Section: Anaesthesiology

Original Research Article

COMPARATIVE STUDY OF SEQUENTIAL COMBINED SPINAL EPIDURAL ANESTHESIA VERSUS SPINAL ANESTHESIA IN HIGH-RISK GERIATRIC PATIENTS FOR MAJOR ORTHOPEDIC SURGERY

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Received : 20/08/2024
Received in revised form : 06/10/2024
Accepted : 21/10/2024

Keywords:
Spinal anesthesia, Bupivacaine, Fentanyl, Geriatric.

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DOI: 10.47009/jamp.2024.6.5.123

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2024; 6 (5); 652-656

Abstract

Background: Sequential combined spinal epidural anesthesia (Sequential CSEA) is likely the most significant development in the central neuraxial block for high-risk geriatric patients in this decade since it combines the benefits of both spinal and epidural anesthesia while reducing adverse effects. **Aim and objective:** These investigations compare the clinical outcomes of spinal anesthesia against sequential combination spinal epidural anesthesia in geriatric patients at high risk of undergoing major orthopedic procedures. **Materials and Methods:** For the study, 50 senior adults aged 65 and 80 undergoing major elective orthopedic procedures were chosen. They were divided randomly into two equal groups, each with 25 patients, based on their ASAPS I or II grades. Sequential CSEA was performed on Group I (n = 25) with 1 ml (5 mg) of 0.5% bupivacaine heavy and 20 mcg of fentanyl in the subarachnoid area. A tiny incremental dosage of 0.5 % isobaric bupivacaine epidural, 1.5 to 2 ml for every unblocked segment to achieve T10 sensory level, was used to treat the anticipated incompleteness of the spinal block. Spinal anesthesia was administered to Group II (n = 25) using 2 ml of (10 mg) 0.5% bupivacaine heavy and 20 mcg of fentanyl. To assess the levels of significance, the P-value was chosen. Significance was defined as P< 0.05. **Result:** The average age in years was 69.28 ± 8.72 in Group I, and 69.96 ± 8.56 in Group II. There was no significant difference in age between the groups. The difference in the maximum sensory level achieved in the two groups was highly significant (P< 0.001). The difference in the onset of complete motor blockade (min) in the two groups was highly significant (P< 0.001). The mean time to the total duration of a motor blockade is statistically significant (P<0.001). The mean time to a maximum duration of sensory analgesia is statistically significant (P<0.001). **Conclusion:** So sequential combined spinal epidural anesthesia is a safe, effective, and reliable technique with stable hemodynamics along with the provision of prolonged analgesia compare to spinal anesthesia for high-risk geriatric patients undergoing major orthopedic surgery.

INTRODUCTION

Orthopedic surgery frequently uses spine anesthesia. Modern anesthesia practices are increasingly utilizing the combined spinal epidural, single segment, and needle-via-needle approach.[1, 2] It has a quick onset, is effective, safe, and has a low risk of hazardous side effects. It also has the potential to strengthen a weak block and lengthen the duration of analgesia. Patients experience this both during and after surgery.[2,3] Geriatric patients undergoing major surgery have a significantly higher incidence of morbidity and mortality compared to younger age groups due to their diminished cardio respiratory

reserve and coexisting illnesses.[4] Morbidity and the American Society of Anesthesiologists' (ASA) classification are associated.[5] Orthopedic surgery frequently utilizes spine anesthesia. White et al.[6]reported that patients with hip fractures with ASA I and II had the same risk of mortality as controls who had their age and sex accounted for (8% death per year). However, those with an ASA III status had death rates that have been 49% higher than their controls, or 6.3 times higher.

An increasing percentage of the population is older. They are more likely to have co-morbidities such as heart disease, diabetes, hypertension, cerebrovascular disease, and renal failure, which require careful assessment during the pre-anesthetic assessment.[7] They react less adrenergically to stressors and exhibit poor compensatory mechanisms in response to hypovolemia. Due to weak protective reflexes and compromised chest wall compliance, they are also vulnerable to postoperative pulmonary problems. Their compromised immune systems make them more susceptible to surgical site infections. They are more likely to experience postoperative disorientation and delirium. They need lower doses of sedatives, local anesthetics, and opioid analgesics to have the intended effect.[8] However, studies.[9–11] have not shown a connection between the outcome for geriatric patients and different anesthetic procedures. This is a newer method called the sequential combined spinal-epidural technique or the modified combination spinal epidural approach. It uses a low spinal dose to treat low blood pressure and then extends the block cephalad with an epidural anesthetic.[12,13] This method is becoming more and more common in contemporary obstetric practice due to several purported advantages[14], chief among them being stable hemodynamic conditions. Elderly, high-risk patients undergoing orthopedic surgery now employ sequential combined spinal epidural anesthesia (CSEA) with excellent outcomes.[15]

In this study, aged high-risk patients undergoing major orthopedic surgery were compared to the clinical outcomes of sequential CSEA and spinal anesthesia.

MATERIALSANDMETHODS

After obtaining approval from the institutional ethical committee and informed written consent from the patient, the study was conducted at the Anesthesiology Department, Gandhi Medical College/Hospital, Secunderabad. Study length April 2022-May 2024.

For the study, 50 geriatric adults between the age group of 65 and 80 who were undergoing major elective orthopedic procedures were chosen. They were divided randomly into two equal groups, each with 25 patients, based on their ASAPS I or II grades. Based on a pilot study carried out earlier in the same institute, the size of the study's sample was chosen. Based on the findings of the pilot study comparing the clinical effects of the two groups, the number needed for the study was estimated using a well-known power of 80% and a value of 0.05.

Group I (n = 25) Sequential CSEA with 1ml (5 mg) of 0.5 % bupivacaine heavy + Fentanyl 20mcg instilled the subarachnoid space. Expected incompleteness of spinal block was managed with a small incremental dose of 0.5 % isobaric bupivacaine epidural, 1.5 to 2 ml for every unblocked segment to achieve T10 sensory level. Group II (n=25) Spinal anesthesia given with 2 ml of (10 mg) 0.5 % bupivacaine heavy + 20 mcg of fentanyl.

Blood pressure and other vital signs were monitored before surgery. Examining the heart and lungs an intravenous line is set up with an 18G IV needle. The tools needed for intubation and resuscitation are stored at the ready, along with an anesthetic machine. Under aseptic conditions, the L3-L4 interspinous spacers were chosen with the greatest part of the iliac crest serving as the anatomical reference. To make it easier to insert the 18G Tuohy epidural needle, local infiltration was administered with 2% lignocaine in a 2 ml dose. The epidural space was identified using the loss of resistance technique and the 18G Tuohy needle, which was introduced and advanced gently. The epidural needle is used to insert a 27G Whitacre needle for lumbar puncture. The spinal needle latched onto the epidural needle after receiving a CSF. Drugs were administered by the groups to which they were assigned after the subarachnoid space's presence was confirmed. An 18G epidural catheter is inserted into the epidural space after the spinal needle is removed, and the catheter is then set at the proper length. After administering spinal anesthesia, the patient was placed in a supine position, and the beginning of analgesia and the block were noticed. Following a negative aspiration test, a 0.5% bupivacaine (isobaric) epidural block was administered. Bupivacaine was administered epidurally as 1.5-2 ml/unblocked segment up to the T10 sensory level was reached. The amount of motor block achieved and the time it took to achieve it are reported. Following the start of the sensory block for an hour, the pulse and blood pressure were recorded every five minutes until the procedure was complete. Any adverse effects like nausea, vomiting, dizziness bradycardia and hypotension were treated appropriately. Duration of surgery and any further requirement of epidural drug required is noted and administered as required.

Statistical analysis

All the data were entered in Excel 2019 and statistical analysis was performed using the statistical software, SPSS 25.0.0.0. Data were expressed in percentages and mean values (with standard deviation). Differences between the groups were analyzed using Pearson's chi-square test for categorical variables and the independent t-test for continuous variables. In cases where the p-value

ISSN (O): 2687-5365; ISSN (P): 2753-6556

was less than 0.05, the results were deemed statistically significant.

RESULTS

50 patients aged 65 to 80 years old who were geriatric adults posted for elective major orthopedic surgeries, a prospective, randomized, comparative study.

In the present study, both groups were comparing concerning demographic characteristics and did not show any statistically significant difference (P > 0.05) (Table 1). The average age in years was 69.28 ± 8.72 in Group I, and 69.96 ± 8.56 in Group II. There was no significant difference in age between the groups. The average weight in kgs in Group I was 54.25 ± 9.66 and in Group II was 55.76 ± 6.96, there was no significant difference in weight between the groups and the two groups were compare. The average height in cms in Group I was 154.56 ± 4.84 and in Group II was 154.76 ± 5.14, there was no significant difference in height between the groups. The two groups were compare.

The number of patients undergoing each type of geriatric orthopaedic surgery was compare in both groups, allowing for a fair comparison. Furthermore, the average operation time was similar in both groups (Group I: 104.80 ± 9.56 min and Group II: 111.42 ± 9.88 min). Table 2 shows the motor and sensory features of both groups. After giving the study medication in the epidural space, the time needed for the start of sensory block to the T10 dermatome in Group I was 3.96 ± 1.60 minutes and in Group II was 3.32 ± 1.40 minutes, with a statistically significant difference between the two groups (P = 0.139). The difference in the maximum sensory level achieved in the two groups was highly significant (P< 0.001). The average level of analgesia at 10 min in group II is higher than in group I. In group I, 60% of patients obtained a level of analgesia at T8, 24% of patients at T10, 16% of patients at T6. In group II 48% of patients obtained a level of analgesia at T6, 32% of patients at T8, and 20% of patients at T4. The p-value by the chi-square test is 0.008 < 0.05, which is significant.

Although the mean time taken to reach the maximum sensory level (Group I: 21.94 ± 2.35 min vs. Group II: 13.7 ± 1.0 min) was again compare in both groups (P = 0.001). The difference in the onset of complete motor blockade (min) in the two groups was highly significant (P< 0.001). The mean time to a total duration of a motor blockade in Group I was 142.28 ± 9.04 minutes and in Group II was 120.42 ± 9.44 minutes. The mean time to the total duration of a motor blockade is statistically significant (P value<0.001). The mean time to a maximum duration of sensory analgesia in Group I was 232.82 ± 10.29 minutes and in Group B was 162.60 ±12. 48 minutes. The mean time to a maximum duration of sensory analgesia is statistically significant (P<0.001). The results are shown in table-2.

Hemodynamic Parameters

The mean pulse rate changes showed that there was a gradual fall in pulse rate in group I by the end of 10 minutes, while in group II sudden fall in pulse rate by the end of 5 minutes. Both groups' pulse rates gradually rose till the end of the surgery. P value by t-test is less than 0.05, which is significant (figure-1).

Analysis showed there was a rapid fall in systolic blood pressure in group II by the end of 5 to 10 minutes whereas in group I there was a gradual drop in systolic blood pressure by the end of 10 to 15 minutes both groups thereafter showed a gradual rise towards the end of surgery. P value by t-test is less than 0.05, which is significant. Shows in figure-2.

There was a rapid fall in diastolic blood pressure in group II by the end of 5min, the fall in BP was near 20% of baseline BP. Group, I showed a gradual fall in diastolic blood pressure by the end of 10 minutes, the fall in BP was 10 to 15% of baseline BP. Both groups' diastolic blood pressures gradually raised toward the end of surgery. The p-value by t-test is less than 0.05, which is significant, Shows in Figure 3.

Table 1: Demographic profile of Group I and Group II

Demographic profile	Group I(n = 25)	Group II (n = 25)	*P*-value
Age(Yrs)	69.28 ± 8.72	69.96 ± 8.56	0.782
Weight(Kgs)	54.25 ± 9.66	55.76 ± 6.96	0.529
Height(Cms)	154.56 ± 4.84	154.76 ± 5.14	0.888
Sex			
Males	21	18	
Females	4	7	0.1667

P > 0.05 non-significant

Table 2: Sensory and motor block characteristics in Group I and Group II

Values in minutes	Group I(n = 25)	Group II(n = 25)	*P* value
the onset of sensory analgesia to T_{10} Level(min)	3.96 ± 1.60	3.32 ± 1.40	0.139
the maximum level of sensory analgesia(min)	21.94 ± 2.35	13.7 ± 1.0	<0.001
Maximum sensory level achieved	T_6, T_8	T_4, T_6, T_8	0.008
The onset of complete motor blockade(min)	21.86 ± 2.60	16.00 ± 1.27	<0.001
The total duration of motor blockade(min)	142.28 ± 9.04	120.42 ± 9.44	<0.001
The maximum duration of Sensory analgesia(min)	232.82 ± 10.29	162.6 ± 12.48	<0.001

P > 0.05 non-significant, P < 0.05 significant, P < 0.001 highly significant.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

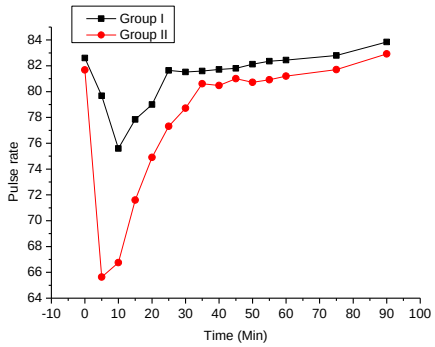

Figure 1: Hemodynamic parameters of Pulse rate changes intra-operatively

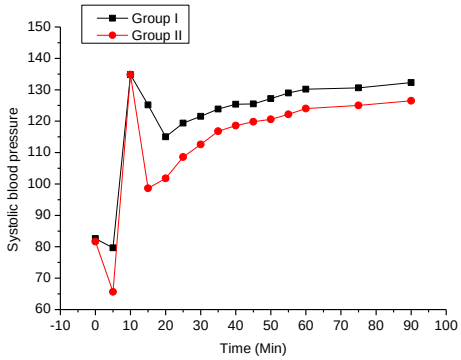

Figure 2: Hemodynamic parameters of Systolic blood pressure changes intra-operatively

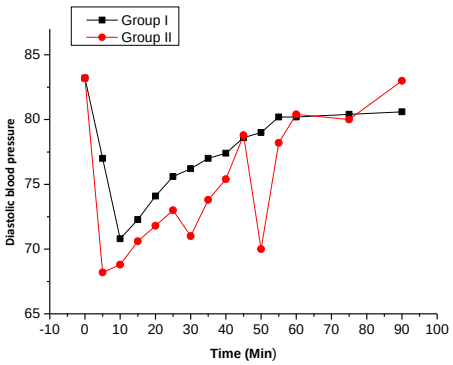

Figure 3: Hemodynamic parameters of diastolic blood pressure changes intra-operatively

Adverse effects of group I 3 patients had nausea, and 2 patients had hypotension, Group II 3 patients had nausea, 4 patients had hypotension, and 2 patients had bradycardia during the intraoperative period. There was no difference in the incidence of nausea and hypotension in both groups. However no statistically significant (p<0.435) was calculated by the chi-square test.

DISCUSSION

According to several studies, older individuals have analgesia levels that are 3–4 spinal segments higher than those of young adult patients following subarachnoid injection of hyperbaric local anesthesia solution.[16,17] The acute problem of precipitous arterial hypotension brought on by severe sympathetic block is still a typical occurrence in elderly individuals undergoing spinal anesthesia. Despite preventative treatments like fluid preload and prophylactic vasopressor (ephedrine), it could be challenging to keep these individuals' blood pressure around normal. A sequential combination spinal epidural approach that uses a spinal dose of local anesthetic that is inadequate for surgery is reported in obstetric practice as a way to lessen the frequency and severity of hypotension. Injections of hyperbaric local anesthetic solution into the subarachnoid space result in analgesia levels that are higher than those before, according to several investigations. The epidural medication is then used to purposefully extend the block cephalad.[18] This approach does not postpone the onset of the block, but it does result in a sufficient amount of sensory block.[19] Sequential CSEA is especially helpful in high-risk elderly orthopedic patients, where a more gradual sympathetic block onset is preferred to minimize side effects on hemodynamics.[20] Local anesthetics are frequently used with opioid compounds to strengthen the spinal block while also lowering the dose. To convert an insufficient dose of a local anesthetic to an appropriate dose without delaying recovery, we added 20 mcg of fentanyl to the local anesthetic bupivacaine in both groups. Average age, weight, and height did not significantly differ between the two groups in our study. Fentanyl 20 mcg and 1 ml (5 mg) of heavy 0.5% bupivacaine from Group I Sequential CSEA was injected into the subarachnoid area. For each segment that was left unblocked to reach the T10 sensory level, a tiny incremental dose of 0.5 % isobaric bupivacaine was administered epidurally. 20mcg of Fentanyl and 2ml of heavy (10 mg) 0.5% bupivacaine were used to administer group II spinal anesthesia.

In our study, the motor and sensory features of both groups, a statistically significant difference between the two groups. The difference in the maximum sensory level achieved in the two groups was highly significant (P < 0.001). The difference in the onset of complete motor blockade (min) in the two groups was highly significant (P< 0.001). The mean time to the total duration of a motor blockade is statistically significant (P value<0.001). The mean time to a maximum duration of sensory analgesia is statistically significant (P value<0.001). Hemodynamic Parameters viz pulse rate changes, systolic blood pressure, and diastolic blood pressure were significant. There was no difference in the incidence of nausea and hypotension in both groups, however no statistically significant (p<0.435).

It might be claimed that the continuous spinal approach offers all of CSEA's benefits. Caudaequina syndrome and post-dural puncture headache are, however, more likely to occur.[21] The block in sequential CSEA resulted from a relatively small

ISSN (O): 2687-5365; ISSN (P): 2753-6556

amount of the local anesthetic through the spinal route followed by an epidural drug which helped to increase the subarachnoid block to the desired level which conforms to the study of Swami et al[22] for cesarean section. Many considerations have been given as to how epidural top-up works after spinal anesthesia in sequential CSEA.[23]

CONCLUSION

We concluded the sequential combined spinal-epidural technique is effective and safe, produces a stable hemodynamically, and provides prolonging analgesia compared to spinal anesthesia in geriatric patients undergoing major orthopedic surgery.

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ISSN (O): 2687-5365; ISSN (P): 2753-6556