

Comparative Evaluation of Post Operative Urinary Retention of Intrathecal Bupivacaine and Ropivacaine in Lowerlimb Orthopaedic Surgeries

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Abstract: ***Background and Aims:** Inability to void urine post spinal anaesthesia is always worrisome factor. Present study of bupivacaine 0.5% (12.5mg) 2.5ml versus ropivacaine 0.75% (18.75mg) 2.5ml in equianalgesic doses was taken to observe the correlation of time to void urine and time for functional recovery. **Methods:** We studied forty adult male patients of ASA1 and 11, and assigned to two groups (bupivacaine/ropivacaine) for receiving SA for lower limb elective orthopaedic surgeries, lasting up to 60 mins. Post op patients monitored and time noted when patient voided the urine, in case of inability to void with full bladder sensation or observation of distended bladder by palpation then urinary catheterization done and time noted and data was analysed with SPSS 22.0 for windows software. **Results:** Both groups were comparable in terms of time to void (6.0 ± 1.3 vs. 5.0 ± 1.3 h; $P > 0.05$), Height of sensory block at 20 mins (T10: T8: T6: T4) 5: 7: 8: 0 vs 2: 8: 10: 0; Complete motor block (modified Bromage grade 3 in mins) of SA 9.3 ± 3.1 vs. 9.2 ± 1.9 grade; $P > 0.05$, Duration of motor block (85 ± 8.2 vs 70 ± 5.1) time to complete ambulation (6.7 ± 1.3 vs. 6.0 ± 1.0 h; $P > 0.05$), respectively. Two patients from bupivacaine group required catheterization after 6.5 hrs past surgery due to restlessness. **Conclusion:** Our study concluded that Bupivacaine delays bladder emptying than ropivacaine when bupivacaine and ropivacaine were used in doses of 12.5mg and 18.75mg.*

Keywords: Postoperative urinary retention, Time to void, Modified Bromage score, Time to complete Ambulation

1. Introduction

Ability to void urine is considered as most important criteria for complete motor and sensory ambulation. [1] Postoperative urinary retention (POUR) is one of the most worrisome complications next to hemodynamic adverse effects following spinal anesthesia (SA) defined as “the inability to void 8 hours after end of surgery.” [2-6] or >12 hrs from induction of anaesthesia. Prolonged bladder distention due to POUR may cause anxiety, haemodynamic instability like (tachycardia, hypertension, restlessness), detrusor dysfunction, urinary tract infection etc. [7] Thus attainment of bladder function is a major concern post spinal anaesthesia. [8]. Despite many advantages of SA, there remains the problem of insufficient attainment of urinary bladder function, which significantly delays the discharge after day-case surgery. [9]

This study used fixed doses of 2.5 ml of 0.5% of hyperbaric bupivacaine (12.5mg) and 2.5ml of 0.75% isobaric solution of ropivacaine (18.75 mg) to assess the time to void urine. The primary objective of the study was to compare POUR after SA between bupivacaine and ropivacaine.

2. Material & Methods

This is an observational study which was approved by institutional ethics committee of BVDU (Medical college and hospital, Sangli. The study took place between May 2, 2021 to oct 2 2021, at BVDU (Medical college and Hospital, Sangli. All the participants included in the study provided written informed consent.

Forty male patients aged 18–60 years, with ASA grades I–II, posted for elective lower limb orthopaedic surgeries, lasting less than 60 mins under SA were included in this study.

Patients who were allergic to amide local anesthetics, infection at the site of injection, Coagulopathy or other bleeding disorder, Uncooperative and nonconsented patient, Spinal deformity, Catheterized patients, posted for emergency surgery and inadequate starvation are excluded from the study. Thorough preanesthetic assessment was done. The patients were educated regarding post operative full bladder sensation or inability to void and were instructed to inform to anesthesiologist. After NBM status confirmed an informed consent was obtained.

In the operating room, monitors like ECG, Spo2, NIBP, Temp were attached and recorded. Intravenous access was established and pre-loaded with Ringer lactate 10ml/kg. Under all aseptic precautions lumbar puncture done in the midline at L2–L3 or L3–L4 space after infiltration with 2% lidocaine with 25 G Quincke’s spinal needle after free flow of cerebrospinal fluid confirmed, the study solution was injected intrathecally. Patients were made supine immediately. Throughout the procedure patients received oxygen 5 l/min through venti mask along with continuous noninvasive monitoring and recording. Patient’s bladder emptied by red rubber catheter immediately after spinal anaesthesia and catheter removed.

Onset of sensory block will be assessed in the normal limb by assessing the changes in pin prick sensation every 1min till no sensation (grade 2) is achieved

Gromley and Hill scale:

Normal sensation – 0

Blunted sensation-1

No sensation-2 (Grade 2 was taken as onset of sensory block)

Onset of Motor block will be assessed every 1 min till complete motor block is achieved (grade 3) in the normal limb.

Modified Bromage scale:

0 = no paralysis, able to flex hips/knees/ankles
1 = able to move knees, unable to raise extended legs
2 = able to flex ankles, unable to flex knees
3 = unable to move any part of the lower limb (Grade 3 was taken as complete motor block).

Hemodynamic monitoring was recorded. Hypotension was defined as fall in mean arterial pressure and bradycardia was defined as fall in more than 20% from baseline. Intraoperative events were monitored and treated accordingly.

Postop patients monitored for 8hrs. Time when patient voided urine noted and the patients who did not void voluntarily were monitored for bladder distention by abdominal palpation and if they do not have urge for emptying even after 8hrs then catheterization done after injection of local anaesthetic and time noted and those who reported as full bladder but could not void urine voluntarily be also catheterized and bladder was emptied and time noted.

3. Observation and Results

The demographic data was comparable in both groups (Table 1)

Demographic profile of patients

Variables	Group A (Bupivacaine) n=20	Group B (Ropivacaine) n=20
Age	40.8±13.0	37.2±13.6
ASA (I: II)	04:16	09:11
Weight (kg)	57.4±11.3	59.0±10.7
Duration of surgery (in min)	36±24.0	34±26.0

Above table represents the demographic variables namely such as (age, weight), Duration of surgery, ASA grading. In group A patients who received bupivacaine 0.5% 2.5ml mean age was 40.8±13.0 and mean weight was 57.4±11.3 and mean duration of surgery was 36±24.0. In group B patients who received Ropivacaine 0.75% 2.5ml mean age was 37.2±13.6 and mean weight was 59.0±10.7 and duration of surgery mean was 34±26.

Effect of spinal anaesthesia on sensory and motor blockade [Table 2]

Characteristics (h)	Group A Bupivacaine (n=20)	GroupB Ropivacaine (n=20)	P- value
Height of sensory block at 20 mins (T10: T8: T6: T4)	5: 7: 8: 0	2: 8: 10: 0	0.07
Complete motor block (modified Bromage grade 3)	9.3±3.1	9.2±1.9	>0.05
Duration of motor block (min)	85±8.2	70±5.1	<0.001

Table 2 represents correlation of effects of spinal anaesthesia on sensory functions in both the groups. In Group A patients

who received Bupivacaine 0.5% 2.5ml five patients achieved maximum sensory block after 20 mins at level of T10 and seven patients achieved sensory block over 20 mins at level T8 and eight patients achieved sensory block over 20 mins at level T6. Comparison of effects of spinal anaesthesia on motor function in terms of complete motor block in mins (modified bromage score) in Group A patients who received Bupivacaine 0.5% 2.5ml mean was 9.3±3.1 where as in terms of Duration of motor block (min) mean was 85±8.2. In Group B patients who received Ropivacaine 0.75% 2.5ml two patients achieved sensory block over 20 mins at level of T10 and eight patients achieved sensory block over 20 mins at level T8 and ten patients achieved sensory block over 20 mins at level T6. Comparison of effects of spinal anaesthesia on motor function in terms of complete motor block in mins (modified bromage score) in Group B patients who received Ropivacaine 0.75% 2.5ml mean was 3.0±0.9. In terms of Duration of motor block (min) was 70±5.1.

Comparison of hemodynamic parameters. [Table3]

Hemodynamic parameters	Bupivacaine n=20	Ropivacaine n=20	P value
Mean Blood pressure (mean in mm hg)	72±2	70±3	>0.05
Pulse rate	68±8	69±7	>0.05
SpO2	99±1	99±1	>0.05
Temperature	97.6±1	97.0±1.6	>0.05

Above table compares hemodynamic parameters that includes Mean blood pressure, Pulse rate, Spo2, Temperature. In group A patients who received bupivacaine of 0.5% 2.5 ml one patient developed hypotension with mean less than 50 mm hg where treated with i. v fluids. One patient developed Bradycardia with rate<50 treated with atropine 0.02mg/kg. The haemodynamic parameters of the patient in group A patients who received Bupivacaine where Mean blood pressure was 72±2, Pulse rate was 68±8, Spo2 was 99±1 and temperature was 97.6±1. The haemodynamic parameters of the patient in group B patients who received Ropivacaine 0.5% 2.5 ml where Mean blood pressure was 70±3, Pulse rate was 69±7, Spo2 was 99±1 and temperature was 97.0±1.6. Where p value was insignificant for both the groups.

Table 4: Effects of spinal anaesthesia on time to void and time to complete ambulation

Characteristics (h)	Group A Bupivacaine (n=20)	GroupB Ropivacaine (n=20)	Pvalue
Time to void (hours)	6.0±1.3	5.0±1.3	0.294
Time to complete ambulation (hours)	6.7±1.3	6.0±1.0	0.088

Correlation of time to void (hours) and time to complete ambulation (hours) between two groups were done in the above table where in Group A 18 patients voided urine voluntarily who received Bupivacaine 0.5% 2.5ml with the mean time was 6.0±1.3hrs and time to complete ambulation (hours) mean was 6.7±1.3 with P value of 0.294. In group B patients who received Ropivacaine 0.5% 2.5 ml all patients voided urine voluntarily none of them required urinary catheterization and mean time to void was 5.0±1.3 hrs and

time to complete ambulation (hours) mean was 6.0 ± 1.0 with P value of 0.088.

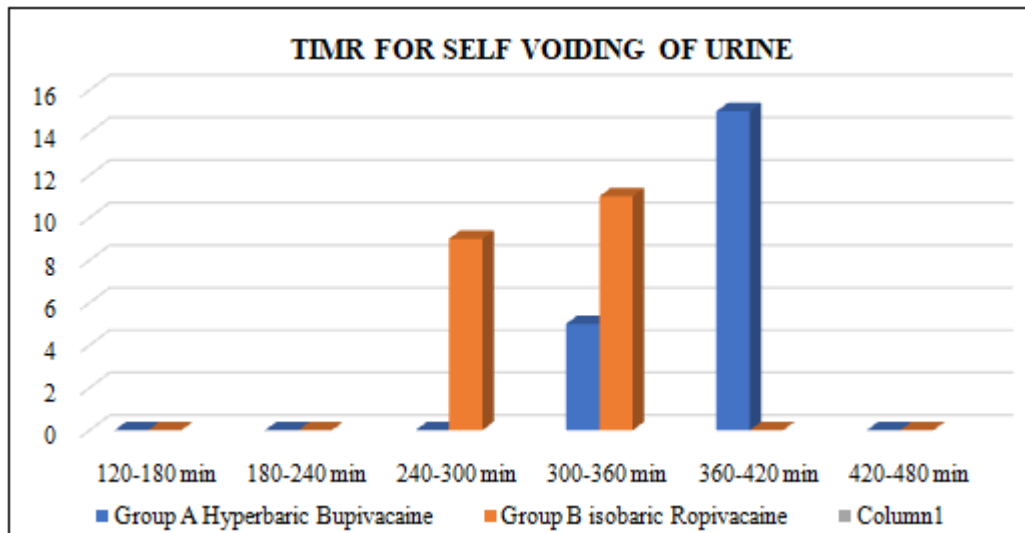


Chart 1: Time for self-voiding of urine

Chart diagram of number of patients on y axis and time to void urine on x axis in minutes explained where from 120-240 mins none of the patients voided the urine. And from 240 to 300 mins 11 patients who received bupivacaine voided the urine whereas 9 patients who received ropivacaine voided the urine. And between 300 to 360 mins Group B who received Ropivacaine 11 members voided the urine when compared with Group A Bupivacaine where 5 of them voided the urine. And between 360-420 min 15 patients who received bupivacaine voided the urine among which 2 patients required catheterization 6.5 hrs past surgery.

4. Discussion

POUR defined as “the inability to void 8 hours after end of surgery with bladder being distended or patient being uncomfortable” [3] or to “inability to void urine >12 hours after induction of anesthesia with >500 ml urine drained on catheterization.” [4] Following SA, especially if a long-acting anesthetic agent or large doses of anesthetic agent being used, this causes prolonged blockage of transmission of action potentials in the sacral nerves innervating the bladder due to which the sensation of urgency to void on bladder distention disappears. [11, 12] This study includes demographic variables that are comparable of Age, Weight which showed no statistical significant. Duration of surgery, ASA (Table 1) grading showed too showed no statistical significant difference when compared between two groups Bupivacaine 0.5% 2.5 ml and Ropivacaine 0.75% 2.5ml.

In terms of correlation between effects of spinal anaesthesia and height of sensory block at 20 mins (T10: T8: T6: T4) and complete motor block (modified Bromage grade 3) where p value no statistically difference obtained. And correlation between effects of spinal anaesthesia and duration of motor block in mins p value was <0.001 with statistical difference. (Table 2)

Intrap hemodynamic parameters which included Mean blood pressure, Pulse rate, Spo2, Temperature (Table 3). On comparison between two groups of bupivacaine and ropivacaine p value was with statistically no significance. Following SA, especially if a long-acting anesthetic agent or large doses of anesthetic agent being used, this causes prolonged blockage of transmission of action potentials in the sacral nerves innervating the bladder due to which the sensation of urgency to void on bladder distention disappears. [11, 12] Thus, the normal urination process is not restored, even after emptying the bladder with a Foley catheter. [4, 13] Such patients are said to have developed POUR. [12-14] With time, the level of analgesia regresses to lower segments to L5, reaching thereafter to S2-S4 and the strength of the detrusor muscle of the bladder start returning to normal, allowing the patient to void urine. [11-12, 15]. Thus, the ability to void is widely considered as one of the important criteria to discharge in-patients successfully. [1, 2]

Correlation of time to void (hours) and time to complete ambulation (hours) between two groups were done in the above mentioned (Table 4) where in Group A patients who received Bupivacaine 0.5% 2.5ml the time to void (hours) mean was 6.0 ± 1.3 and in group B patients who received Ropivacaine 0.5% 2.5 ml time to void (hours) mean was 5.0 ± 1.3 that makes statistically insignificant with p value 0.294. Time to complete ambulation (hours) in Group A patients who received bupivacaine mean was 6.7 ± 1.3 and in Group B patients who received Ropivacaine mean was 6.0 ± 1.0 with P value of 0.088. Hence forth no statistical difference observed in terms of time to void and time to complete ambulation (hours).

Following SA, though group ropivacaine required lesser time to void and no patient developed the POUR where two patients of group bupivacaine required catheterization post 6.5 hrs after surgery. Gautier *et al.* showed that the use of ropivacaine for SA led to reduced incidence of POUR and allowed patients to walk and void urine earlier than the patients who were given bupivacaine in equivalent dose. [14] Higher incidence of POUR was found with the use of long-acting and high-dose local anesthetics. [4, 11] With

short-acting and low-dose local anesthetics, the time to void was shorter because of faster regression of sensory and motor block leading to a rapid recovery of bladder function [18, 19] which is the requirement for same day surgery. It was seen that the time to void urine was more than the time for complete ambulation, consistent with the observation that complete normalization of detrusor strength occurs nearly 1–3.5 h after ambulation. [16, 17].

The meta-analysis by Baldini *et al.* showed that the major perioperative factors that contribute to POUR are a long duration of surgery, and spinal or EA, apart from other preoperative factors. [2] However, the preferred spinal anesthetic agent and dose for minimizing POUR are still unclear. [2] The minimum effective anesthetic concentration of bupivacaine producing anesthesia at T12 level and complete motor paralysis was 10 mg, that is, a dose which produces complete anesthesia within 20 min of administration in 50% of human subjects by blocking transmission of nerve action potential. [20, 21]. The doses less than 7.5 mg are associated with a high failure rate (25%). [18] The minimum analgesic concentration of local anesthetic for bupivacaine was found to be 0.16% in another study. [17].

Therefore, the present study was conducted to compare the effect of SA on POUR using a fixed dose of 12.5. mg of bupivacaine and an adjusted dose of 18.75 mg of ropivacaine for surgical anesthesia for two reasons. First, only isobaric solution of ropivacaine and hyperbaric solution of bupivacaine are commercially available. Second, baricity of the local anesthetic agent (whether hyperbaric or isobaric solution) in equal doses has been found to have no significant effect on time to regression of the sensory blockade due to the distribution in cerebrospinal fluid. [3, 11]

5. Conclusion

Our study concluded that Ropivacaine 0.75% of 2.5 ml (18.75 mg) causes less post op urinary retention than Bupivacaine 0.5% of 2.5ml (12.5mg) when used in equianalgesic doses in lower limb orthopedic surgeries lasting for 45-60 mins.

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