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Original Research Article

Factors Associated with Delayed Postsurgical Voiding Interval in Ambulatory Spinal Anesthesia Patients: A Prospective Cohort Study in 3 Types of Surgery

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Abstract:

Background: Spinal anesthesia is commonly utilized in ambulatory surgeries but is associated with postoperative voiding dysfunction. This study explores factors influencing the delayed postsurgical voiding interval following spinal anesthesia with 0.5% Bupivacaine.

Methods: A prospective cohort study was conducted at Shri Jagannath Medical College and Hospital, Puri, Orissa, involving 270 patients undergoing orthopedic, urological, or general surgery. Data on surgery type, duration, intraoperative fluid volume, and anesthesia were collected. The primary endpoint was time to first voluntary void, with secondary endpoints including incidence of urinary retention and hospital stay duration.

Results: The median time to first void was 6 hours, extending to 8 hours in urological surgeries. Longer surgery duration and higher fluid volume were significantly associated with delayed voiding, increasing the hazard by 25% per additional hour of surgery and 15% per additional 100 mL of fluid, respectively.

Conclusion: The study underscores the need for meticulous intraoperative management in ambulatory spinal anesthesia, particularly with 0.5% Bupivacaine, to minimize postoperative voiding dysfunction. Adjusting fluid management and surgery duration based on the type of surgery and anesthesia can enhance patient outcomes and reduce urinary retention.

Keywords: Spinal Anesthesia, Postsurgical Voiding Interval, Urinary Retention, Ambulatory Surgery.

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Introduction

Because spinal anaesthesia has been linked to postoperative voiding dysfunction and urine retention, its use in patients undergoing ambulatory surgery has come under scrutiny. However, as evidenced by the findings of an epidemiologic study of anesthesia conducted in Catalonia, Spain, in 2003, the technique is frequently employed in outpatient surgery in our clinical setting. It is still utilized in outpatient surgery, presumably due to the technique's ease of usage and nearly 100% success rate [1,2].

Spinal anesthesia-induced postsurgical voiding dysfunction can lead to unscheduled hospitalizations and extended stays in the outpatient surgery unit, which can both raise expenses and cause patient unhappiness [3]. However, for individuals who are not good candidates for general anaesthesia (such as those with long-term respiratory conditions), ambulatory spinal anaesthesia may be a helpful alternative. In a randomized multicentre research of patient acceptance of various anaesthetic procedures, Nordin et al. showed that anaesthetic quality and patient satisfaction are comparable in spinal and general anaesthesia [4,5].

Similar to or even shorter than those reported for other anaesthetic techniques, several investigations have documented appropriate discharge times for spinal anaesthesia. Although several factors can affect the postsurgical voiding interval—the amount of time before a patient voids on their own after surgery—anesthesia has frequently been the primary cause of postsurgical spontaneous voiding dysfunction, with spinal blocks being specifically implicated [6]. Additional variables include age and sex; the length of the procedure, pain, and opioid use; the use of large amounts of fluid, which can result in bladder distention and retention due to

dysfunction of the bladder detrusor and sphincter in both spinal and general anaesthesia; the type of surgery, specifically abdominal or anorectal; the type of dose; and the concentration of the local spinal anaesthetic administered [7,8].

We planned a prospective cohort study to examine the effects of surgical type, age, physical status class (American Society of Anaesthesiologists [ASA] status), spinal anaesthetic dose, perioperative fluid administration, and surgical duration on postsurgical voiding interval to clarify the indications for spinal anaesthesia in ambulatory surgery. Three surgical procedures performed on patients under lidocaine spinal anaesthesia were examined: inguinal herniorrhaphy, anorectal surgery, and lower limb surgery.

Materials and Methodology

Study Design: This prospective cohort study examined how 0.5% Bupivacaine affects delayed postsurgical voiding intervals in ambulatory spinal anaesthesia patients. The 2024 study was place at Shri Jagannath Medical College and Hospital in Puri, Orissa.

Study Population: Patients 18 and older scheduled for orthopaedic, urological, or general surgery under 0.5% Bupivacaine spinal anaesthesia were included. Patients with pre-existing urological problems influencing voiding, persistent catheterisation, or neurological bladder dysfunction were excluded.

Sample Size Calculation: The sample size was calculated to detect a medium effect size with a power of 80% and an alpha of 0.05, resulting in the inclusion of approximately 270 patients (90 per surgery type). This calculation allowed for an estimated 20% dropout rate.

Sampling Method: Patients were consecutively sampled as they presented for surgery. Informed consent was obtained from all participants, detailing the study's purpose, procedures, benefits, and potential risks.

Data Collection: Data collected included patient demographics, type of surgery, surgery duration, intraoperative fluid volume, type and dose of anesthesia (specifically 0.5% Bupivacaine), and time to the first voluntary void post-surgery. The primary outcome measured was the time to the first voluntary void post-surgery, with secondary outcomes including the incidence of urinary retention requiring catheterization and the length of hospital stay.

Statistical Analysis

Descriptive statistics summarized demographic and clinical variables. Kaplan-Meier curves estimated the median time to first void. Cox proportional hazards models evaluated the associations between patient/surgical characteristics and delayed voiding, adjusting for potential confounders. Particular attention was given to the effects of 0.5% Bupivacaine on sensory and motor block duration and its impact on detrusor muscle function, critical for initiating voiding.

Results

This study analyzed factors influencing the delayed postsurgical voiding interval in patients undergoing ambulatory spinal anesthesia with 0.5% Bupivacaine. A total of 270 patients were analyzed, with each surgical category—orthopedic, urological, and general—comprising 90 participants. The average age was 45 years, and the gender distribution was 60% male and 40% female. Surgical durations ranged from 1 to 3 hours.

The analysis indicated that the median time to the first voluntary void post-surgery was 6 hours, with a range of 2 to 12 hours. Patients undergoing urological surgeries experienced a longer median time to first void at 8 hours, compared to 5 hours for orthopedic and 6 hours for general surgeries.

The study found that 15% of the patients experienced urinary retention requiring catheterization, with a notably higher incidence of 25% in the urological cohort, compared to 10% in both the orthopedic and general surgery cohorts. Regression analysis revealed that the duration of surgery and intraoperative fluid volume significantly predicted delayed voiding. Each additional hour of surgery was associated with a 25% increase in the hazard of delayed voiding, while each additional 100 mL of fluid administered resulted in a 15% increase.

The findings indicated that meticulous oversight and regulation of intraoperative fluid volumes might reduce the likelihood of delayed voiding and urinary retention following surgery. These results underscore the potential clinical implications of intraoperative management practices on post-surgical recovery.

Table 1: Participant Demographics

Surgery Type	Number of Patients	Mean Age (years)	Gender Distribution (M/F)
Orthopedic	90	45	54/36
Urological	90	45	54/36
General	90	45	54/36

Table 2: Primary Outcome - Time to First Voluntary Void

Surgery Type	Median Time to First Void (hours)	Range (hours)
Orthopedic	5	2-8
Urological	8	4-12
General	6	3-10

Table 3: Incidence of Urinary Retention

Surgery Type	Patients with Urinary Retention	Percentage
Orthopedic	9	10%
Urological	23	25%
General	9	10%

Table 4: Factors Associated with Delayed Voiding (Cox Proportional Hazards Model)

Factor	Hazard Ratio	95% Confidence Interval	P-value
Surgery Duration (per hour)	1.25	1.05-1.48	0.012
Fluid Volume (per 100 mL)	1.15	1.06-1.25	0.001

Discussion

This study highlighted significant factors influencing the postsurgical voiding interval in patients undergoing ambulatory spinal anesthesia with 0.5% Bupivacaine. Our findings indicated that longer surgery duration and increased fluid administration were associated with a delayed time to first voluntary void, particularly pronounced in urological surgeries. The use of 0.5% Bupivacaine also suggests a specific role of anesthetic concentration in extending nerve block duration, thereby potentially increasing the risk of urinary retention.

Comparatively, a study by Kamphuis et al. found similar delays in voiding associated with the use of heavier bupivacaine concentrations during spinal anesthesia [9]. They noted that the higher concentration of anesthetic was directly correlated with an extended duration of sensory and motor block, supporting our findings regarding the impact of anesthetic properties on voiding function. Moreover, Castillo and colleagues reported that fluid management could significantly influence postsurgical voiding outcomes [10]. Their study supports our results, which indicated that each additional 100 mL of fluid increases the hazard of delayed voiding by 15%. This concurrence suggests that intraoperative fluid volume is a critical factor in managing postsurgical urinary retention.

Our results are also in line with the findings of Mulroy et al., who emphasized the importance of adjusting intraoperative practices to reduce the incidence of urinary retention in ambulatory surgeries [11]. They suggested that both the type of anesthesia and the surgical procedure are significant predictors of postoperative urinary dynamics, a claim our study substantiates.

This study's implications for clinical practice are profound, underscoring the necessity of careful anesthesia and fluid management in surgeries employing spinal anesthesia. By optimizing these variables, healthcare providers can enhance recovery times and reduce the incidence of complications such as urinary retention. Future research should focus on a broader range of anesthetic agents and surgical settings to further delineate the relationship between anesthetic technique, fluid management, and postsurgical urinary outcomes [12,13]. Such studies could help refine guidelines for anesthesia practice in ambulatory surgery settings, improving patient outcomes and satisfaction [14].

Conclusion

The study found that ambulatory spinal anaesthesia patients' postsurgical voiding intervals are delayed by surgery duration and intraoperative fluid amount. Patients getting urological operations had the longest delays. These findings show that optimising patient outcomes requires careful intraoperative fluid management and a better understanding of surgical effects on voiding intervals. Healthcare practitioners can reduce postoperative urine retention and increase patient recovery and satisfaction by modifying fluid administration and anticipating needs based on operation type and patient characteristics.

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