

ORIGINAL ARTICLE

Low dose of isobaric bupivacaine provides lower incidence of spinal hypotension for hip surgery in elderly patients

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ABSTRACT

Background and Objectives: Spinal anesthesia for surgical repair of hip fracture in the elderly is associated with a high incidence of hypotension. The aim of this study was to compare the hemodynamic effects of a single injection of low dose (7.5 mg) versus full dose (15 mg) of isobaric bupivacaine.

Methodology: Fifty patients older than 60 years undergoing surgery for hip fracture were randomly divided into two groups of 25 patients. For spinal anesthesia, Group 1 received 15 mg of 0.5% isobaric bupivacaine and Group 2 received 7.5 mg of the same solution. Hypotension was defined as SBP decrease > 30% of the pressure in nursing and would be dealt with ethylephrine bolus of 2 mg.

Results: All patients showed satisfactory spinal anesthesia. With 15 mg four patients required one dose of ethylephrine and one patient required two doses to correct hypotension. In the group with 7.5 mg no patient developed hypotension. The lower dose reflected in significantly less cephalad spread, less motor block and shorter PACU stay.

Conclusions: The dose of 7.5 mg of isobaric bupivacaine for spinal anesthesia provides sufficient level of analgesia for surgical correction of hip fractures in elderly patients, eliminating the need for the use of vasopressor.

Key words: Hemodynamics; Regional anesthesia; Techniques; Spinal anesthesia

Citation: Imbelloni LE, Braga RL, Filho GBD, da Silva A. Low dose of isobaric bupivacaine provides lower incidence of spinal hypotension for hip surgery in elderly patients. *Anaesth Pain & Intensive Care* 2014;18(1):17-20

INTRODUCTION

Neuraxial anesthesia is often used for surgical treatment of hip fractures in elderly patients.¹ Spinal anesthesia is often preferred for its effectiveness, speed, minimal effect on mental state, reduced blood loss and protection against thromboembolic complications.² In the elderly, there is a high prevalence of clinical problems and reduction of physiological compensation mechanisms.

Spinal anesthesia is associated with risk of severe and prolonged hypotension due to rapid extension of sympathetic block, hindering the cardiovascular adaptation and compromising the blood supply to various vital organs. The administration of vasopressor and crystalloids has

been used to mitigate this effect.^{3,4} Furthermore, ephedrine and other vasopressor can lead to serious cardiac side effects (hypertension or tachycardia). Smaller doses of local anesthetic reduces the severity and incidence of hypotension during spinal anesthesia.^{4,5} These results are of particular concern in elderly patients with high risk of hypotension.

As part of the process of accelerated postoperative recovery, dose reduction should lead to shorter hospital stays. The main objective of this study was to compare the hemodynamic effects of a single injection of low dose (7.5 mg) versus full dose (15 mg) of isobaric bupivacaine in elderly patients undergoing surgical repair of hip fracture,

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with respect to the incidence of hypotension and side effects. As secondary objectives, we studied occurrence of thirst, hunger, nausea, vomiting, and urinary retention.

METHODOLOGY

We studied patients over the age of 60 years undergoing corrective hip fracture, ASA physical status I-III, of both genders from 1st July 2012 to 30 June 2013. The protocol was registered in the Brazil Platform. The Ethics Research Committee approved the study protocol and all patients were informed and agreed to participate in the study. Inclusion criteria were: normal blood volume, no pre-existing neurological disease, no coagulation disorders, without infection at the puncture site, which did not present agitation, mental confusion and / or delirium, did not make use of bladder indwelling catheters, with hemoglobin level >10 g% and who were not in the ICU.

The incidence of hypotension in several studies ranges from 15% to 33%. Taking the level of significance of 5% and a power of 80%, it was 40 patients. Fifty were selected to ensure against data loss. All 50 patients received 200 ml of 12.5% dextrinomaltose orally about 2 to 4 hours before surgery. Upon arrival to the operating room, patients were questioned about the presence of thirst and hunger.

The subjects were randomly divided into two groups (defined by the dose used) using a sealed envelope technique: group 1, 15mg of 0.5% isobaric bupivacaine and group 2, 7.5 mg of isobaric bupivacaine (Cristalia Chemicals and Pharmaceuticals Ltda). The volume would be administered in different groups and injected by a researcher, and the assessment and care would be performed by another researcher.

After sedation with intravenous ketamine (0.1µg/kg) and midazolam (1mg), skin cleansing with chlorhexidine and excess removal, spinal puncture was performed with the patient in sitting position, through the median interspace L2-L3 or L3-L4, using a 26G or 27G Quincke needle (B. Braun Melsungen). After observing CSF confirming the correct position of the needle, 15mg or 7.5 mg of 0.5% isobaric bupivacaine were administered at a rate of 4 ml/min placed in the supine position for evaluation of the parameters studied and released the surgery. Patients were immediately placed in supine position for surgery. The sensorial blockade and motor blockade was evaluated at 10 min after injection.

The level of sensory block, defined as the lack of recognition of a sting with the stylus needle used for spinal anesthesia was assessed bilaterally at the midclavicular line. Motor block was assessed by modified Bromage scale: 0 = free movement of the lower limbs, 1 = inability to raise the extended members, 2 = inability to flex knees, 3 = inability to move the ankles. Sensory and motor block were assessed

in both groups at 10 minutes after injection. In case of failure of the spinal block, a new one would be performed with another 10mg of 0.5% hyperbaric bupivacaine. In case of insufficient time for the procedure it would be finished under general anesthesia with a laryngeal mask.

Hemodynamic parameters were evaluated with five minute intervals throughout the procedure. Hypotension (SBP decrease>30% ward pressure) was treated with etilephrine (2 mg intravenous) while bradycardia (HR<50 bpm) was treated with atropine (0.50 mg intravenous). The total use of vasopressors for each patient complaints and operative as nausea and vomiting were recorded.

In PACU after termination of motor block, patients received 200 ml of 12.5% dextrinomaltose. If in 30 minutes nausea and vomiting did not occur, they could be sent to the infirmary. Data relating to surgical time, recovery time of motor block, time to administration dextrinomaltose, length of stay in the PACU, need for catheterization, pain and treatments administered were recorded by an observer. The postoperative analgesia consisted of lumbar plexus block (anterior or posterior) with neurostimulator and injection of 40 ml of 0.25% bupivacaine and tenoxicam (40 mg) and dipyron (40 mg/kg) in 100 ml of Ringer's lactate. The blockade and the first analgesic dose were performed at the end of surgery in the operating room. It was not part of the study to evaluate the quality of postoperative analgesia, only its duration.

Statistical Analysis

For statistical analysis the Wilcoxon-Mann Whitney test, Chi-Square with Monte Carlo simulation and the Fisher exact test were used. The level of significance was $p < 0.05$.

RESULTS

There is no significant difference between the groups with regard to demographic characteristics (Table I). No failures occurred in both groups. All patients were sedated with intermittent doses of midazolam and ketamine.

All patients received dextrinomaltose. The average duration of fasting was $2:42 \pm 0:16$ hours, with no significant difference between groups. This reflected a lack of thirst and hunger in all patients on arrival to the OR.

Table 1: Demographic data

Variables	Group 1 (15 mg)	Group 2 (7.5 mg)	p-Value
Age (years)	76.44±12.26	75.72±11.43	0.61
Weight (kg)	65.48±9.24	62.92±7.10	0.22
Height (cm)	161.16±7.44	158.56±7.47	0.19
Gender: F / M	18 / 7	19 / 6	1.00 *

* Fisher's exact test

The cephalad spread is shown in Table II, with significant differences between both groups. In the group with 15 mg cephalad dispersion ranged between T₁₀ and T₆, while in the 7.5 mg group showed more uniform dispersion, remaining between T₁₂ and T₁₀. This reflected a mode two segments lower in the group with the lower dose (T₁₁ x T₉), with a significant difference. All patients had complete motor blockade.

Table 2: Cephalad spread of anesthesia

Level sensitive	Group 1 (15 mg)	Group 2 (7.5 mg)	p- Value
T6	2	0	0,00
T7	1	0	
T8	8	0	
T9	10	0	
T10	4	8	
T11	0	9	
T12	0	8	
MODE	T9	T11	

There was no bradycardia and hypotension in the group with 7.5mg. In the group with 15mg bradycardia occurred in one patient, corrected with atropine and hypotension in five patients (20%), with a significant difference ($p < 0.05$). Hypotension was corrected with a single dose in four patients and two doses in one patient.

No significant difference was observed in the infusion with Ringer's lactate ($1,396 \pm 322$ ml with 15 mg and 1224 ± 172 ml with 7.5 mg). All patients received 500 ml of 6% hetastarch during the procedure. Seven patients in group 1 and six in group 2 received blood, without significant difference.

The mean operative time was 2:05 hours and there was no significant difference between groups. The full dose (15 mg) provided a motor block with an average duration of 3:58 h, whereas with half the dose (7.5 mg) the mean duration was 2:07 h, 42% shorter. The time for the dextrinomaltose intake in the PACU was 54.7% shorter in the lower dose group. This reflected a shorter PACU stay (Table 3).

Table 3: Duration of surgery, motor block, time to oral feeding with CHO, and length of stay in the PACU

Variables	Group 1 (15 mg)	Group 2 (7.5 mg)	p-Value
Duration surgery (hrs)	2:12±0:30	1:57±0:20	0.07
Duration block (hrs)	3:58±0:16	2:07±0:08	0.00
Dextrinomaltose time (hrs)	2:41±0:53	1:09±0:26	0.00
PACU time (hrs)	3:09±0:58	1:39±0:29	0.00

No nausea and vomiting were observed in 50 patients. With the higher dose, urinary retention occurred in three patients and mental confusion in two. All patients were discharged from the hospital on the first day postoperatively.

DISCUSSION

This study demonstrates that the use of low dose of isobaric bupivacaine (7.5 mg) for surgical treatment of femur fracture and hip in elderly patients provides satisfactory anesthesia without hypotension. Hemodynamic stability was demonstrated in these patients, and no patient required the use of a vasopressors. In our study, patients experienced lesser hypotension than a full dose study (68%) or continuous spinal anesthesia (31%). The time to recover from the motor block was almost half of that obtained with full dose. This resulted in a shorter stay in the PACU.

Defining the decrease in systolic blood pressure (SBP) less than 90 mmHg, the incidence of hypotension was 30%.⁶ Other studies have used a 30% decrease in the value ward or a decrease of SBP less than 85 mmHg.⁷ In this study, hypotension was not detected with the use of low dose compared with 20% when using the full dose. The stability of blood pressure is a problem in elderly patients, regardless of the technique used. In a retrospective study of 300 patients the incidence of hypotension was lower than 10%, which was dose-dependent incidence.¹ Although the use of low doses of local anesthetic for spinal anesthesia can reduce the severity and incidence of hypotension has not been possible to develop a reliable technique using low-dose single shot. In this study the use of 7.5 mg of isobaric bupivacaine in the sitting position showed that this can be a low dose for femur fracture surgery in the elderly.

Recently it was demonstrated a strong correlation between the dispersion cephalic block analgesia and volume lumbosacral spinal LCS.⁸ These data also indicate the variability and unpredictability of the volume of LCS. Therefore, there is a great variability of local anesthetic spread when injected into the LCS.

Some authors intensify nociceptive blockade of low doses of local anesthetic through the synergistic action of a lipophilic opioids such as fentanyl⁹ and sufentanil,⁵ making it possible to achieve surgical anesthesia in almost all patients. In this study, given the concerns about the potential adverse effects of intrathecal opioids in the elderly, and use the same solution proposed for single injection compared with continuous spinal anesthesia (7.5 mg), it was decided not to add opioid. In this study, spinal anesthesia with low doses provided adequate anesthesia when compared with full doses, no reported failures. No patient complained of pain during surgery, showing that this dose there was no need to use additional lipophilic opioid.

The thirst is a real discomfort presented by most patients when they come to the operating room because of the

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long time of fasting.¹⁰ Studies showed that the patient's perception, this nuisance is intense and result in increased anxiety, dehydration, irritability, weakness and despair.¹⁰ In this study using 200 ml of solution rich in carbohydrates between 2 and 4 hours before surgery reduced the incidence of thirst and may have contributed to the lower incidence of hypotension in both groups.

Previously, rapid infusion of large volumes of crystalloid was used to maintain stable hemodynamics and prophylaxis of hypotension induced by spinal anesthesia. However, this practice is not advisable in elderly patients with cardiac involvement due to the short half-life of crystalloid intravascular and increased risk of heart failure and pulmonary edema. Addition of a colloid to crystalloid seems to be a reasonable conduct because colloids remain longer in the vascular space.¹¹ In this study, the colloid was used in all patients during surgery and may have influenced the reduced incidence of hypotension.

Bromage scale is a qualitative indicator of motor block and not quantitative. However, as all patients had the maximum degree of motor blockade of the lower limbs after injection of the anesthetic, it was not necessary to correlate different degrees.

Confusion in the postoperative period is a transitory situation in the elderly and its etiology is unknown. Several studies of hip fracture unable to correlate confusion with the type of anesthesia used.¹³ Several independent risk factors for the onset of postoperative delirium, including postoperative pain.¹⁴ Because of regional anesthesia

provide better analgesia compared to systemic techniques, it may have some advantages in decreasing confusion postoperatively. Analgesia in this group of patients was performed by lumbar plexus block, avoiding opioids.

Catheterization is a common procedure during major surgery, allowing monitoring of urine output and serves as a marker of hemodynamic stability. This study aims to accelerate the recovery, the urinary catheter was not used in any patient. During surgery, several factors can cause urinary retention: age, gender, comorbidities, drug type and length of surgery, fluid infusion during the surgical procedure and the effects of anesthetic technique.¹⁵ In this study, urinary retention occurred only in the group with the highest dose was used, requiring catheterization relief in the infirmary.

CONCLUSION

In conclusion, this study shows that low-dose (7.5 mg) of isobaric bupivacaine provides adequate spinal anesthesia for surgical repair of hip fracture and / or hip in elderly patients compared with the full dose (15 mg) of the same solution, causing dramatically less hypotension and eliminated the need for the use of vasopressor to control. This low dose gave less cephalad spread, shorter motor block, and shorter PACU stay.

Financial Support: None

Conflict of Interest: None declared by the authors

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