International Journal of Medical and Pharmaceutical Research

Online ISSN-2958-3683 | Print ISSN-2958-3675
Frequency: Bi-Monthly
Available online on: https://ijmpr.in/

Case Series

Continuous Spinal Anaesthesia in Geriatric Patients for Orthopaedic Procedures Involving the Proximal Femur: A Case Series

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OPEN ACCESS

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Received: 19-03-2026
Accepted: 22-04-2026
Available online: 30-04-2026

ABSTRACT

Objective: to evaluate the onset of sensory and motor blockade, intra-operative haemodynamic changes and the extent of the block.
Method and methodology: 12 geriatric patients scheduled for proximal femur surgery were administered spinal anaesthesia with 1.3 mL hyperbaric bupivacaine and 0.2 mL inj. Fentanyl in L3,4 space (total 1.5mL) with an 20G epidural catheter inside the subarachnoid space. Onset and height of sensory, motor and haemodynamic changes were recorded.
Results: Mean time to onset of sensory and motor blocks are 271.5±14.12 and 311.5±17.76 seconds respectively. No significant hypotension and bradycardia were noted.
Conclusion: Continuous spinal anaesthesia (CSA) can be used safely and effectively in geriatric patients undergoing proximal femur orthopaedic procedures. It provides a stable hemodynamic conditions along with the provision of prolonging the duration of anaesthesia through graded dosing.

Keywords*: Continuous spinal anaesthesia, proximal femur fracture surgery, intrathecal catheter.*

INTRODUCTION

Continuous spinal anaesthesia (CSA) is a technique in which spinal anaesthesia is established and maintained by the intermittent administration of small doses of local anaesthetic into the subarachnoid space through an indwelling catheter.[1]. First described in 1907 by Dean, Edward Tuohy in 1944 introduced intrathecal catheterisation using a ureteral catheter inserted 4–5 cm through a 15-gauge Huber-point needle, demonstrating that incremental dosing reduced local anaesthetic requirements by 20–25% compared with single-shot spinal anaesthesia.[1]

There is no clear survival advantage of any single anaesthetic technique or agent in elderly patients.[2] Regional anaesthesia provides multiple benefits over general anaesthesia in patients undergoing orthopaedic procedures.[3] CSA is considered safe in high-risk patients due to improved control of local anaesthetic spread and reduced cardiovascular consequences.[4]

The elderly population exhibit considerable variability in functional status, frailty, and comorbidities, and is more susceptible to cognitive complications such as postoperative cognitive dysfunction (POCD) and delirium.[5]As elderly patients frequently require a higher level of perioperative care than younger patients, strategies aimed at optimising anaesthetic management to reduce complications and improve outcomes are of significant benefit to the individual patients and society.[6] Continuous spinal anaesthesia is considered advantageous as it offers greater control over anaesthetic management compared with the conventional single-bolus spinal injection technique.[7]It has been reported that CSA produces an acceptable sensory and motor blockade limited haemodynamic changes and side effects by allowing the induction dose to be reduced and fractionated via a catheter.[2]

CSA is supported as an option to general anaesthesia in high-risk patients having lower limb or lower abdominal surgeries, where general anaesthesia could raise morbidity and mortality.[8] This study was conducted on geriatric patients undergoing orthopaedic procedures of the proximal femur to assess the safety and efficacy of continuous spinal anaesthesia. The

objectives were to evaluate the onset of sensory and motor blockade, intra-operative haemodynamic changes and the extent of the block.

MATERIALS AND METHODS

This study was carried out on 12 patients of geriatric age group (between 75 to 95 Years) scheduled for orthopedic procedures on the proximal femur in the Department of Anesthesiology and Critical Care in Lakhimpur Medical College and Hospital after obtaining informed written consent.

Prior to surgery, a thorough pre-anaesthetic check-up and baseline investigations were done, the anesthetic procedure was explained to all the patients. Frailty was assessed using Clinical Frailty Scale (CFS)[9]. Once the patient was in the operative room, standard monitoring equipments were attached, including peripheral oxygen saturation (SpO2) measurement, non-invasive blood pressure monitoring, initial pulse rate measurement, and electrocardiogram. Venous access was secured with an 18G cannula. Ringer's lactate was administered for intravenous co-loading at a rate of 15ml/Kg. All anaesthetic equipments were checked and the operation table was kept in a neutral position. Under full aseptic and antiseptic precautions, an 18G tuohy needle was inserted into the subarachnoid space via L3-L4 intervertebral space using a midline/para-median approach. Confirmation of subarachnoid space was done by clear flow of CSF and a commercially available 20G epidural catheter (Perifix one 401 filter set) was threaded into the space up to a distance of 2-3 cm and fixed with commercially available transparent adhesive film. Next, the patients were placed in a supine position and 1.3 ml of 0.5% hyperbaric bupivacaine heavy with 0.2 ml (10 mcg) of injection fentanyl was given. Oxygen face mask was connected at 4 litres per minute. The onset and height of sensory block was assessed bilaterally using the loss of cold sensation with an alcohol swab technique, moving upwards from below along the mid-axillary line along with pinprick method at 5 minutes and 15 minutes after the administration of the LA and the highest level of sensory block achieved was recorded. After achieving a block level of at least up to L1 and a Modified Bromage scale of 2 (for motor block), the surgeons were allowed to continue with the procedure.

Hemodynamic parameters were noted during the operative period including heart rate, mean arterial blood pressure, and SpO_2 were monitored every 2 minutes for the first 10 minutes and every 5 minutes till the completion of the surgery.[10] Further dose of 0.5 ml of Injection 0.5% hyperbaric bupivacaine was given every 45 minutes through epidural catheter till the completion of the surgery. At the end of the surgery, the catheter was removed and sterile antiseptic dressing was applied.

RESULTS

Of the 12 patients enrolled for the study, 5 were males with average age 84±3.39 and 7 were females with average age 82.7±6.42 years. The average age of the patients was 83.25±5.20 years.

Gender	Male	Female
No. of patients	5	7
Average age in yrs	82.7±2.42	84±1.52

ASA grading	ASA I	ASA II	ASA III
No. of patients	3	6	3

Frailty level	Mild frailty	Moderate frailty	Severe frailty
No. of patients	2	6	4

	Sensory block	Motor block
Mean onset of block in seconds	274.5±14.12	311.5±17.76

1.3 ml of hyperbaric bupivacaine with 0.2 mL fentanyl administered via spinal catheter (total volume 1.5 mL), considering epidural catheters can hold up to 1 mL of dead space[11], 0.5 mL will reach the subarachnoid space. It was found 1.5 mL as initial drug volume was sufficient for providing adequate anaesthesia in 10 patents whereas 2 patients needed additional 0.5 mL of hyperbaric bupivacaine.

LA Requirement	2.5 mg	5 mg
No. of patients	10	2

	Co-morbidities					
	Hypertension	T2DM	Post CVA status	COPD	Hypothyroid	CAD
No. of Patients	4	5	3	2	4	2

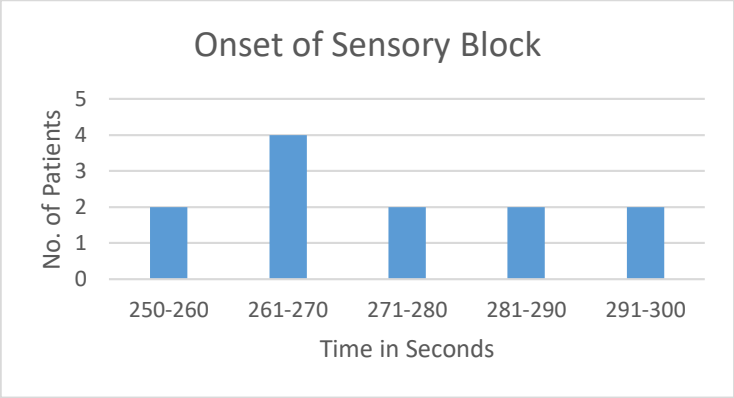

Fig 1: Onset of sensory block

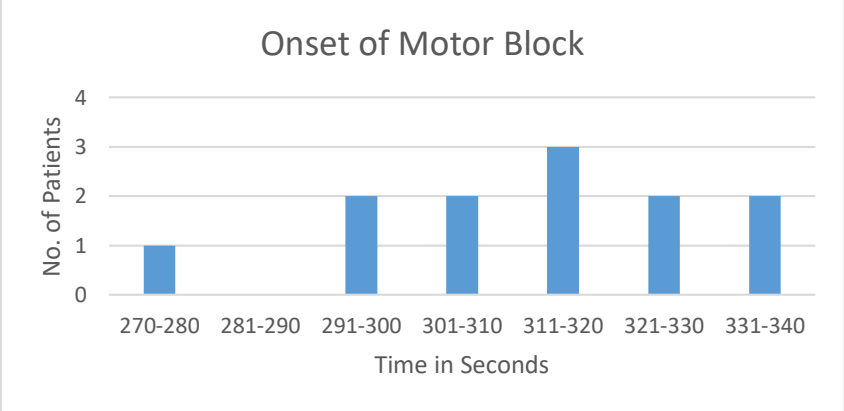

Fig 2: Onset of motor block

Regarding hemodynamic variation, no significant hypotension (SBP<90mmHg) or bradycardia (HR<55/min) was observed in the patients. The patients were stable throughout the intraoperative period.

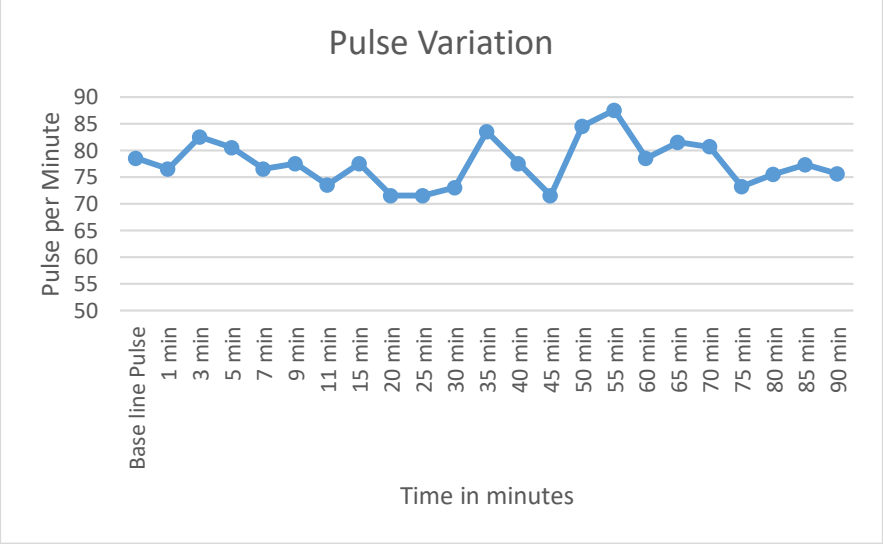

Fig 3: Pulse distribution of patients

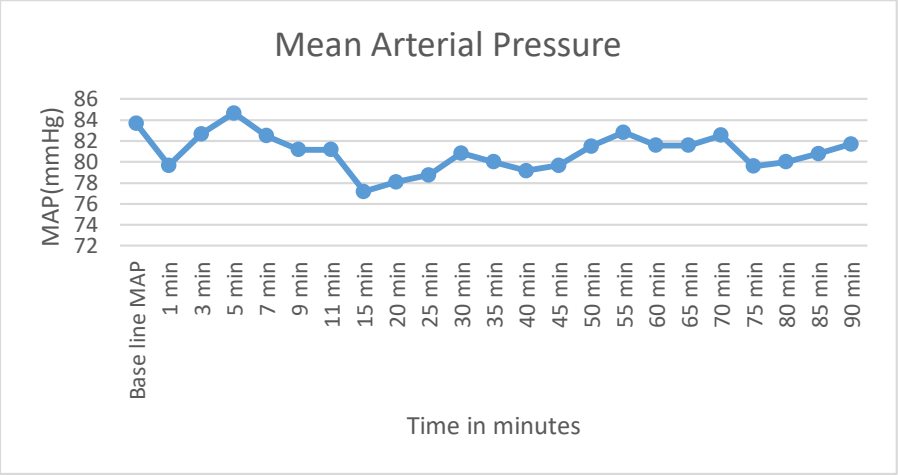

Fig 4: Mean Arterial Pressure Distribution of patients

DISCUSSION

The results of the present study indicate that CSA is effective and safe technique for geriatric patients undergoing orthopedic procedures on the proximal femur.

Clinical studies suggest that CSA provides greater hemodynamic stability than other neuraxial techniques[12]. The choice of anaesthetic agent for CSA remains controversial, but given its more predictable block and routine safe use in single dose spinal anesthesia[13], hyperbaric bupivacaine was chosen for this patient group as it allows control of the level of block by dose and position.

In our study, the mean onset of sensory blockade was found to be 274.5±14.12 seconds. Our findings are consistent with the study done by Elfeky, Mohamad A et al[4] where they compared continuous spinal anesthesia with continuous epidural anesthesia in high-risk elderly patients undergoing major orthopedic lower limb surgeries and found the onset time with CSA group to be significantly lower than CEA group (5.24 mis vs 18.20 mins). This rapid onset of sensory and motor blockade enables early identification of anesthetic failure and prompt correction of inadequate sensory blockade.[4] Similar results were obtained by Gulcin O et al[14] in their study where they got rapid onset with continuous spinal anesthesia in high-risk patients undergoing abdominal surgery, thus allowing easy titration to individual patient tolerance and desired clinical end point.

In the present study, the time to reach sensory block upto T12 was 274.5±14.12 seconds. This is slightly less compared what was found by by Elfeky, Mohamad A et al[4] in their study where they found the time to reach T10 in CSA group to be significantly lesser than the CEA group (8.40 vs 18.8 mins). In the present study, the mean onset of motor blockade and time to reach Bromage II block was 311.5±17.76 seconds. Similar results were obtained by the studies done by Elfeky, Mohamad A et al[4] and Imbelloni et al[3].

In our study, there was slight fall BP 2 minutes after administration of LA however it did not require vasopressor administration. All the patients remained hemodynamically stable throughout the procedure. Our results are similar to what was found by Elfeky, Mohamad A et al[4] where they found that the number of patients treated for hypotension and total dose of ephedrine was more in the CEA group than in the CSA group, though the maximum decrease in MAP below the baseline values was less than 30% which is not clinically significant. These findings are consistent with studies by **Denny NM et al[1]**, Gulcin O et al[14] and by **Saber R et al**[15], which reported less reduction in blood pressure, improved cardiovascular stability, and no cases of severe hypotension with CSA.

There was no incidence of PDPH in our study and this is consistent with other studies by Elfeky, Mohamad A et al[4], Gulcin O et al[14] and Leyla T et al[16]. However, in another study by Alonso E et al[17] in caesarean patients, there was a 29% incidence of PDPH where 18% of the patients required a blood patch.

Cauda equina syndrome is a serious but rare complication of CSA[18], mainly associated with micro-catheters and hyperbaric, highly concentrated local anesthetics, particularly 5% lidocaine[19]. In our study, the use of macro-catheters and hyperbaric bupivacaine resulted in no neurological complications, supporting the safety of CSA when properly applied.

CONCLUSION

Continuous spinal anaesthesia (CSA) can be used safely and effectively in elderly patients undergoing lower limb orthopedic surgeries involving proximal femur. It can be a beneficial alternative anaesthetic technique in elderly patients in whom large doses of local anesthetics can lead to adverse hemodynamic changes. It allows us to achieve a faster onset

of neuraxial blockade as compared to other titratable techniques, while simultaneously providing stable hemodynamic conditions in patients along with the provision of prolonging the duration of anaesthesia through graded dosing.

LIMITATIONS OF THE STUDY

1. Patients could not be followed up for long to evaluate possible development of neurological complications.
2. Difficulty in pain assessment due to cognitive decline in the study population due to advanced age.
3. Effect of anaesthesia on cognition was not assessed.

CONFLICT OF INTEREST: nil.

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