (6%) in the study population, with all cases occurring in patients who received bupivacaine. However, statistical analysis did not demonstrate a significant association between the type of spinal anesthetic used and the occurrence of POUR.

The observed incidence of POUR (6%) in our cohort is consistent with the

lower end of the reported range in literature, which typically varies from 5% to 70% depending on the definition of POUR, type of surgery, anesthetic technique, and patient population (Cambise *et al.*, 2024; A. A. A. Niazi & M. A. A. J. E. J. o. A. Taha, 2015). A number of factors may have contributed to our study's comparatively low rate. First, compared to other surgical specialties, especially urological or colorectal procedures, which are known to have higher rates, the bulk of our patients (91%) had orthopedic surgery, which may have affected their POUR profile (Geller, 2014; Reed *et al.*, 2023). Second, the decreased incidence was probably caused by the demographics of our study cohort, which included a low prevalence of pre-existing risk factors including diabetes (21%), and a majority of participants in the 36–45 age range. These results are consistent with earlier studies showing that pre-existing urological diseases, advanced age, and male gender are important risk factors for POUR (Agrawal *et al.*, 2019).

Our research revealed that patients who received bupivacaine experienced all six POUR cases, but the lidocaine group did not experience any incidents. The Chi-Square test showed no statistically significant correlation between the incidence of POUR and the type of spinal anesthetic medication used, despite this apparent trend ($p=0.606$). The very small sample size in the lidocaine group ($n=4$) is probably the cause of this lack of statistical significance, especially the high p -value for the Continuity Correction ($p=1.000$). Even though bupivacaine is a frequently used long-acting local anesthetic for spinal anesthesia, POUR and delayed bladder emptying are known to be caused by its prolonged duration of action, particularly on sacral nerve roots (A. Pomajzl & L. E. Siref, 2023). In contrast, lidocaine, being a shorter-acting agent, typically allows for earlier recovery of bladder function (Nicholas S Hernandez *et al.*, 2022). Despite the statistical non-significance, the observed clinical pattern calls for more research using a larger, more balanced cohort in order to conclusively determine the relative incidence of POUR between lidocaine and bupivacaine. Current research is still examining the relative effectiveness and adverse effects of lidocaine and bupivacaine, frequently pointing out that bupivacaine has a longer half-life (Chan *et al.*, 2024; Velioglu *et al.*, 2020).

All of the POUR patients in our study had symptoms like decreased urine flow, painful urination, or incomplete voiding, and all of them claimed that their

problems started more than 24 hours after surgery and that they needed intermittent catheterization. Even at a low incidence, POUR has a clinical impact, as evidenced by the need for catheterization and the persistence of urine retention for longer than 24 hours. POUR with a delayed onset can be especially difficult because patients may have been released from the hospital, which could result in problems if left untreated (Joni Jackson *et al.*, 2019). Intermittent catheterization is a common and successful treatment for POUR, reducing risk of infection and encouraging bladder retraining. (Gray *et al.*, 2019; Stoffel *et al.*, 2016). In order to avoid difficulties, recent guidelines and reviews continue to stress the significance of early detection and effective care, including bladder scanning and catheterization (Colleen D. McDermott *et al.*, 2023; Serlin *et al.*, 2018).

Conclusion

In this study, 100 patients who received spinal anesthesia had their incidence and contributing variables for postoperative urine retention (POUR) evaluated. All afflicted instances occurred more than 24 hours after surgery, and the overall incidence of POUR was 6%. The symptoms included incomplete voiding, painful urination, and reduced urine output. Intermittent catheterization was used to successfully manage every POUR case. Despite the fact that all POUR cases happened in this group, statistical analysis using the Chi-square test revealed no significant correlation between the kind of spinal anesthetic agent and the development of POUR ($p = 0.606$). The majority of patients received Bupivacaine. Other patient attributes including age or gender did not show any noteworthy correlations. The findings suggest that while POUR is relatively uncommon in this population, it remains a clinically important complication that requires awareness and timely management.

References

- Agrawal, K., Majhi, S., & Garg, R. J. W. J. o. A. (2019). Post-operative urinary retention: review of literature. 8(1), 1-12.
- Akkoc, A., Aydin, C., Topaktas, R., Kartalmis, M., Altin, S., Isen, K., & Metin, A. (2016). Prophylactic effects of alpha-blockers, Tamsulosin and Alfuzosin, on postoperative urinary retention in male patients undergoing urologic surgery

- under spinal anaesthesia. *International braz J urology*, 42(3), 578-584.
- Baldini, G., Bagry, H., Aprikian, A., Carli, F., Warner, D. S., & Warner, M. A. J. A. (2009). Postoperative urinary retention: anesthetic and perioperative considerations. *110*(5), 1139-1157.
- Begani, M., Mulchandani, D. V., & Choudhary, S. (2019). *Anesthesia in Day Care Surgery* (Vol. 43): Springer.
- Biardeau, X. (2024). *Optimization of electrical stimulation/modulation therapies in the management of neurogenic and non-neurogenic lower urinary tract dysfunction*. University of Antwerp,
- Bjerregaard, L. S., Bagi, P., & Kehlet, H. (2014). Postoperative urinary retention (POUR) in fast-track total hip and knee arthroplasty: A challenge for orthopedic surgeons. *Acta orthopaedica*, 85(1), 8-10.
- Brouwer, T. A., van Roon, E. N., Rosier, P. F. W. M., Kalkman, C. J., & Veeger, N. (2021). Postoperative urinary retention: risk factors, bladder filling rate and time to catheterization: an observational study as part of a randomized controlled trial. *Perioperative Medicine*, 10(1), 2. doi:10.1186/s13741-020-00167-z
- Cacciatore, S., Ferrara, M. C., Iuorio, M. S., Dall'Olio, L., Bellelli, F., Elmi, D., . . . Okoye, C. (2024). Urinary Catheterization Management in Older Adults With Hip Fracture: A Systematic Review. *Journal of the American Medical Directors Association*, 105410.
- Cambise, C., De Cicco, R., Luca, E., Punzo, G., Di Franco, V., Dottarelli, A., . . . Aceto, P. (2024). Postoperative urinary retention (POUR): A narrative review. *18*(2), 265-271. doi:10.4103/sja.sja_88_24
- Chan, E., Billard, K., Sims, L., Yang, C., & Sauder, D. J. T. J. o. H. S. (2024). Does Addition of a Longer Acting Local Anesthetic Improve Postoperative Pain After Carpal Tunnel Release? A Randomized Controlled Trial. *49*(10), 1000-1006.
- Feliciano, T., Montero, J., McCarthy, M., & Priester, M. (2008). A Retrospective, Descriptive, Exploratory Study Evaluating Incidence of Postoperative Urinary Retention After Spinal Anesthesia and Its Effect on PACU Discharge. *Journal of PeriAnesthesia Nursing*, 23(6), 394-400. doi:<https://doi.org/10.1016/j.jopan.2008.09.006>

Online ISSN

3007-3197

Print ISSN

3007-3189

<http://amresearchreview.com/index.php/Journal/about>

- Garg, B., Ahuja, K., Khanna, P., & Sharan, A. D. J. C. S. S. (2021). Regional anesthesia for spine surgery. *34*(5), 163-170.
- Gautam, N., Islam, S. U., Paudel, S., & Nasrullah, F. (2023). Prophylactically Given Tamsulosin in Preventing Postop Urinary Retention in Surgery Under Spinal Anaesthesia. *Pakistan Journal of Medical Health Sciences*, *17*(03), 80-80.
- Geller, E. J. J. I. j. o. w. s. h. (2014). Prevention and management of postoperative urinary retention after urogynecologic surgery. 829-838.
- Gray, M., Wasner, M., Nichols, T. J. J. o. W. O., & Nursing, C. (2019). Nursing practice related to intermittent catheterization: a cross-sectional survey. *46*(5), 418-423.
- Hernandez, N. S., Wang, A. Y., Kanter, M., Olmos, M., Ahsan, T., Liu, P., . . . Kryzanski, J. (2022). Assessing the impact of spinal versus general anesthesia on postoperative urinary retention in elective spinal surgery patients. *Clinical Neurology and Neurosurgery*, *222*, 107454. doi:<https://doi.org/10.1016/j.clineuro.2022.107454>
- Hernandez, N. S., Wang, A. Y., Kanter, M., Olmos, M., Ahsan, T., Liu, P., . . . Neurosurgery. (2022). Assessing the impact of spinal versus general anesthesia on postoperative urinary retention in elective spinal surgery patients. *222*, 107454.
- Hollman, F., Wolterbeek, N., & Veen, R. (2015). Risk factors for postoperative urinary retention in men undergoing total hip arthroplasty. *Orthopedics*, *38*(6), e507-e511.
- Jackson, J., Davies, P., Leggett, N., Nugawela, M., Scott, L., Leach, V., . . . Sharma, J. J. B. o. (2019). Systematic review of interventions for the prevention and treatment of postoperative urinary retention. *3*(1), 11-23.
- Jackson, J., Davies, P., Leggett, N., Nugawela, M. D., Scott, L. J., Leach, V., . . . Whiting, P. (2018). Systematic review of interventions for the prevention and treatment of postoperative urinary retention. *BJS Open*, *3*(1), 11-23. doi:10.1002/bjs5.50114 %J BJS Open
- Joy, J. J. (2018). *Effect of Intravenous Magnesium Sulphate on Block Characteristics and*

Online ISSN

3007-3197

Print ISSN

3007-3189

<http://amresearchreview.com/index.php/Journal/about>

Post Operative Analgesia for Inguinal Hernia Surgeries Under Spinal Anaesthesia.

Rajiv Gandhi University of Health Sciences (India),

Kopel, J., & Sharma, D. P. (2021). Spinal surgery and urinary retention: A review of the literature. *Journal of Clinical Urology*, 14(1), 4-9.
doi:10.1177/2051415820916932

Lawrie, C. M., Ong, A. C., Hernandez, V. H., Rosas, S., Post, Z. D., & Orozco, F. R. (2017). Incidence and risk factors for postoperative urinary retention in total hip arthroplasty performed under spinal anesthesia. *The Journal of Arthroplasty*, 32(12), 3748-3751.