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RESEARCHARTICLE

EFFICACY OF SPINAL ANAESTHESIA AFTER BUPIVACAINE ALONE AND AFTER ADDING CLONIDINE IN ORTHOPAEDIC LOWER LIMB SURGERIES

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ABSTRACT

Background: 0.5 % Bupivacaine is commonly used in spinal anaesthesia. Intrathecal clonidine is known as an adjuvant for improving duration of sensory and motor blockade. **Objective:** To study efficacy of spinal anaesthesia after addition of intrathecal clonidine in lower limb orthopaedic surgeries. ***Materials and method:*** A total of 80 patients, posted for lower limb orthopaedic surgeries were randomly allocated into 2 groups. In Group A & Group B patients, 3ml of bupivacaine 0.5% (heavy) + 0.2 ml saline and 3ml of bupivacaine 0.5% (heavy) + 30mcg clonidine injected intrathecally respectively. After injecting drug, following observations recorded- time of onset of sensory blockade (T10), maximum level of sensory blockade, time required to achieve maximum level of sensory blockade, time of onset of motor blockade, time taken for maximum motor blockade. Study groups were compared by chi-square test. ***Result:*** The results suggested that there was significant difference in onset of sensory and motor blockade and time required to achieve maximum sensory and motor blockade after addition of intrathecal clonidine as an adjuvant. ***Conclusion*:** Addition of intrathecal clonidine with hyperbaric bupivacaine as adjuvant, can result in reduction in time of onset of motor and sensory blockade in lower limb surgeries compared to 0.5% bupivacaine alone.

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INTRODUCTION

For lower limb procedures, spinal and epidural anaesthesia is highly popular since it avoids the drawbacks of general anaesthesia, such as airway manipulation, polypharmacy, and other unfavourable outcomes like postoperative nausea and vomiting, as well as the need for additional intravenous analgesics[1]. But Spinalanaesthesia is most commonly used over epidural anaesthesia in lower limb surgeries. Spinal anaesthesia is simple and cost-effective anaesthesia. In spinal an aesthesia which is also known as Sub Arachnoid Block, drug is injectedintrathecally in the sub arachnoid space that is directly in the CSF. It mixes with CSF and acts locally blocking the nerve roots above and below the injected level.Inj. Bupivacaine 0.5% heavy is a local anaesthetic commonly used in spinal anaesthesia. It contains 0.5% bupivacaine, which is a potent amide-type anaesthetic agent. The term "heavy" refers to the formulation's increased density compared to regular bupivacaine, making it more likely to settle in the lower parts of the spinal canal when administered into the subarachnoid space. This ensures that the anaesthesia acts on the desired areas of the body, such as the lower limbs or pelvic region, by utilizing gravity. Bupivacaine 0.5% heavy is effective in producing a combination of sensory and motor blockades, providing pain relief and muscle relaxation for procedures like cesarean sections, lower limb surgeries, or other surgeries requiring regional anaesthesia. However, it should be used cautiously due to its potential side effects, such as cardiovascular toxicity (in high doses) and the possibility of hypotension. The onset and duration of action can vary based on individual factors like dosage, positioning, and other drugs used in conjunction with bupivacaine. But efficacy of spinal anaesthesia after intrathecal bupivacaine alone is limited. Hence, for prolonging the duration of spinal anaesthesia, adjuvants are needed. These adjuvants also affect onset of sensory and motor blockade. Clonidine is an imidazole derivative with selective partial agonist properties which inhibits nociceptive impulses by activation of post junctional alpha-2 adrenoreceptor in the dorsal horn of spinal cord[2]. When clonidine is administered intrathecally alongside bupivacaine, it leads to a dose-dependent enhancement of sensory and motor blockades, as well as longer periods of pain relief after surgery.

Additionally, clonidine helps reduce pain during surgery but can increase the risk of low blood pressure (hypotension) as a side effect.

MATERIAL AND METHODS

Study design: Prospective observational case control study.

Sampling method: Randomised sampling.

Method of collection: The study was conducted at HBT Trauma Care Hospital, Mumbai in 80 ASA grade I or II patients undergoing elective orthopaedic lower limb surgeries under spinal anaesthesia. All patients were explained about the procedures and an informed written consent was obtained. Statistical analysis wasdone by using Chi square test.

INCLUSION CRITERIA

- Patients aged between 21 and 60 years
- ASA I and II
- Only elective surgery patients
- 4.Posted for orthopaedic lower limb surgeries.

EXCLUSION CRITERIA

- Any contraindication of regional anaesthesia
- patient refusal.
- Morbidly obese patients
- allergy to study drugs

This study was done on 80 patients posted for orthopaedic lower limb surgeries at HBT Trauma Care Hospital, Mumbai. These 80 patients were randomly divided in 2 equal groups.

Group 1received 15mg of 0.5 % hyperbaric bupivacaine + 0.2ml of normal saline (Total 3.2 ml) intrathecally.

Group 2 received 15mg of 0.5 % hyperbaric bupivacaine + 0.2ml i.e. 30mcgof Clonidine (Total 3.2 ml) intrathecally.

Under all aseptic precautions lumbar puncture was done in sitting position in all patients. 25G Quincke's spinal needle is used in all patients for puncture. The study drug of both groups was injected at L3 – L4 space after confirmation of free flow of clear CSF. After giving spinal drug patients were made supine and then monitored. Sensory blockade was tested by pinprick method at every 30 sec for first five minutes, every 1 minute for next 5 minutes and every 5 minutes till the end of surgery. For this 26G blunt tip needle was used. Quality of motor blockade was assessed by Bromage scale.

Onset of sensory blockade: was defined as time taken from the injection of study drug till loss of pin prick sensation at T10 level. Time taken for maximum sensory blockade: was defined as the time taken from the injection of study drug to the maximum sensory blockade attained.

Onset of motor blockade: was defined as the time taken from the injection of study drug till the patient was unable to move hip but was able to move knee and ankle. Quality of motor blockade was assessed by Bromage scale.Bromage0 - able to move hip, knee and ankle.

Bromage 1-Unable to move hip but able to move knee and ankle.

Bromage 2 -Unable to move hip and knee but able to move ankle.

Bromage 3-Unable to move hip, knee and ankle.

Time taken for maximum motor blockade: was defined as the time taken from the injection of study drug to maximum motor blockade attained (Bromage 3).

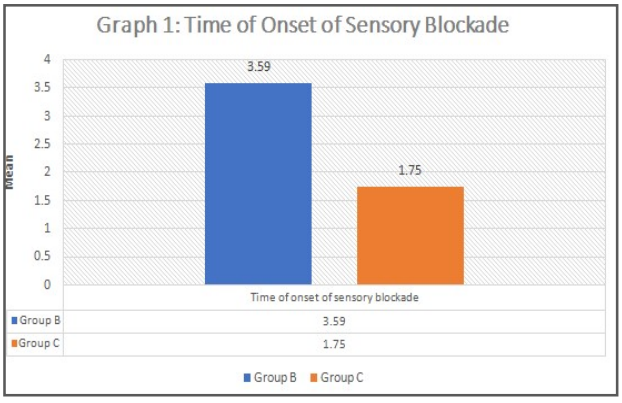
Statistical analysis: Data was entered into Microsoft Excel (Windows 7; Version 2007) and analyses were done using the Statistical Package for Social Sciences (SPSS) for Windows software (version 22.0; SPSS Inc, Chicago). Descriptive statistics such as mean and standard deviation (SD) for continuous variables, frequencies and percentages were calculated for categorical Variables were determined. Association between Variables was analyzed by using Chi-Square test for categorical Variables. ANOVA (Analysis of Variance) was used to compare mean of quantitative variables between 3 groups, followed by Tuke's post hoc inter-group comparison test to compare the same parameters between any 2 groups. Bar charts and Pie charts were used for visual representation of the analyzed data. Level of significance was set at 0.05.

Observations and Results

- The time taken for onset of sensory blockade in group B was 3.59± 0.66 and in group C was 1.75 ± 0.49.
- The time taken for maximum sensory blockade in group B was 8.95±1.03 mins and in group C was 5.9±0.8 mins.
- The time taken for onset of motor blockade in group B was 5.25±0.73 mins and in group C was 2.58± 0.72 mins.
- The time taken for maximum motor blockade in group B was 8.79± 1.05 mins and in group C was 7.29± 1.61 mins.

Table 1. Time of onset of sensory blockade

Parameters	Time of onset of sensory blockade	
	Group B	Group C
Range	2-5 mins	1-3 mins
Mean	3.59	1.75
SD	0.66	0.49
'p' value	<0.001	



The time taken for onset of sensory blockade in group B was 3.59 ± 0.66 and in group C was 1.75 ± 0.49.

Table 2. Maximum level of Sensory Blockade

Maximum level of Sensory Blockade	Number of Patients			Total
	T4	T6	T8	
Group B	5	10	25	40
Group C	9	16	15	40

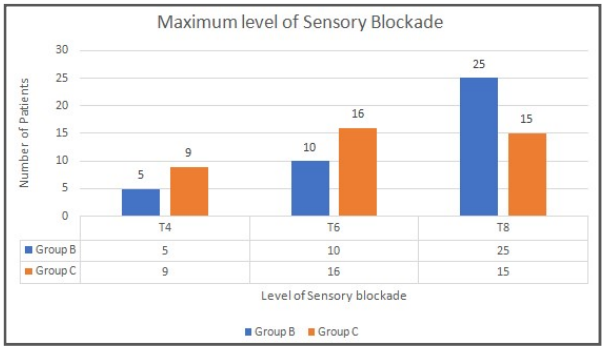
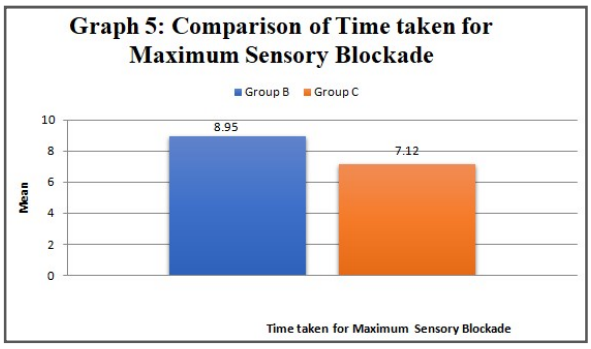


Table 3. Time taken to achieve Maximum level of sensory blockade

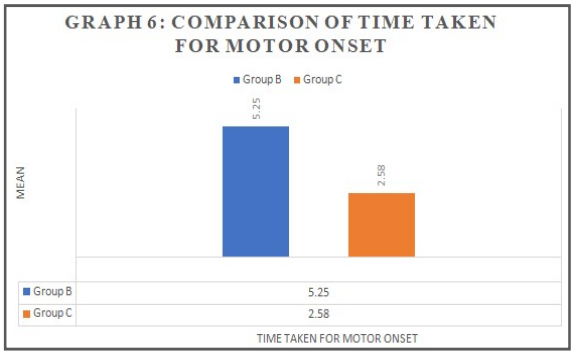
Parameters	Time taken to achieve Maximum level of sensory blockade in mins		'p' value for B vs C
	Group B	Group C	
Range	7 – 10	6-8	<0.001
Mean	8.95	7.12	
SD	1.03	0.72	



The time taken for maximum sensory blockade in group B was 8.95±1.03 mins and in group C was 5.9±0.8 mins.

Table 4. Time of onset of motor blockade in mins

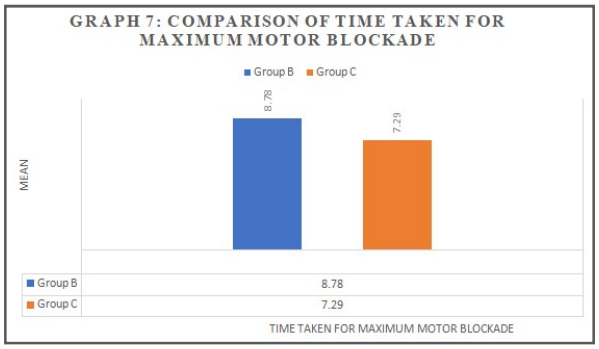
Parameters	Time of onset of motor blockade in mins		'p' value for B vs C
	Group B	Group C	
Range	4-6	1-3	<0.001
Mean	5.25	2.58	
SD	0.73	0.72	



The time taken for onset of motor blockade in group B was 5.25±0.73 mins and in group C was 2.58± 0.72 mins.

Table 5. Time taken to achieve Maximum level of motor blockade

Parameters	Time taken to achieve Maximum level of motor blockade		'p' value for B vs C
	Group B	Group C	
Range	6-10	5-9	<0.001
Mean	8.78	7.29	
SD	1.01	1.61	



The time taken for maximum motor blockade in group B was 8.79± 1.05 mins and in group C was 7.29± 1.61 mins.

DISCUSSION

For orthopaedic lower limb surgeries, spinal anaesthesia is most preferable anaesthesia. Spinal anaesthesia is very safe and easy to perform. Hyperbaric bupivacaine 0.5% is commonly used local anaesthetic for spinal anaesthesia. Without any adjuvant, analgesic action of bupivacaine alone generally lasts for 2-3 hours.So, for increasing the duration of anaesthesia, some adjuvants are injected intrathecally along with bupivacaine. There are number of intrathecal adjuvants like opioids, benzodiazepines, ketamine and neostigmine α2 agonists etc.Opioids as intrathecal additive prolong the duration of analgesia but they do have drawbacks like respiratory depression, nausea, vomiting and urinary retention[3,4,5].Because of these side effects of opioids, urinary catheterization and post operative monitoring is essential. Clonidine is a partial agonist of α2 adrenergic receptors. It does not have side effects like Opioids when added intrathecally in spinal anaesthesia therefore clonidine is preferred by many anaesthesiologists nowadays. This study is designed to compare the efficacy between hyperbaricbupivacaine 0.5% alone and along with intrathecal clonidine. We found that duration of sensory and motor blocker is prolonged in group c patients who received clonidine. Our results are similar to previous studies.

Time taken for Onset of Sensory Blockade: In our study, mean time taken for onset of sensory blockade is 3.59± 0.66 minute and 1.75 ±0.49 minutes in control group and clonidine group respectively. 'p' value is less than 0.001 so there is statistically significant decrease in onset of sensory blockade in clonidine group.In studies conducted by Leo S [6], Benhamou D et al [7], De Kock Marc et al[8], Dobrydnjov I et al [9] and Grandhe RP et al [10], significant decrease in onset of sensory blocked was found with clonidine. Our study also shows the same results.

Time taken for maximum sensory blockade: In our study, mean time taken for maximum sensory blockade is 8.95 ±1.03 minutes and 7.12 ± 0.72 minute in control group and clonidine group respectively. 'p' value is less than 0.0001 so there is statistically significant decrease in mean time taken for

maximum sensory blockade in the clonidine group. In study done by Leo S et al[6], mean time taken for maximum sensory blockade is 7.4 ± 1.1 minute in control group and 5.9 ± 0.8 minute in clonidine group. This finding occurs with our study also.

Maximum level of sensory blockade: In our study, maximum level of sensory blocked achieved is T4. In control group 5 patients out of 40 had T4 level and in clonidine group 9 patients out of 40 had a T4 level. So, there is no statistically significant difference in maximum level of sensory blocked achieved in control and clonidine groups. In study conducted by Strebel S et al [11], authors also observed no statistically significant difference in maximum level of sensory blockade achieved. This result concurs with our study.

Onset of Motor blockade: In our study, mean time taken for onset of motor blockade is 5.25 ±0.73 minutes and 2.58 ± 0.72 minute in control and clonidine groups respectively. 'p' value is less than 0.001, so there is statistically significant decrease in mean time for onset of Motor blockade inclonidine group. In study of DeKock Marc et al[8], authors also observed a significant decrease in mean time for onset of Motor blockade. Our study findings concur with their study.

Time taken to achieve maximum motor blockade: In our study mean time taken for maximum motor blocked is 8.78 ± 1.05 minute and 7.29 ± 1.61 minute in control group and clonidine group respectively. 'p' value is less than 0.001 so there is statistically significant decrease in mean time taken for maximum motor blockade in clonidine group. In study by Leo S.et al[6]mean time taken for maximum motor blockade is 6.57 ±0.9 minute in control group and 6.43 ± 1.04 minute in clonidine group. This finding concurs with our study.

CONCLUSION

In orthopaedic lower limb surgeries when clonidine is used intrathecally with hyperbaric bupivacaine 0.5%, it decreases the time taken for onset of motor and sensory blockade.

ABBREVIATIONS

CSF- cerebrospinal fluid
Inj- injection
ASA- American Society of Anaesthesiologists
mg- milligram
ml-millilitre
mcg- microgram
min- minute
sec- second
SD- standard deviation

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