ORIGINAL RESEARCH

A comparative analysis of sequential combined spinal epidural anesthesia and epidural volume extension in patients undergoing lower limb orthopaedic surgery

[1]Dr. Ankit Madan, [2]Dr. Partha Chakraborty, [3]Dr. Kashi Nath Singh, [4]Dr. Rai Ankit Satyajeet

[1]Assistant Professor, Department of Orthopaedics, KM Medical College and Hospital, Mathura, UP, India
[2]Assistant Professor, Department of Anaesthesia, FH Medical College and Hospital, Etmadpur, UP, India
[3]Assistant Professor, Department of Surgery, FH Medical College and Hospital, Etmadpur, UP, India
[4]Assistant Professor, Department of Orthopaedics, Lord Buddha Koshi Medical College and Hospital, Saharsa, Bihar, India

Corresponding Author
Dr. Rai Ankit Satyajeet
Assistant Professor, Department of Orthopaedics, Lord Buddha Koshi Medical College and Hospital, Saharsa, Bihar, India

Received: 23 October, 2021 Accepted: 26 November, 2021

ABSTRACT
Background: In contemporary anesthesia practice, the combined spinal epidural (CSE) is widely used. It offers postoperative analgesia, a quick onset, a longer duration, and a lower risk of local anesthetic toxicity. The present study compared sequential combined spinal epidural anesthesia with epidural volume extension in lower limb orthopaedic surgery. **Materials & Methods:** 90 patients scheduled for lower limb orthopaedic surgery of both genderswere divided into 2 groups of 45 each. Group I was sequential combined spinal epidural (SCSE) group and group II was epidural volume extension (EVE) group. All underwent lower limb orthopaedic surgery. In both groups, metrics were recorded, including anesthesia readiness time, modified Bromage motor score, motor block duration, sensory regression time to T12, general anesthesia supplementation, time to first request for postoperative analgesia, number of patients requiring pethidine, and mean pethidine consumption. **Results:** Group I had 25 males and 20 females and group II had 22 males and 23 females. Duration of surgery was 131.2 minutes in group I and 124.4 minutes in group II. Anesthesia readiness time was 23.1 minutes in group I and 21.5 minutes in group II. Duration of motor block was 184.2 minutes in group I and 154.2 minutes in group II. The mean modified bromage motor score was 2 in group I and 1 in group II. The difference was significant ($P< 0.05$). The mean pethidine consumption (mg) was 4.2 mg in group I and 3.1 in group II. Time for sensory regression to T12 was 131.2 minutes in group I and 120.2 minutes in group II. Supplementation with general anesthesia was 1.6 in group I and 3.2 minutes in group II, time to first request for postoperative analgesia was 226.6 minutes in group I and 190.1 minutes in group II. Number of patients who required pethidine was 6 in group I and 4 in group II. The difference was significant ($P< 0.05$). **Conclusion:** Both the sequential combined spinal epidural anesthesia and epidural volume extension procedures work well for individuals having orthopedic surgery on their lower limbs.

Key words: Combined spinal epidural, orthopaedic surgery, Epidural volume extension

INTRODUCTION

In contemporary anesthesia practice, the combined spinal epidural (CSE) is widely used. It offers postoperative analgesia, a quick onset, a longer duration, and a lower risk of local anesthetic toxicity. Because of their lower cardiorespiratory reserve and other comorbidities, elderly patients undergoing major orthopedic surgery are far more vulnerable than younger ones.[1]

Although spinal anesthetic is a rapid and easy procedure, there is a chance that it can cause severe hypotension.[2] Sequential combined spinal epidural (SCSE) is a modified kind of anesthesia in which the block is prolonged cephaladically with the epidural medication after a minimal spinal dose insufficient for surgery is used to try to reduce the incidence of hypotension. This method is becoming well-known in the field of obstetric anesthesia, but it can also be

applied to patients having orthopedic surgery because of hemodynamic stability.[3]

Sequential combined spinal epidural (SCSE) is a modified kind of anesthesia in which the block is prolonged cephaladically with the epidural medication after a minimal spinal dose insufficient for surgery is used to try to reduce the incidence of hypotension.[4] Because of its hemodynamic stability, this method is becoming well-known in the field of obstetric anesthesia but can also be applied to patients having orthopedic surgery.

Another modified CSE technique is epidural volume extension (EVE). This method involves injecting normal saline into the epidural area just after the local anesthetic is injected intrathecally.[5] The spinal needle may help with accurate epidural space identification, which is another theory put forth to explain the increased success rate of the CSE procedure. When employing a needle-through-needle CSE approach, a spinal needle with sufficient CSF return indicates that the Tuohy needle should be positioned correctly in the epidural area.[6]

The present study compared sequential combined spinal epidural anesthesia with epidural volume extension in lower limb orthopaedic surgery.

MATERIALS & METHODS

The present study was conducted on90 patients scheduled for lower limb orthopaedic surgery of both genders. All were informed regarding the study and their written consent was obtained.

Data such as name, age, gender etc. was recorded. Patients were divided into 2 groups of 45 each. Group I was sequential combined spinal epidural (SCSE) group and group II was epidural volume extension (EVE) group. All underwent lower limb orthopaedic surgery. In both groups, metrics were recorded, including anesthesia readiness time, modified Bromage motor score, motor block duration, sensory regression time to T12, general anesthesia supplementation, time to first request for postoperative analgesia, number of patients requiring pethidine, and mean pethidine consumption.Results were subjected to statistical analysis. P value less than 0.05 was considered significant.

RESULTS

Table I Distribution of patients

Groups	Group I	Group II
Method	Sequential combined spinal epidural	Epidural volume extension
M:F	25:20	22:23

Table I shows that group I had 25 males and 20 females and group II had 22 males and 23 females.

Table II Assessment of baseline parameters

Parameters	Group I	Group II	P value
Duration of surgery (minutes)	131.2	124.4	0.19
Anesthesia readiness time (minutes)	23.1	21.5	0.05
Duration of motor block (minutes)	184.2	154.2	0.02
Modified Bromage motor score	2	1	0.05

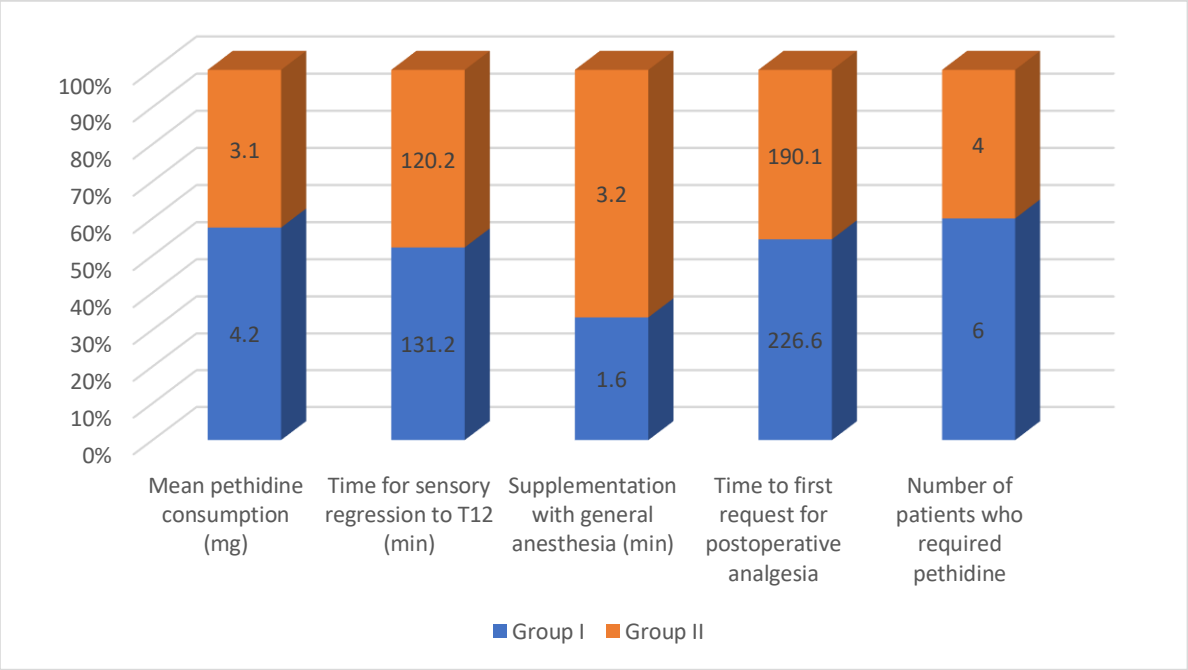
Table II shows that duration of surgery was 131.2 minutes in group I and 124.4 minutes in group II. Anesthesia readiness time was 23.1 minutes in group I and 21.5 minutes in group II. Duration of motor block was 184.2 minutes in group I and 154.2 minutes in group II. The mean modified bromage motor score was 2 in group I and 1 in group II. The difference was significant (P< 0.05).

Table III Assessment of parameters

Parameters	Group I	Group II	P value
Mean pethidine consumption (mg)	4.2	3.1	0.82
Time for sensory regression to T12 (min)	131.2	120.2	0.04
Supplementation with general anesthesia (min)	1.6	3.2	0.01
Time to first request for postoperative analgesia	226.6	190.1	0.02
Number of patients who required pethidine	6	4	0.64

Table III shows that mean pethidine consumption (mg) was 4.2 mg in group I and 3.1 in group II. Time for sensory regression to T12 was 131.2 minutes in group I and 120.2 minutes in group II. Supplementation with general anesthesia was 1.6 in group I and 3.2 minutes in group II, time to first request for postoperative analgesia was 226.6 minutes in group I and 190.1 minutes in group II. Number of patients who required pethidine was 6 in group I and 4 in group II. The difference was significant (P< 0.05).

Graph I Assessment of parameters



DISCUSSION

In contemporary anesthesia practice, the combined spinal epidural (CSE) is widely used. It offers postoperative analgesia, a quick onset, a longer duration, and a lower risk of local anesthetic toxicity. Because of their lower cardiorespiratory reserve and other comorbidities, elderly patients undergoing major orthopedic surgery are far more vulnerable than younger ones. Poor sacral spread and insufficient sensory blocking may be linked to epidural anesthesia.[7] However, it permits moderate dosage, allowing for sporadic evaluation of blood pressure changes and the completeness of sensory blocking. Compared to epidural anesthesia alone, a CSE combined with a low-dose spinal anesthetic can reliably produce dense, non-patchy sensory blocking with enhanced sacral distribution and comparably stable hemodynamics.Understanding how the thecal sac and the epidural space interact is necessary for using the CSE procedure correctly.[8] The thecal sac may compress as a result of elevated pressure in the epidural compartment caused by the administration of an epidural fluid bolus.9. Increased cephalad spread of the spinal anesthetic in the intrathecal region during CSE may result from the use of epidural bolus injection and the compression of the thecal sac.[9] This volume-based phenomena is known as epidural top-up, epidural volume expansion, or epidural volume extension (EVE).The effects of saline and local anesthetics on increased spinal anesthetic spread seem to be comparable.[10] The degree of EVE is also influenced by the local anesthetic baricity and the timing of the epidural bolus. Intrathecal spread is more noticeable if the epidural bolus is given soon after the spinal dosage than if it is given more than 20 minutes later.[11]The present study compared sequential combined spinal epidural anesthesia with epidural volume extension in lower limb orthopaedic surgery.

We found that group I had 25 males and 20 females and group II had 22 males and 23 females. Mutahar et al[12]evaluated the changes in hemodynamic parameters while using SCSE block and spinal anaesthesia for lower limb surgeries. Sixty ASA grade I and II physical status, who underwent lower limb procedures were included in the study. They were divided equally into Group I (spinal) and Group II (SCSE). The haemodynamic parameters in the two groups was observed. From 2 minutes to 20 minutes, there was statistically significant rise in pulse rate in group I, associated with decrease in blood pressure in group I. After 60 min both the groups were comparable.

We found that duration of surgery was 131.2 minutes in group I and 124.4 minutes in group II. Anesthesia readiness time was 23.1 minutes in group I and 21.5 minutes in group II. Duration of motor block was 184.2 minutes in group I and 154.2 minutes in group II. The mean modified bromage motor score was 2 in group I and 1 in group II. For orthopaedic and gynecological surgery, Gupta et al[13] contrasted sequential CSE with epidural block. Forty ASA grade I and II patients, ages 20 to 60, were split into two groups at random. Group A patients were administered 2.5 ml of 0.5% hyperbaric bupivacaine for spinal block and CSE using the "needle through needle technique." Patients in Group B had a catheter-assisted epidural block with 15 milliliters of 0.5% plain bupivacaine. To accomplish a block up to T4-5, a further dosage of 0.5% plain bupivacaine was given through the epidural catheter to all patients (1.5–2 ml each unblocked segment). In the CSE group, the motor blockage and surgical analgesia happened much earlier. Compared to the epidural group, which

had analgesia for 120.75±7.56 minutes, the CSE group experienced analgesia for 81.75±11.09 minutes.In the epidural group, three times as much bupivacaine was needed overall to achieve the same goal level.

We found that mean pethidine consumption (mg) was 4.2 mg in group I and 3.1 in group II. Time for sensory regression to T12 was 131.2 minutes in group I and 120.2 minutes in group II. Supplementation with general anesthesia was 1.6 in group I and 3.2 minutes in group II, time to first request for postoperative analgesia was 226.6 minutes in group I and 190.1 minutes in group II. Number of patients who required pethidine was 6 in group I and 4 in group II. Suzuki et al[14] demonstrated enhanced caudal spread of local anesthetic when the dura was punctured with a 26-gauge spinal needle prior to an epidural bolus when compared to patients who received an epidural alone.

The limitation of the study is small sample size.

CONCLUSION

Authors found that both the sequential combined spinal epidural anesthesia and epidural volume extension procedures work well for individuals having orthopedic surgery on their lower limbs.

REFERENCES

1. Mardirosoff C, Dumont L, Lemedioni P et al. Sensory block extension during combined spinal and epidural. Reg Anesth Pain Med 1998;23:92–95.
2. Rawal N, Holmström B, Crowhurst JA, Van Zundert A. The combined spinal-epidural technique. Anesthesiology Clinics of North America. 2000 Jun 1;18(2):267-95.
3. Bhattacharya D, Tewari I, Chowdhuri S. Comparative study of sequential combined spinal epidural anesthesia versus spinal anesthesia in high- risk geriatric patients for major orthopedic surgery. Indian J. Anaesth 2007;51(1):32–36.
4. Cohen SE, Hamilton CL, Riley ET et al. Obstetric post anesthesia care unit stays: re-evaluation of discharge criteria after regional anesthesia. Anesthesiology. 1998;89(6):1559–1565.
5. Holmstrom E, Laugaland K, Rawal N et al. Combined spinal epidural block versus spinal and epidural block for orthopedic surgery. Can J Anaesth 1993;10(7): 601–606.
6. Loubert C, O'Brien PJ, Fernando R et al. Epidural volume extension in combined spinal epidural anesthesia for elective caesarean section: A randomized controlled trial. Anesthesia 2011;66:341–347.
7. Lucas DN, Gough KL. Enhanced recovery in obstetrics— A new frontier? Int J ObstetAnesth. 2013;22(2):92–95.
8. Dureja GP, Madan R, Kaul HL. Combined spinal epidural anaesthesia. In: Regional anaesthesia and pain management (current perspectives) B. I. Churchill Livingstone Pvt. Ltd., 2000; 139-145.
9. Higuchi H, Adachi Y, Kazama T. Effects of epidural saline injection on cerebrospinal fluid volume and velocity waveform: a magnetic resonance imaging study. Anesthesiology2005;102:285-92.
10. McNaught AF, Stocks GM. Epidural volume extension and low-dose sequential combined spinal-epidural blockade: two ways to reduce spinal dose requirement for caesarean section. International Journal of Obstetric Anesthesia 2007;16:346–353.
11. Hamdani GA, Chohan U, Zubair NA. Clinical usefulness of sequential combined spinal epidural anesthesia in high- risk geriatric patients for major orthopaedic surgery. J Anaesth Clin Pharmacol 2002;18(2):163–166.
12. Gupta P, Dua CK, Verma UC, Saxena KN, Chakraborty I. Sequential combined spinal epidural versus epidural anaesthesia in orthopaedic and gynaecological surgery: A comparative evaluation. Indian Journal of Anaesthesia. 2002 Nov 1;46(6):453-6.
13. Mutahar SA, Madhavi S, Unmesh S, Swati K, Somika A. Comparison of sequential combined spinal epidural anaesthesia and spinal anaesthesia in lower limb surgery: A prospective randomised double blind study. Indian J Clin Anaesth 2019;6(1):66-70.
14. Suzuki N, Koganemaru M, Onizuka S, et al. Dural puncture with a 26G spinal needle affects spread of epidural anesthesia. AnesthAnalg1996;82:1040-4.