

HEMODYNAMIC STABILITY WITH LOW-DOSE SEQUENTIAL COMBINED SPINAL EPIDURAL ANAESTHESIA IN ELDERLY PATIENTS UNDERGOING LOWER LIMB ORTHOPAEDIC SURGERY: A COMPARATIVE STUDY OF 7.5 MG VERSUS 10 MG INTRATHECAL HYPERBARIC BUPIVACAINE

Hrudaynath Manave¹, Govinda Innani², Raksha Rathi², Jyoti Magar³

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Corresponding Author:

Dr. Govinda Innani,

Email: drgovindainnani@gmail.com

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¹PGMO, Department of Anaesthesia, Khan Bahadur Bhabha Hospital, Kurla (West), Mumbai, Maharashtra, India.

²Assistant Professor, Department of Anaesthesia, Mahatma Gandhi Institute of Medical Sciences (MGIMS), Sevagram, Wardha, Maharashtra, India.

³Professor, Department of Anaesthesia, Lokmanya Tilak Municipal Medical College and General Hospital (LTMMC & GH), Sion, Mumbai, Maharashtra, India.

ABSTRACT

Background: Sequential combined spinal epidural anaesthesia (SCSEA) combines the advantages of spinal and epidural anaesthesia while reducing their individual limitations. Low-dose spinal anaesthesia may improve hemodynamic stability, particularly in elderly patients undergoing orthopaedic procedures. The aim is to compare the hemodynamic effects and anaesthetic efficacy of 7.5 mg and 10 mg intrathecal hyperbaric bupivacaine in SCSEA among elderly patients undergoing lower limb orthopaedic surgery. **Materials and Methods:** A prospective observational study was conducted in 60 patients aged above 60 years undergoing lower limb orthopaedic surgery. Patients were divided into: Group B7.5: Intrathecal hyperbaric bupivacaine 7.5 mg
Group B10: Intrathecal hyperbaric bupivacaine 10 mg
Hemodynamic parameters, incidence of hypotension, bradycardia, vasopressor requirement, and adverse events were recorded and analysed. **Results:** The incidence of hypotension was significantly lower in Group B7.5 compared with Group B10 (3.3% versus 20%; $p=0.044$). No episodes of bradycardia occurred in either group. Both groups provided satisfactory surgical conditions without requiring conversion to general anaesthesia. The median peak sensory level achieved was T8 in both groups with no significant difference ($p=0.085$). **Conclusion:** Low-dose intrathecal hyperbaric bupivacaine (7.5 mg) provided better hemodynamic stability while maintaining satisfactory anaesthetic efficacy in elderly patients.

INTRODUCTION

Elderly patients undergoing orthopaedic procedures present significant challenges because of age-related physiological changes, multiple comorbidities and reduced cardiovascular reserve. Maintaining perioperative hemodynamic stability is particularly important in this patient population.^[1]

Spinal anaesthesia remains one of the most commonly used regional anaesthetic techniques for lower limb surgery because of its rapid onset, simplicity and reliability. However, extensive sympathetic blockade may result in hypotension and bradycardia, particularly in elderly patients with reduced physiological compensatory mechanisms.^[2]

Epidural anaesthesia provides greater control over the level and duration of anaesthesia and allows extension of postoperative analgesia. However, it has limitations including slower onset and larger local anaesthetic requirements.^[3]

Rawal first introduced sequential combined spinal epidural anaesthesia using low-dose intrathecal local anaesthetic followed by epidural supplementation to achieve the required surgical level while minimizing abrupt sympathetic blockade.^[4]

Several studies have reported advantages of low-dose SCSEA in high-risk and elderly patients. However, few studies have compared different intrathecal doses of hyperbaric bupivacaine among elderly orthopaedic patients. Therefore, the present study was conducted

to compare 7.5 mg and 10 mg intrathecal hyperbaric bupivacaine in SCSEA.

Objectives

Aim

To compare hemodynamic stability between 7.5 mg and 10 mg intrathecal hyperbaric bupivacaine during sequential combined spinal epidural anaesthesia.

Objectives

1. To compare incidence of hypotension
2. To compare incidence of bradycardia
3. To evaluate vasopressor requirement
4. To assess adverse events.

MATERIALS AND METHODS

Study design: Prospective observational study

Study population: 60 patients undergoing lower limb orthopaedic surgery

Inclusion Criteria

- Age >60 years
- ASA I–III
- Both sexes

Exclusion Criteria

- Patient refusal
- ASA IV and above
- Contraindications to neuraxial blockade
- Hypersensitivity to local anaesthetics

Ethical Considerations

The study was approved by the Institutional Ethics Committee, Lokmanya Tilak Municipal Medical College and General Hospital and written informed consent was obtained from all participants prior to enrolment in the study. IEC NO: IEC/DISS/33/14

Study Procedure

Patients were divided into two groups:

Group B7.5 (n=30):

Received 1.5 ml of 0.5% hyperbaric bupivacaine (7.5 mg)

Group B10 (n=30):

Received 2 ml of 0.5% hyperbaric bupivacaine (10 mg)

Hemodynamic monitoring included:

- Heart rate
- Systolic blood pressure

Hypotension was defined as: Reduction of systolic blood pressure >20% from baseline.

Bradycardia was defined as: Heart rate <50 beats/min.

Statistical Analysis

Data were analysed using Statistical Package for Social Sciences (SPSS) version 10. Continuous variables were expressed as mean±standard deviation, whereas categorical variables were expressed as frequencies and percentages. Comparisons between groups were performed using Chi-square test or Fisher's exact test as appropriate. A p-value <0.05 was considered statistically significant.

RESULTS

The demographic characteristics of the study participants are presented in [Table/Figure 1]. The mean age was comparable between Group B7.5 (68.13 years) and Group B10 (67.07 years), with no statistically significant difference. Gender distribution was similar in both groups, with males constituting 60.0% and 66.7% of participants in Group B7.5 and Group B10, respectively. The groups were also comparable with respect to weight, height, and ASA physical status. No statistically significant differences were observed in any baseline demographic or clinical characteristics, indicating that the two groups were well matched for comparison.

Table 1: Demography

Parameters	Group B7.5 (7.5 mg)	Group B10 (10mg)	P value
No. of Cases	30	30	
Age (yrs)			
Mean	68.13	67.07	0.370
SD	04.58	04.51	
Range	61-75 yrs	60-74 yrs	(NS)
Sex (%)			
Male	18(60.0)	20(66.7)	0.763
Female	12(40.0)	10(33.3)	(NS)
Weight (kg)			
Mean	58.97	57.30	
			0.207
SD	04.94	05.21	
Range	53.00-71.00 kgs	52.00-70.00 kgs	(NS)
Height (Cms)			
Mean	159.73	161.90	
			0.123
SD	05.14	05.59	
Range	152.00 – 168.00cms	150.00 – 170.00cms	(NS)
ASA (%)			
I	14(46.7)	11(36.7)	
			0.944(NS)
II	09(30.0)	12 (40.0)	
III	07 (23.3)	07 (23.3)	0.213(NS)

The median peak sensory level achieved was T8 in both groups, and the difference was not statistically significant ($p=0.085$).

Table 2: Comparison of peak Sensory level achieved with initial intrathecal dose between two groups

Sensory Level	Group B7.5 (N=30) No. %		Group B10 (N=30) No. %	
T 6	01	03.3	05	16.7
T 7	06	20.0	06	20.0
T 8	17	56.7	17	56.7
T 9	03	10.0	03	06.6
T 10	03	10.0	00	00.0
Median	T8		T8	
p value	0.085(NS)			



Table/Figure 3: Comparison of peak Sensory level achieved with initial intrathecal dose between two groups

Hypotension was significantly more common in Group B10 than in Group B7.5 ($p=0.044$). No

episodes of bradycardia were observed. All patients who developed hypotension were treated with intravenous ephedrine.

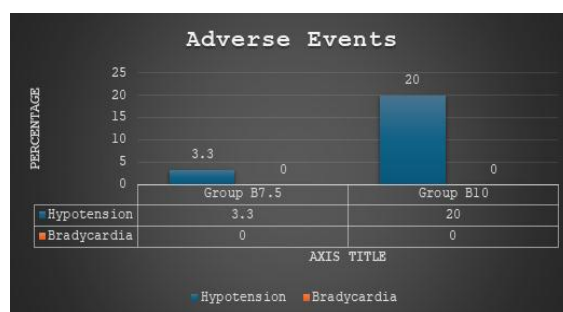


Figure 5: Adverse event

None of the patients required supplementary analgesia or conversion to general anaesthesia.

Table 3: Adverse events

Variable	Group B7.5	Group B10	P value
Hypotension	1 (3.3%)	6 (20%)	0.044
Bradycardia	0	0	NS

Table 6: Requirement of Supplementary Anaesthesia

Variable	Group B7.5	Group B10
Supplementary analgesia	0	0
General anaesthesia	0	0

DISCUSSION

The present study evaluated two doses of intrathecal hyperbaric bupivacaine (7.5 mg and 10 mg) administered as part of sequential combined spinal epidural anaesthesia (SCSEA) in elderly patients undergoing lower limb orthopaedic surgery. The results showed that both doses provided adequate sensory blockade and satisfactory surgical conditions. However, the lower dose was associated with better hemodynamic stability.

The median peak sensory level achieved in both groups was T8, and the distribution of sensory block levels was comparable, with no statistically significant difference between the groups ($p=0.085$). More than half of the patients in each group achieved a sensory level of T8, suggesting that reducing the intrathecal dose did not affect the quality or extent of sensory blockade. Hamdani et al. reported similar findings in high-risk geriatric patients and showed that low-dose sequential CSEA could provide

effective sensory block when combined with epidural supplementation. 5 Bhattacharya et al. also found that lower doses of intrathecal bupivacaine produced satisfactory sensory blockade without compromising surgical anaesthesia.^[6]

Our findings are further supported by Choi et al., who demonstrated that combined spinal epidural anaesthesia could achieve adequate sensory levels even with smaller intrathecal doses when compared with conventional spinal anaesthesia.^[7] Leo et al. likewise reported that although higher doses may result in slightly higher sensory levels, lower doses provide comparable clinical effectiveness with improved safety.^[8]

A key finding of the present study was the significantly lower incidence of hypotension in Group B7.5 (3.3%) compared with Group B10 (20%). This indicates that reducing the intrathecal dose may limit sympathetic blockade and thereby improve cardiovascular stability. Similar observations were reported by Bhattacharya et al.,

who found lower rates of hypotension with sequential CSEA than with conventional spinal anaesthesia in elderly patients.^[6] Hamdani et al. also reported fewer hemodynamic disturbances when low-dose spinal anaesthesia was combined with epidural supplementation.^[5]

The importance of dose reduction has been highlighted by several other investigators. Tummala et al. reported better hemodynamic stability with combined spinal epidural anaesthesia in geriatric orthopaedic patients and suggested that the technique is particularly useful in patients with limited cardiovascular reserve.^[9]

Van de Velde et al. demonstrated a dose-dependent increase in hypotension with larger doses of hyperbaric bupivacaine.^[10]

Likewise, Teoh et al. showed that ultra-low-dose spinal techniques significantly reduced hypotensive episodes while still providing adequate surgical anaesthesia.^[11]

Hartmann et al. identified advanced age and higher sensory block levels as important risk factors for spinal anaesthesia-induced hypotension.^[12]

This supports the use of lower intrathecal doses in elderly patients, who are often more susceptible to cardiovascular instability. In addition, Chen et al. reported that the effective dose of intrathecal bupivacaine decreases with advancing age, indicating that elderly patients may achieve satisfactory anaesthesia with smaller doses.^[13]

Another important observation in the present study was that none of the patients required supplementary analgesia or conversion to general anaesthesia. This suggests that both dosing regimens provided adequate surgical conditions despite differences in their hemodynamic effects. Similar findings were reported by Gupta et al., who concluded that sequential CSEA offers reliable anaesthesia while maintaining the flexibility of epidural supplementation when required.^[14]

Bhattacharya et al. and Tummala et al. also reported excellent surgical conditions with low-dose sequential techniques without the need for conversion to general anaesthesia.^[6,9]

The findings of the present study add to the growing evidence supporting the use of lower intrathecal doses in elderly patients to minimise cardiovascular adverse effects while maintaining adequate anaesthesia.

Overall, the results of the present study indicate that both 7.5 mg and 10 mg intrathecal hyperbaric bupivacaine are effective for sequential combined spinal epidural anaesthesia in elderly patients. However, the 7.5 mg dose provides comparable sensory blockade and surgical conditions with a significantly lower incidence of hypotension. Therefore, low-dose SCSEA appears to be a safer and more suitable option for elderly patients undergoing lower limb orthopaedic surgery, especially those with increased cardiovascular risk.

Limitation

The present study was conducted at a single tertiary care centre and involved a relatively small sample size. Long-term postoperative outcomes and patient satisfaction were not assessed. Larger multicentric studies are required to confirm the findings.

CONCLUSION

The findings of this study suggest that a lower intrathecal dose of hyperbaric bupivacaine can achieve the desired anaesthetic effect without compromising surgical conditions in elderly patients undergoing lower limb orthopaedic procedures. While both dosing regimens performed well clinically, the 7.5 mg dose was associated with fewer hemodynamic disturbances and a more favourable safety profile.

These results highlight the value of tailoring intrathecal drug dosage to the physiological needs of elderly patients rather than routinely using higher doses. Sequential combined spinal epidural anaesthesia with low-dose bupivacaine offers an effective balance between adequate anaesthesia and cardiovascular stability, making it a practical option for geriatric orthopaedic surgery. Further studies with larger sample sizes may help confirm these findings and support wider clinical application.

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