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Comparative Study of Sequential Combined Spinal Epidural Anaesthesia Versus Spinal Anaesthesia in High-Risk Geriatric Patients for Major Orthopaedic Surgery: Government Medical College, Nizamabad, Telangana, India

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ABSTRACT

Sequential combined spinal epidural anaesthesia (Sequential CSEA) is a major advancement in central neuraxial blockade for high-risk geriatric patients this decade since it combines the advantages of spinal and epidural anaesthesia while mitigating unfavourable effects. This study looks at the differences between spinal anaesthesia and sequential combination spinal epidural anaesthesia in older people who are likely to need major orthopaedic procedures. The study selected 80 geriatric individuals aged 65-80 who were undergoing major elective orthopaedic surgeries. We randomly allocated the participants into two equal groups of 40 patients each, based on their ASA Grade I or II classifications. We conducted sequential CSEA on Group I (n=40) using 1 ml (5mg) of heavy bupivacaine and 20mcg of fentanyl in the subarachanoid space. To reach a T10 sensory level, a 0.5% isobaric bupivacaine epidural dose increase of 1.5-2ml was given for each segment that wasn't blocked. This was done because the spinal block was expected to be incomplete. Spinal anaesthesia was delivered to Group II (n=40) with 2ml of 10mg% bupivacaine heavy and 20mcg of fentanyl. The P-value was selected to evaluate the levels of significance. Significance was established at P<0.05. The mean age was 62.32±7.69 years in Group I and 68.32±3.28 years in Group II. No substantial age disparity existed between the groups. The disparity in the maximal sensory level attained by the two groups was significantly significant (P<0.001). The disparity in the initiation of total motor blockage (min) between the two groups was significantly significant (P<0.001). The average length of motor obstruction is statistically significant (P<0.001). The average duration till the peak of sensory analgesia is statistically significant (P<0.001). So sequential combined spinal epidural anaesthesia is a safe, effective and reliable technique with stable hemodynamic along with the provision of prolonging analgesia compared to spinal anaesthesia for high-risk geriatric patients undergoing major orthopaedic surgery.

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Key Words
Bupivacaine, epidural, fentanyl, geriatric, spinal anaesthesia

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INTRODUCTION

The Spinal anaesthesia is frequently utilized in orthopaedic surgery. Modern anaesthesia practices are increasingly utilizing the combined spinal epidural, single segment and needle via needle approach[1-3]. 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. Both during and after surgery[4]. Due to their diminished cardiorespiratory reserve and coexisting illnesses, geriatric patients undergoing major surgery have a much greater incidence of morbidity and mortality compared to younger age groups[5]. The American Society of Anaesthesiologists (ASA) classification and morbidity are related[6]. White[7] 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 taken into account (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. Co-morbidities such as heart disease, diabetes, hypertension, cerebrovascular disease and renal failure are more common in them and need to be carefully assessed during the pre-anaesthetic assessment[8]. They respond less adrenergic to stressors and poorly to hypovolemic in terms of compensatory mechanisms. Due to weak protective reflexes and compromised chest wall compliance, they are also vulnerable to post-operative pulmonary problems. They are more vulnerable to surgical site infections since their immune systems are compromised. They are more likely to experience postoperative disorientation and delirium. They need lower doses of sedatives, local anaesthetics and opioid analgesics to have the intended effect[9]. The modified combination spinal epidural approach, also known as the sequential combined spinal-epidural technique, is a newer technique that uses an inadequate spinal dose to alleviate hypotension before purposefully extending the block cephalad with an epidural anaesthetic[10-14]. With excellent outcomes, the sequential combined spinal epidural anaesthesia (CSEA) is now employed in elderly high-risk patients undergoing orthopaedic surgery[15,16]. In this study, aged high-risk patients undergoing major orthopaedic surgery were compared to the clinical outcomes of sequential CSEA and spinal anaesthesia.

MATERIALS AND METHODS

Following the acquisition of approval from the institutional ethics committee and informed written consent from the patient, the study was executed at the Department of Anaesthesiology, Government General Hospital, Nizamabad.

Duration of Study: May 2023 to May 2024. The study selected 80 geriatric patients, aged 65-80, who were undergoing major elective orthopaedic surgeries. We randomly allocated the participants into two equal groups of 40 patients each, based on their ASA Grade I or II grades. The sample size for the study was determined based on a prior pilot study conducted at the same institute. With a power of 80% and a significance level of 0.05, the results of the pilot study that compared the effects of the two groups helped figure out the size of the sample that would be needed. Sequential CSEA with 1ml (5mg) of 0.5% bupivacaine heavy and 20 mcg of fentanyl were given into the subarachanoid area to the 40 people in Group I. To fix the expected incompleteness of the spinal block, a small amount of 0.5% isobaric bupivacaine was added epidural-1.5-2ml for each segment that wasn't blocked-until a T10 sensory level was reached. Group II (n=40) received spinal anaesthesia consisting of 2 ml of 0.5% heavy bupivacaine (10 mg) combined with 20 mcg of fentanyl. Before the surgical procedure, we assessed vital indicators. An 18G IV needle established an intravenous line secured. The instruments required for intubation and resuscitation are readily available, accompanied by an anaesthetic machine. Under aseptic settings, the L3-L4 inter spinous space was selected, utilizing the highest portion of the iliac crest as the anatomical reference point. To facilitate the insertion of the 18G Tuohy epidural needle, local infiltration was performed using a 2ml dosage of 0.2% lignocaine. The epidural space was located via the loss of resistance approach with an 18G Tuohy needle, which was inserted and advanced with care. The epidural needle is utilized to introduce a 27G Whitacre needle for lumbar puncture. The spinal needle engaged with the epidural needle following the acquisition of cerebrospinal fluid. The group I administered drugs following the confirmation of the subarachanoid space's presence. An 18G epidural catheter is introduced into the epidural space following the removal of the spinal needle and the catheter is subsequently adjusted to the appropriate length fixed. The patient was positioned supine and the onset of analgesia and the motor blockade were observed. Subsequent to a negative aspiration test, a 0.5% isobaric bupivacaine epidural block was delivered at a dosage of 1.5-2 ml each unblocked segment until the T10 sensory level was attained. The quantity of motor block attained and the duration required to acquire it are documented. Pulse rate and blood pressure were monitored every five minutes until first half an hr and every 10 min still the surgery concluded. Any adverse effects such as nausea, vomiting, dizziness, bradycardia and hypotension were managed appropriately. The duration of the surgery and any additional required epidural topups are given and documented.

Statistical Analysis: All parametric data are presented as mean±SD and non-parametric data are tabulated. Students t-tests and Chi-square tests were used where applicable and a P value <0.05 was considered statistically significant. Statistical analysis was performed using the statistical package for origin Pro 8.5.

RESULTS AND DISCUSSIONS

80 patients aged 65-80 years old who were geriatric adults posted for elective major orthopaedic surgeries, a prospective, randomized, comparative study. In the present study, both groups were comparable concerning demographic characteristics and did not show any statistically significant difference (P>0.05) (Table 1). The average age in years was 62.32±7.69 in Group I and 68.32±3.28 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 comparable. 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. Two groups were comparable. The number of patients undergoing each type of geriatric orthopaedic surgeries was comparable 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. P value by 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 comparable 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 were shown in table-2.

Hemodynamic Parameters: The mean pulse rate changes showed that there is a gradual fall in pulse rate in group I by end of 10min, while in group II sudden fall in pulse rate by end of 5min. both groups' pulse rates gradually rose till the end of the surgery. P value by t-test is <0.05, which is significant (fig. 1).

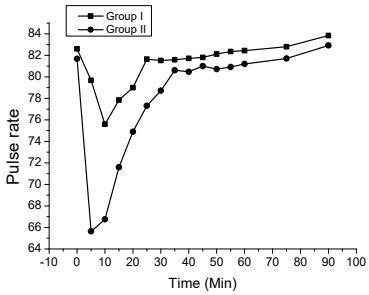

Fig. 1: Hemodynamic Parameters of Pulse Rate Changes Intra-Operatively

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

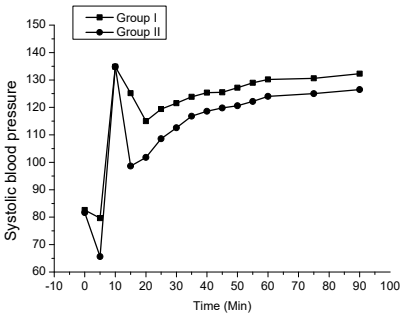

Fig. 2: Hemodynamic Parameters of Systolic Blood Pressure Changes Intra-Operatively

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

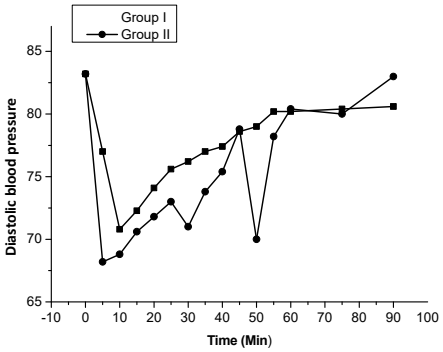

Fig. 3: Hemodynamic Parameters of Diastolic Blood Pressure Changes Intra-Operatively

Table 1: Demographic Profile of Group I and Group II

Demographic profile	Group I(n=40)	Group II (n=40)	P-value
Age(Yrs)	62.32± 8.72	68.32±3.28	0.78
Weight(Kgs)	54.25±9.66	55.76±6.96	0.53
Height(Cms)	154.56±4.84	154.76±5.14	0.89
Sex			
Males	21	18	0.167
Females	4	7	

P>0.05 non-significant

Table 2: Sensory and Motor Block Characteristics in Group I and Group II

Values in minutes	Group I (n=40)	Group II (n=40)	P value
the onset of sensory analgesia to T_{10} Level(min)	3.96±1.60	3.32±1.40	0.14
the maximum time 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	0.007
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.

Adverse effects of group-I, 3 patients had nausea and 2 patients had hypotension, in 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) as calculated by the chi-square test. According to several studies, older individuals have analgesia levels that are 3-4 spinal segments higher than those of young adult patients following subarachanoid injection of hyperbaric local anaesthesia solution[17,18]. The acute problem of precipitous arterial hypotension brought on by severe sympathetic block is still a typical occurrence in elderly individuals undergoing spinal anaesthesia. Despite preventative treatments like fluid pre load 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 anaesthetic that is inadequate for surgery as a way to lessen the frequency and severity of hypotension. The epidural medication is then used to purposefully extend the block cephalad[19]. This approach does not postpone the onset of the block, but it does result in a sufficient amount of sensory block[20]. The sequential CSEA is especially helpful in high-risk elderly orthopaedic patients, where a more gradual sympathetic block onset is preferred to minimize side effects on hemodynamic[21-24]. Local anaesthetics are frequently used with opioid compounds to strengthen the spinal block while also lowering the dose. To convert an insufficient dose of a local anaesthetic to an appropriate dose without delaying recovery, we added 20 mcg of fentanyl to the local anaesthetic bupivacaine in both groups. Average age, weight and height did not significantly differ between the two groups in our study. Fentanyl 20mcg and 1ml (5mg) of heavy 0.5% bupivacaine from Group I Sequential CSEA were injected into the subarachanoid 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 epidural. 20mcg of Fentanyl and 2ml of heavy (10 mg) 0.5 % bupivacaine heavy was used to administer group II spinal anaesthesia. 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).

CONCLUSION

We concluded the sequential combined spinal-epidural technique is effective and safe, procedure with a stable hemodynamic and with a provision of prolonging analgesia compared to spinal anaesthesia in geriatric patients undergoing major orthopaedic surgery.

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