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Comparison between Hyperbaric Bupivacaine, Isobaric Levobupivacaine and Levobupivacaine with Clonidine given intrathecally in patients undergoing Lower Limb Orthopaedic Surgery under spinal anaesthesia

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Abstract

Hyperbaric bupivacaine is the most common anaesthetic agent used for Subarachnoid block (SAB). In this study we compared hyperbaric Bupivacaine, isobaric Levobupivacaine and isobaric Levobupivacaine with clonidine in patients undergoing lower limb orthopedic surgery. Levobupivacaine is the pure S enantiomer of racemic bupivacaine but it is less cardiotoxic and neurotoxic. Intrathecal clonidine has been extensively used as an alternative to neuraxial opoid for prolongation of postoperative analgesia. Though its efficacy with hyperbaric bupivacaine has been studied by many trials, only few studies have been undertaken which assessed efficacy of clonidine with levobupivacaine. In the study, 90 patients were divided into three groups namely Group B, Group LB and Group LC with thirty in each group. Control group (Group B) received 3ml of 0.5% of hyperbaric bupivacaine (15 mg) plus 0.2ml of 0.9% normal saline, Group LB received 3ml of 0.5% (15 mg) of isobaric levobupivacaine plus 0.2ml of 0.9% normal saline and Group LC received 3ml of 0.5% (15 mg) isobaric Levobupivacaine along with clonidine 30 micrograms. Onset and duration of sensory as well as motor blockade were the parameters studied along with perioperative hemodynamic changes.

Keywords: Bupivacaine, Levobupivacaine, Clonidine, Spinal anaesthesia

Introduction

Subarachnoid block (SAB) is the most common anaesthetic technique used for patients undergoing lower limb orthopedic surgery. Only few studies have been done in the past involving administration of isobaric levobupivacaine intrathecaly. Levobupivacaine has pharmacological activity similar to that of racemic bupivacaine[1] but its cardiotoxicity and neurotoxicity potential are lesser than the racemic bupivacaine.[2] Levobupivacaine is being used intrathecally for surgeries which demand a prolonged period of anaesthesia and analgesia during intra operative as well as in post operative period. Levobupivacaine has been used as an effective alternative to bupivacaine[3,4].

Clonidine when used intrathecally, potentiates the action of local anaesthetics and improves the quality of analgesia[5,6]. This study was planned to assess and compare isobaric levobupivacaine and hyperbaric bupivacaine with clonidine added as adjuvant to intrathecal levobupivacaine, on quality of anaesthesia and duration of post-operative analgesia in patients undergoing lower limb surgery.

Materials and Methods

This prospective, randomized, double blind study was conducted on 90 patients of ASA grade I or II, between 25 to 60 years of age, of average height and weight and planned for femur or tibia plating under spinal anaesthesia. Exclusion criteria included allergy to study drugs, patient refusal, severe systemic disorders such as hypertension, diabetes mellitus or any heart disease and all common contraindications for spinal anesthesia such as bleeding disorders, infection at the puncture site or raised intracranial pressure. The patients were randomized into three groups of 30 each using computer generated random number table:

Group B (n=30) → received 3 ml (15 mg) of 0.5% hyperbaric bupivacaine plus 0.2ml normal saline

Group LB (n=30) → received 3 ml (15 mg) of 0.5% isobaric levobupivacaine plus 0.2ml normal saline

Group LC (n=30) → received 3 ml(15 mg) of 0.5% isobaric levobupivacaine plus 0.2ml (30 mcg) Clonidine

Thus all patients received total of 3.2 ml volume intrathecally.

On arrival in the operating room, monitoring devices including non-invasive blood pressure (NIBP), electrocardiogram (ECG) and pulse oximetry(SpO2) were applied and base line parameters were recorded. Preloading was done with Ringer Lactate (10–15 ml/kg). With the patient in sitting position, SAB was given at L3-L4 space using 23 G BD spinal needle (Quincke type) and immediately the patient was resumed to supine position. The anaesthesiologist who administered the block and anaesthesiologist who assessed the block were different and were blinded to the drug combination used. NIBP, pulse rate, SpO2 and ECG were monitored initially at every 5 mins interval and then at every 15 minutes till the end of the procedure. Sensory level was checked along the mid clavicular line by pinprick test every minute until T10 level was obtained. Motor block was assessed by modified Bromage scale as follows.

0. No paralysis and able to flex hips or knees or ankles;
1. able to move knees but unable to raise extended legs
2. able to flex ankles but unable to flex knees;
3. Unable to move any part of lower limb.

The time of onset of sensory block was taken as the interval between intrathecal drug administration and achievement of T10 dermatome level of sensory block. The onset time of motor block was taken as the interval between intrathecal drug administration and achievement of a Bromage score of 3. In the postanesthesia care unit, the patients were assessed for status of blockade, pain scores and hemodynamic parameters. Pain was assessed by visual analog scale (VAS) ranging from 0 to 10. Duration of sensory block was taken from the time of intrathecal drug administration to the point when VAS score became three. Duration of motor block was defined as the interval from intrathecal drug administration to the point when the Bromage score again became zero. Hemodynamic side effects like hypotension and bradycardia or any other post operative events if present were also noted and treated accordingly.

Statistical analysis: Statistical analysis was performed using the SPSS version 17. Data were analysed using one way ANOVA test, Chi-square test and Bonferroni test. A p value <0.05 was considered statistically significant and p value >0.05 was considered not significant.

Results

The study & control groups had no significant difference with respect to any demographic variables as depicted in Table 1.

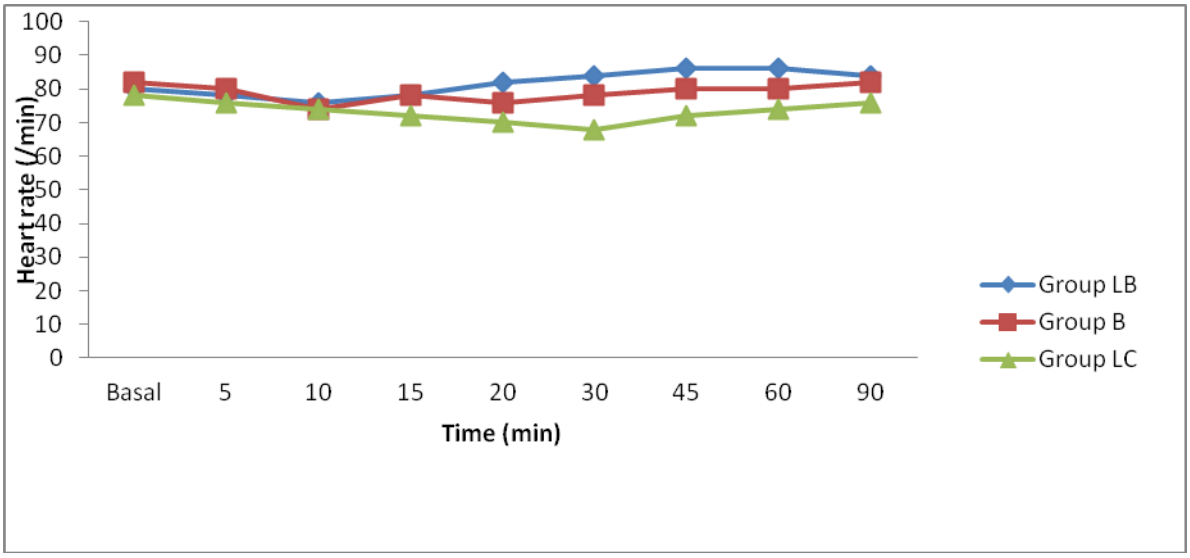
Table 1: Demographic profile comparison

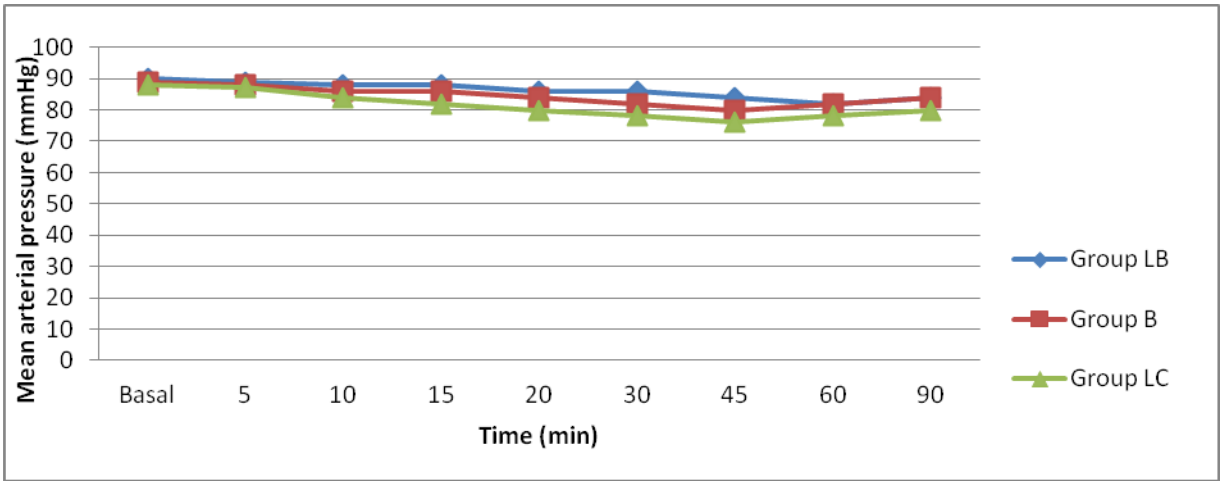
Characteristics	Group B	Group LB	Group LC	P value
Age (years)	54.82± 1.85	54.28± 2.03	55.98± 1.26	>0.05
Height (in cms)	157.12± 2.38	158.67± 3.21	156.67± 3.61	
Weight(kgs)	53.45± 4.22	52.19± 3.17	51.49± 4.84	

Table 2: Study variables studied in all three groups (mins)

Variables	Group B	Group LB	Group LC	P value
Sensory onset time	3.94±0.90	5.27±1.13	6.12 ±1.23	<0.05
Motor onset time	5.37±1.39	6.15±1.58	7.62±2.38	
Duration of sensory block	177.50±13.352	205.10±17.198	274.87±18.151	
Duration of motor block	159.27±11.414	171.83±10.752	219.97±14.38	

Fig 1: Line diagram showing haemodynamic changes





Sensory onset time was lowest in bupivacaine (B) group compared to levobupivacaine (LB) and Levobupivacaine clonidine (LC) groups. Motor onset time was much delayed in LC group compared to B and LB groups. However duration of analgesia was found to be prolonged in group LC compared to group B and group LB. Duration of motor blockade was found to be least in group B and highest in group LC.

Hypotension was noted in 6 patients (20%) of LC group. Bradycardia was seen in 3 patients (10%) of LC group.

Discussion

Hyperbaric bupivacaine has been the most commonly and routinely used intrathecal agent for subarachnoid block. Short duration of sensory and motor blockade and unfavourable cardiac profile are few limitations associated with this drug. Levobupivacaine, a S enantiomer of racemic bupivacaine has been shown to be less cardiotoxic and neurotoxic with better hemodynamic properties[7,8,9,10]. Clonidine, an alpha 2 adrenoreceptor agonist, is being extensively used as an adjuvant to local anaesthetics[11] due to its no respiratory depression or addiction properties. Numerous studies have been done in past using clonidine as an adjuvant to intrathecal bupivacaine to enhance its postoperative anlgesia[12,13]. But use of clonidine with intrathecal levobupivacaine has not been extensively studied so far.

In our study, the onset of sensory and motor blockade was found to be faster in hyperbaric bupivacaine group than other two groups and was slowest in group LC. This sequence of onset time of blockade may be explained by the density of the drug solution used. Addition of clonidine to levobupicaine, makes the density of solution to be lighter in comparison to levobupicaine alone. This could be the reason for the delayed onset of sensory and motor blockade in levobupivacaine clonidine group. However a study done by Opas Vanna found no difference between isobaric levobupivacaine and hyperbaric bupivacaine in regard to the time of onset of blockade as well as in duration of sensory blockade.[14] The delayed onset of blockade in Group LC, in our study, is in accordance with the work done by E.Van Sommeren et al.[15]

Duration of sensory analgesia was found to be maximum in LC group (274.87±18.15) and also statistically significant ($p<0.05$). Niemi L in his study found that addition of clonidine to intrathecal bupivacaine increases the duration of analgesia in knee surgeries[16]. In his study, Niemi L mixed clonidine to intrathecal bupivacaine and the mean duration of clonidine enhanced analgesia in his study was 217

minutes. But in our study we found that by adding clonidine to intrathecal levobupivacaine, the duration of sensory analgesia was enhanced to 274 minutes.

Earlier studies have shown that duration of motor blockade is enhanced when clonidine is added to local anaesthetics.[17,18] In our study, the duration of motor blockade was prolonged in levobupicaine with clonidine group than other two groups. E.Van Sommeren et al also reported that addition of clonidine to bupivacaine prolongs the duration of motor blockade[15].

Hypotension and bradycardia are the most commonly reported adverse events after administering SAB with local anaesthetic agents and also especially when alpha 2 agonists like clonidine is added as an adjutant. In our study, decrease in heart rate was more in group LC (levobupivacaine with clonidine) than other groups which was statistically significant ($p < 0.05$). These changes in heart rate were significant between 20th min until 60th min after sub arachnoid injection. Though the maximum reduction in heart rate was seen in levobupivacaine with clonidine group, the number of patients who required intervention were only 7 in levobupivacaine with clonidine group and 3 in bupivacaine group. The levobupivacaine group had better hemodynamic stability in comparison to other two groups. Though there was fall in mean arterial pressure in all the groups, no statistically significant difference was seen between the groups in terms of mean arterial pressure.

Conclusion

In our study, the group receiving isobaric levobupivacaine was found to have better hemodynamic stability. Though the onset time of both sensory and motor blockade were delayed on addition of clonidine to levobupivacaine, the prolonged duration of sensory analgesia without any untoward adverse events makes this combination a good alternative to both hyperbaric bupivacaine and isobaric levobupivacaine in lower limb orthopaedic surgeries where prolonged pain relief is warranted.

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