



## Research Article

# Perioperative complications in patients undergoing urological surgery with spinal anesthesia: A prospective, observational study

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## ABSTRACT

**Background:** Spinal anesthesia is widely used as the primary anesthesia method in urological surgeries, and this prospective observational study aimed to evaluate the associated complications.

**Materials and Method:** Demographic data, procedures, and spinal anesthesia-related complications (e.g., hypotension, bradycardia, and headache) of patients who underwent urological surgery with spinal anesthesia were recorded perioperatively. Patients were questioned about complications on the 5th and 14th postoperative days.

**Results:** Mean arterial pressure decreases in those administered intraoperative hyperbaric bupivacaine were higher at the 5th ( $p=0.010$ ), 10th ( $p=0.003$ ), and 15th minute ( $p=0.001$ ) than in those administered levobupivacaine and lidocaine. In patients administered crystalloid and colloid solutions, an increase in hypotension was observed at the intraoperative 10th minute (systolic arterial pressure (SAP):  $p=0.008$ , diastolic arterial pressure (DAP):  $p=0.011$ ) and 15th minute (SAP:  $p=0.017$ ). Post-dural puncture headache (PDPH) occurred on days 1 and 2 in 7 patients and resolved within 3 days. Two patients reported leg pain and one patient reported gluteal numbness with bupivacaine. A majority of the patients (83%) stated that they would prefer spinal anesthesia if they were to have surgery again.

**Conclusions:** Identifying perioperative complications in urological surgeries performed under spinal anesthesia helps in effective management and has implications for clinical practice.

## ARTICLE INFO

*Article history:*

Received 19 March 2024

Revised 24 April 2024

Accepted 12 May 2024

*Keywords:*

Spinal anesthesia

Urological surgery

Complications

Local anesthetics



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## 1. Introduction

The utilization of anesthesia in surgical procedures is an area that is perpetually developing. The fundamental principles and objectives of these advancements revolve around the preferences of the patient, their comfort, ensuring safety, and achieving effective outcomes in surgical procedures. Spinal anesthesia is crucial, particularly in urological procedures, and its significance in this setting remains unchanged [1].

Factors such as hemodynamic stability, patient satisfaction, reduction in opioid use and postoperative analgesic needs, early discharge, and decreased costs determine the role of spinal anesthesia in urological surgeries [2–4]. Furthermore, some articles suggest a decrease in lymphatic flow in metastatic lymph nodes during oncological urological procedures, as well as a lower rate of tumor recurrence following noninvasive bladder tumor surgery conducted under spinal anesthesia [5,6].

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ISSN: 2980-292X / DOI: <https://doi.org/10.20528/cjpm.2024.02.001>

Despite the various advantages of spinal anesthesia, it also has undeniable disadvantages. Some contraindications for the procedure include the patient's refusal, coagulopathy, severe hypovolemia, or local infection in the procedure area. Disadvantages include providing a limited surgical duration depending on the local anesthetic agent and insufficient muscle relaxation for some surgeries [7]. Hypotension and bradycardia are the most common complications, occurring in 15-30% of cases. Possible risks include post-dural puncture headache, cauda equina syndrome, diplopia, hearing loss, anterior spinal artery syndrome, Horner syndrome, arachnoiditis, meningitis, and epidural abscess [1].

This study aimed to investigate and evaluate the perioperative complications of spinal anesthesia in patients undergoing urological surgery.

## 2. Materials and Method

Following local ethics committee approval (TYHEK:2010-98), the study was carried out at a tertiary hospital between August 1st, 2010, and May 31st, 2011. Patients aged between 20 and 80 years, classified as American Society of Anesthesiologists (ASA) grade I-II, were included in the study. Exclusion criteria encompassed contraindications to spinal anesthesia (including infection at the injection site, lack of consent, coagulopathy or other bleeding diathesis, severe hypovolemia, increased intracranial pressure), respiratory failure, history of allergies, opioid addiction, and refusal to provide consent for study participation.

A pre-anesthetic evaluation was performed the day before, an informed consent form was obtained, and the spinal anesthesia technique was explained. The quantity of hydration administered, and the specific fluid utilized in the preoperative unit on the morning of the surgery were documented.

In the operating room, following the application of standard ASA monitoring, which included three-channel electrocardiography, non-invasive blood pressure monitoring, and peripheral oxygen saturation measurement, patients were positioned, and spinal anesthesia was administered. The preferred local anesthetic and its volume, along with the type and thickness of the spinal needle used, were documented for each block. The sensory block was evaluated using the bilateral Pinprick Test along the mid-clavicular line, the motor block was assessed using the modified Bromage Scale (0: No paralysis, 1: Can only move the knee and feet, cannot lift the leg straight, 2: Cannot bend the knee, can only move the foot, 3: Cannot move the foot joint or thumb, complete paralysis) [8].

Surgery was initiated once sensory blockade was achieved at the T10 level. Any administration of perioperative sedation was documented. Baseline values for all patients were recorded prior to the administration of spinal anesthesia. Subsequent measurements of heart rate (HR), systolic arterial blood pressure (SBP), diastolic arterial blood pressure (DAB), mean arterial blood pressure (MAP), peripheral oxygen saturation (SpO<sub>2</sub>), and respiratory rate (RR) were documented at the 5th

minute post-spinal injection, as well as intraoperatively at the 5th, 10th, 15th, 30th, 45th, and 60th minutes, and postoperatively in the recovery unit at the 5th, 10th, 15th, 30th, 60th, and 90th minutes. Hypotension was defined as a decrease in mean arterial pressure of 20% or more during the perioperative period and was initially treated with a crystalloid infusion (15-20 ml/kg/h IV 0.9% NaCl) [9]. If hypotension persisted, 5 ml./kg. /h. iv. colloid infusion was employed, and 5-10 mg of ephedrine was administered intravenously. If the heart rate was less than 50 beats per minute, 0.5 mg of atropine was administered intravenously.

In the recovery unit, patients were evaluated for the time the block disappeared, headache, back and waist pain, nausea, itching, double vision, blurred vision, tinnitus, and hearing loss. The questions were repeated on the first day in the ward, and complaints of inability to urinate after the urinary catheter was removed were also assessed. The patients' discharge times were recorded, and the questions were repeated in person or by phone on the 5th and 14th postoperative days.

## 3. Statistical Methods

SPSS 15.0 for Windows was utilized to conduct the statistical analyses (Chicago, Illinois). Descriptive statistics were calculated using percentages to represent categorical data and mean±standard deviation to analyze continuous data. For categorical data, comparisons between groups were conducted using the Chi-square and Fisher's Exact tests. For continuous data, the Mann Whitney U test was utilized to compare two groups, while the Kruskal Wallis test was employed to compare more than two groups. When a significant p value was obtained from the Kruskal-Wallis test, pairwise group comparisons were conducted using the Mann Whitney U test with Bonferroni correction.  $p < 0.05$  was considered as statistical significance.

## 4. Results

107 patients were recruited, with 7 excluded due to failed spinal anesthesia, resulting in 100 patients being included for evaluation. The study's flow chart is presented in Fig. 1. Table 1 provides a summary of the demographic data and types of surgery for all patients.

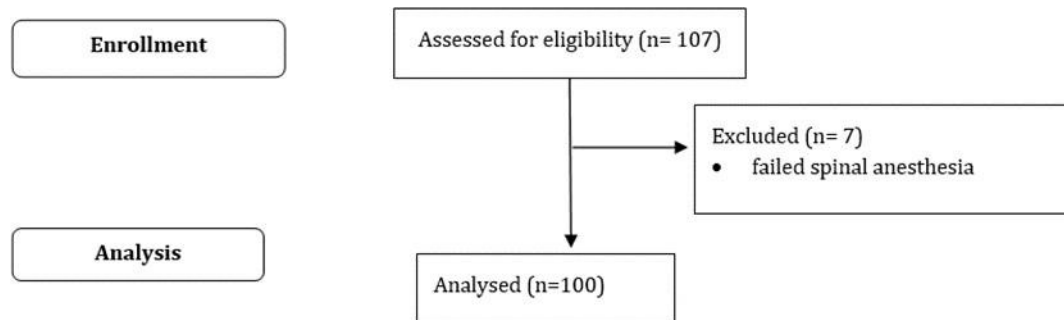
No patient was sedated before the procedure; after the sensory block was achieved, 1-2 mg midazolam was administered intravenously in all patients.

In the study, hyperbaric bupivacaine  $15.08 \pm 2.42$  mg (Marcaine® Spinal Heavy 0.5%, AstraZeneca) was administered to 56 patients, levobupivacaine 15 mg (Chirocaine® 5mg/ml, Abbott) was administered to 33 patients, and lidocaine  $65.91 \pm 6.64$  mg (Jetmonal 2%, Adeka) was administered to 11 patients. There was no significant difference among the agents in terms of the time until reaching motor block level Bromage 3 and sensory block level T10 ( $p > 0.05$ ) (Table 2).

Seventy-nine patients received  $470.25 \pm 208.89$  ml of 0.09% NaCl (Physiological Serum) 20 minutes before the

block, while 19 patients received 689.47±188.90 ml of colloid (Voluven 0.6% HES, Fresenius Kabi). Two patients underwent the procedure without receiving any fluids. A greater reduction in intraoperative MAP was observed in patients administered hyperbaric bupivacaine at the 5th (p=0.010), 10th (p=0.003), and 15th

(p=0.001) minutes compared to those administered levobupivacaine (Fig. 2). Regardless of the agents used, the group that received physiological saline experienced a significantly greater reduction in intraoperative SAP (p=0.008) and DAP (p=0.011) at the 10th minute, as well as in MAP at the 15th minute (p=0.017).



**Fig. 1.** The flow-chart of the study.

**Table 1.** Demographic data and type of the surgery.

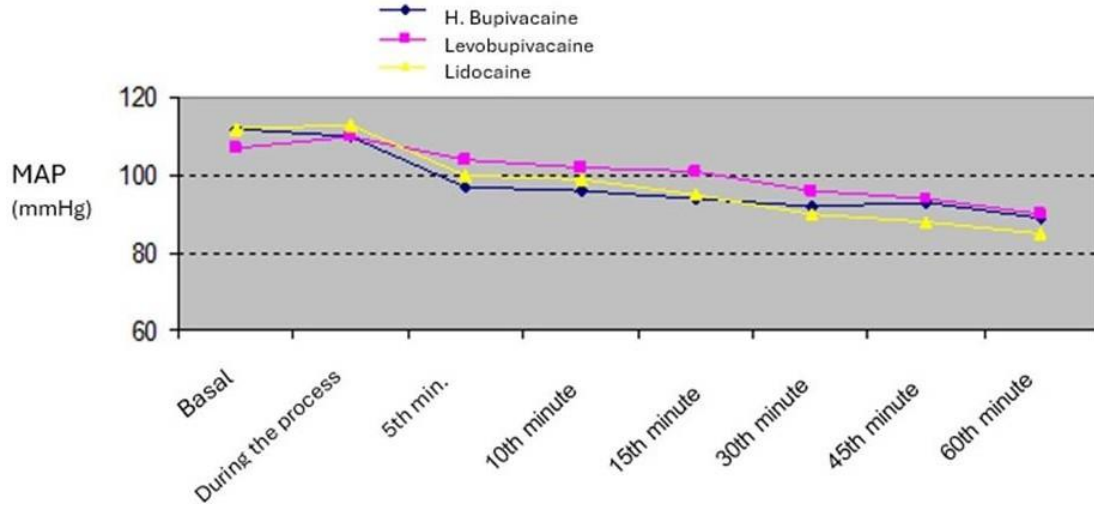
Demographic data	Mean±SD
Age (year)	61.6±14.16
Weight (kg)	75.37±13.31
Height (m)	1.69±0.07
BMI (kg/m <sup>2</sup> )	26.3±3.85
ASA	n
ASA I	23
ASA II	77
Comorbidity	
DM	14
HT	35
COPD	9
CAD	2
CHF	1
Type of Surgery	n
TURP	58
Varicocele	23
Exploratory cystoscopy	15
Open prostatectomy	4

ASA: American Society of Anesthesiologists; DM: Diabetes mellitus; HT: Hypertension; COPD: Chronic obstructive pulmonary disease; CAD: Coronary artery disease; CHF: Congestive heart failure; TURP: Transurethral resection of the prostate.

**Table 2.** Time taken for sensory block to reach T10 and motor block to reach Bromage.

Time* (min)	Hyperbaric Bupivacaine (n:56)	Levobupivacaine (n:33)	Lidocaine (n:11)	p
Sensory block	5.93±2.72 (Mean±SD)	5.16±0.85 (Mean±SD)	5.50±1.85 (Mean±SD)	p>0.05
Bromage 3	6.17±2.80 (Mean±SD)	5.27±1.19 (Mean±SD)	5.50±3.31 (Mean±SD)	p>0.05

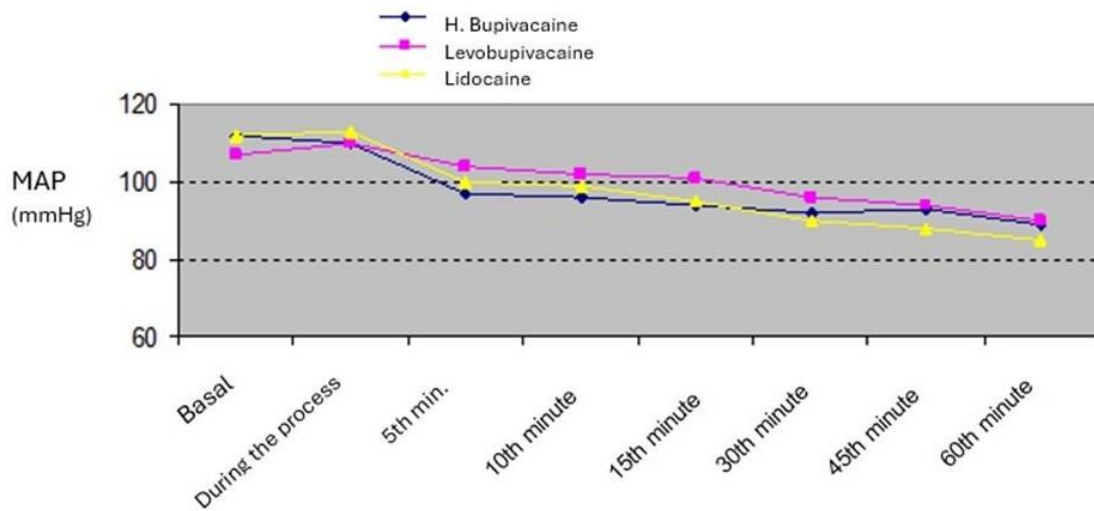
\*The time to achieve complete sensory and motor blockade was presented as the mean and standard deviation.



**Fig. 2.** Comparison of MAP levels for each agent.

When comparing postoperative hypotension among different OAB agents, no statistically significant differences were observed ( $p > 0.05$ ) (Fig. 3). While MAP did not decline below 50 mmHg in any patient, at the 10th minute postoperatively, a reduction of 20% or greater

was noted in comparison to the baseline value. No statistically significant difference was observed when postoperative blood pressures were compared between patients who received preoperative crystalloid and colloid, regardless of the local anesthetic agent used ( $p > 0.05$ ).



**Fig. 3.** Comparison of postoperative MAP levels per agent.

In seven patients, the onset of post-dural puncture headache (PDPH) was observed on the first day, while in another seven patients, it manifested on the second day. He recovered completely within three days following adequate hydration, analgesic administration, and bed rest. All patients were mobilized eight hours after the operation. PDPH was observed in individuals with an average age of  $52.73 \pm 13.95$  years. A 25 G Quincke spinal needle was used in 40 patients and a 22 G Quincke spinal needle was used in 60 patients. No correlation was observed between the needle gauge and the incidence of PDPH ( $p > 0.05$ ).

Following the surgery, one patient experienced discomfort in their right leg starting from the first day, while another experienced pain in their left leg. Both patients experienced complete alleviation of pain by the seventh day. One patient experienced numbness in the gluteal region from the 5th to the 16th day but did not

develop incontinence. Bupivacaine was administered as the agent for neuraxial blockade in all three patients, with the surgical procedure being transurethral resection of the prostate (TURP) performed in the lithotomy position.

Eleven of the forty-five patients with a prior surgical history underwent spinal anesthesia, one patient experienced postoperative low back pain, and one patient had unsuccessful spinal anesthesia. Throughout the investigation, neuraxial blocks administered to these patients did not result in any complications. The mean stay of patients in the intensive care unit was  $150.6 \pm 199.44$  minutes, and the mean time to discharge was  $2.85 \pm 1.54$  days. Eighty-three percent of the patients who participated in the study expressed a preference for spinal anesthesia as a form of anesthesia during a subsequent operation.

## 5. Discussion

This study evaluates the clinical results of various local anesthetic drugs, the use of different needle measurements, and the management of intraoperative fluids in male patients undergoing urological surgery with spinal anesthesia. Comparison of the findings with existing information in the literature provides perspective on the effectiveness and safety of spinal anesthesia.

The selection of local anesthetic agents during surgery is crucial for ensuring effectiveness and safety. Our study found no significant differences in the time required to achieve sensory and motor blockade when using different local anesthetic agents, such as hyperbaric bupivacaine and isobaric levobupivacaine. These findings are consistent with existing literature on the subject [10].

Hypotension is a frequently observed adverse effect following spinal anesthesia, with a prevalence as high as 74%, particularly in cases of cesarean section [11]. Strategies employed to avoid hypotension or lessen its occurrence and intensity involve the administration of intravenous fluids, vasopressor medications, and 5-hydroxytryptamine 3 (5HT<sub>3</sub>) receptor antagonists [12]. Preloading refers to administering fluids before spinal anesthesia, while co-loading refers to administering fluids during surgery [13]. The suitable liquids for application include crystalloids and colloids. While some studies suggest the simultaneous administration of crystalloids and prior administration of colloids, there is currently no conclusive agreement among experts [14,15]. In our study, 79 patients were given an average of 470 ml of crystalloid preoperatively, and 19 patients were given an average of 689 ml of colloid. When patients receiving crystalloid or colloid solutions were compared, SBP at the 10th minute ( $p=0.008$ ), MAP at the 10th minute ( $p=0.011$ ), and SBP at the 15th minute ( $p=0.017$ ) indicated more hypotension in the crystalloid group. No significant difference was found in postoperative measurements. While the faster absorption and distribution of crystalloids may lead to significant hypotension in the intraoperative period, the longer effect of colloids may cause this difference to disappear in the postoperative period.

In their study on patients undergoing hip fracture surgery, Vives et al. [16] found no hemodynamic differences between intrathecal levobupivacaine and bupivacaine. However, Pehlivan et al. [17] reported that bupivacaine had a greater impact on QT intervals. Consequently, levobupivacaine was deemed more effective than bupivacaine, particularly in patients with cardiac conditions, and it can be used safely. In our investigation, we observed a more significant reduction in mean arterial pressure in patients who were administered hyperbaric bupivacaine at the 5th, 10th, and 15th minutes compared to those who were administered levobupivacaine ( $p<0.05$ ). The disparities seen among agents can be attributed to the fact that levobupivacaine exhibits a lower incidence of cardiovascular adverse effects compared to bupivacaine.

The prevalence of headache following dural puncture ranges from 3.5% to 33%. The most efficient method to reduce the occurrence of PDPH is to utilize an atraumatic needle with a non-sharp tip [18]. While some studies sug-

gest that using small-diameter needles can be preventive [19,20], Arevalo-Rodriguez I et al. [21] found no statistically significant relationship between needle diameter and the development of PDPH. In this study, we utilized 25 G. Quincke spinal needles in 40 patients and 22 G. Quincke spinal needles in 60 patients. The occurrence of PDPH overall was found to be 14%. While patients using a 22 G. spinal needle showed increased levels of PDPH, the difference was not statistically significant. We believe this distinction can be effectively illustrated in studies involving a larger cohort of patients.

Transient neurological symptoms (TNS) refer to temporary symptoms that include sensory impairment in the back, hips, one or both lower extremities, radiating pain, headaches, reduced muscle strength, and difficulty in urination. These symptoms can occur even when there is no complete loss of sensation or motor function following spinal anesthesia. TNS generally resolves on its own after 10 days. The term 'Transient neurological toxicity' was initially used, but later changed to 'Transient neurological symptom' [22]. While lidocaine is commonly associated with TNS [23], a new study comparing lidocaine, mepivacaine, and bupivacaine found no difference in terms of GNS development [24]. Ten individuals in our study experienced paravertebral low back pain following spinal anesthesia, although this pain disappeared on its own. There was no notable disparity observed in the frequency of TNS between the administration of lidocaine and its usage as a local anesthetic agent in these patients. Leg pain resolved by the 7th day in two patients, but one patient experienced numbness in the gluteal region from the 5th to the 16th day, without any incontinence. Bupivacaine was administered to these three individuals.

Our study's limitations warrant consideration. General validity may be limited by the fact that this is a single-center study, and patients were selected from a homogeneous population. Further research may be guided by a more thorough examination of other clinical criteria that were examined in our study, such as the requirement for postoperative analgesia or long-term results. Due to the observational nature of the study, parameters such as needle type, length, type, and volume of local anesthetic were not standardized and were left to the practitioner's discretion. This may have influenced our results. Another limitation of our study is that we did not conduct a power analysis or determine the sample size, as our study followed a prospective observational cohort design. The sample size was chosen based on similar studies in the literature [25]. Nevertheless, given recent studies, the sample size in our study may appear relatively small. There is a necessity for prospective comparative studies incorporating more comprehensive, standardized protocols. The findings from our study could serve as preliminary data for such endeavors.

## 6. Conclusions

This study on urological surgery patients found no significant difference between hyperbaric bupivacaine and isobaric levobupivacaine in terms of sensory and

motor block durations. Crystalloid solutions caused more intraoperative hypotension than colloid solutions. Hyperbaric bupivacaine caused a greater decrease in mean arterial pressure at 5, 10, and 15 minutes compared to levobupivacaine. The overall occurrence of PDPH was 14% and there was no significant difference between needle sizes. Paravertebral low back pain and transient neurological symptoms were mild and resolved spontaneously. More research with larger samples is needed to confirm these findings.

#### Acknowledgements

None declared.

#### Funding

The authors received no financial support for the research, authorship, and/or publication of this manuscript.

#### Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this manuscript.

#### Author Contributions

All of the authors made substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data; were involved in drafting the manuscript or revising it critically for important intellectual content; and gave final approval of the version to be published.

#### Data Availability

The datasets created and/or analyzed during the current study are not publicly available, but are available from the corresponding author upon reasonable request.

#### Ethics Approval and Consent to Participate

This study was approved by the ethics committee local ethics committee approval (TYHEK:2010-98). All methods were performed in accordance with relevant guidelines and regulations.

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