

Effect of Clonidine Addition To Hyperbaric 0.5% Bupivacaine For Spinal Anaesthesia In Lower Limb Surgery [A Comparative Study]

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Abstracts: Background: The use of subarachnoid block has become an established and reliable method of providing anaesthesia for lower abdominal and lower limb surgery. Regional anaesthesia is generally well tolerated by all patients, producing less postoperative confusion and delirium than general anaesthesia. It is also associated with lesser incidence of post-operative thromboembolism. However subarachnoid block has got its own inherent complications, especially related to cardiovascular stability. Aim: to compare the haemodynamic, sensory and motor effects of a low dose bupivacaine – clonidine spinal anaesthesia versus conventional dose of bupivacaine in patients undergoing lower limb surgery. Method: Prospective, randomized double blind study was undertaken in 60 selected patients posted for lower limb surgeries. Data were collected for duration and onset of motor and sensory effects, haemodynamic changes and side effects of study drugs and they were statistically analyzed. Results: We found in our study that time of onset of adequate level of sensory block (T10) was significantly longer for group B which contains 30µ gm of clonidine (126±14) than group A (95±10). The total duration of sensory block for Group A was 227.6±9.8 mins while Group B had 351.9± 17.5 mins and motor block for group A was 162.5±7.51 mins while in group B had 274.8±14.4 mins. Conclusion: Clonidine when combined with low dose bupivacaine has prolonged the duration of motor and sensory blockage and incidence of intra operative pain with maintaining haemodynamic stability. [Chand K et al NJIRM 2012; 3(1) : 113-119]

Key Words: Low dose spinal anaesthesia, bupivacaine, clonidine

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Introduction: The use of subarachnoid block has become an established and reliable method of providing anaesthesia for lower abdominal and lower limb surgery.¹ Regional anaesthesia is generally well tolerated by all patients, producing less postoperative confusion and delirium than general anaesthesia.² It is also associated with lesser incidence of post-operative thromboembolism.³ However subarachnoid block has got its own inherent complications, especially related to cardiovascular stability.⁴

Many drugs have been used for spinal anaesthesia in lower limb surgery e.g. Lignocaine, bupivacaine, ropivacaine etc., but bupivacaine is still considered as a standard drug for the same as far as therapeutic and side effect profile is concerned.⁴ There had been many drugs studied for the prolongation of duration of bupivacaine in spinal anaesthesia such as opioids, alpha2 agonist e.g. clonidine, adrenaline etc. each of them has its own advantages and disadvantages.⁵

Alpha2 adrenergic receptor activation triggers intense analgesic response by involving spinal and supraspinal receptors. They also play an important role in pain modulation by inhibiting the nervous conduction of Aδ & C fibers. Clonidine when combined with bupivacaine has prolonged the duration of motor and sensory blockage and incidence of intra operative pain.⁶

The goal of this study is to compare the hemodynamic and sensory-motor effects of a low dose bupivacaine – clonidine spinal anaesthesia versus conventional dose of bupivacaine in patients undergoing lower limb surgery.

Material and Methods: This study was conducted at civil hospital, BJMC, Ahmedabad. Approval of the college ethics committee and written informed consent from all the patients were obtained. It was a prospective study, where 60 selected patients posted for lower limb surgeries were randomly divided into two groups. First group received

bupivacaine alone and the second group a combination of bupivacaine and clonidine.

Patients satisfying the inclusion criteria were randomly divided into groups of 30 each. Both the patient and the principle investigator were blinded for the drug, which was being administered during the period of observation.

Inclusion criteria

- ASA I & II (American Society of Anaesthesiologist physical status classification – physiologically normal)
- Age 20 to 70 years
- Height 155-175 cm.
- Patients posted for lower limb surgeries

Exclusion criteria

- Any known contraindication to spinal anesthesia as follows:
- History of allergy to local anesthetics
- Patients with severe cardiac or respiratory disease eg. Cardiac arrhythmia, abnormal cardiac anatomy or congestive cardiac failure,
- Patients with increased intra cranial pressure, infection at local sites, hematological disorder like bleeding diathesis, psychiatric illness, mental retardation, clinical evidence of significant dehydration
- Hemoglobin concentration less than 8g/dl
- Patients with uncontrolled hypertension, taking medications such as digoxin.
- Spine deformity

Routine investigations in the form of Hb, blood sugar, urea, Rh typing, X-ray, ECG were carried out. Any specific investigations, if required according to the individual cases were also done. The patients who were selected and posted for lower limb surgeries were scrutinized as per criteria mentioned above. They were randomly divided into the bupivacaine and clonidine group using the random number chart. Both the groups were comparable with respect to age, height, cardiac risk index and pre-anaesthetic arterial pressure.

Preparation: All the patients were fasted overnight for 8 to 10 hrs. No intravenous fluid was given till arrival to operating theatre. Patients received no premedication before arrival in the operating theater. Psychological preparation was done and the procedure explained to all the patients in

advance. On arrival in the operating room an i.v. access was secured using an 18G cannula under local anesthesia in the left forearm vein. All the patients were given 4mg ondansetron and 1 mg midazolam i.v. Before spinal block, each patient received a fast infusion of 8 ml/kg of lactated Ringer's solution. Standard monitoring included continuous electrocardiogram, pulse oximetry, non-invasive automated blood pressure measurements and visual assessment of respiration.

Lumbar puncture was performed with the patient in the sitting position at the L 3–4 interspace, with a 23-gauge Quincke-point needle after subcutaneous lidocaine infiltration under strict aseptic and antiseptic precautions.

Group A received 3ml Of 15 mg hyperbaric bupivacaine 0.5% (Astra, Sodertalje, Sweden) plus 0.2 ml saline and Group B 15 mg (3 ml) of hyperbaric bupivacaine 0.5% plus 30 µg clonidine. Injected volume for both groups was 3.2 ml. Injections were made over 10-15sec. After completion of injections the patients were immediately returned to the supine position. Sensory level of T10-T8 was achieved. Throughout the procedure patients received an oxygen supplementation of 4L/min via oxygen mask.

The syringe was prepared by one researcher and administered by a second who remained blinded to its contents. Patient assessment and care were conducted and study data were recorded by the second researcher.

Data collection : Pulse rate, blood pressure and SpO2 were checked immediately after giving spinal anesthesia (0 min), every 2 min for the first 10 minutes and every 5 min for the next 30 min and every 15 min thereafter till 1hour postoperatively. They were followed up to 12 hours after surgery and thereafter with routine post-op care in the post-surgical wards.

For the purpose of the study hypotension was defined as a systolic blood pressure of < 90 mmHg or a decrease of more than 30% from the baseline mean arterial pressure. Reaching either criterion was considered hypotension and was treated with an incremental intravenous bolus of mephentermine 6 mg and i.v. fluid infusion.

Bradycardia was defined a heart rate <60/min or decrease more than 20% of baseline pulse rate and it was treated with IV atropine.

Main outcome and measurements: The following parameters were assessed and compared

- Time for adequate level of analgesia (T10, assessed with pinprick).
- Peak sensory level reached (assessed with pinprick)
- Time for motor block to recede to L 3-4 level, ability to flex knee.(modified bromage scale)⁷
- Duration of sensory block.
- Incidence of complications including – respiratory depression, hypotension, bradycardia, nausea and vomiting, sedation, shivering and mandatory bladder catheterization within 12 hours.

The motor block was assessed using a modified bromage score⁷

- 0- No paresis - full movement of lower limb
- 1- Partial paresis - Flex knees and ankles
- 2- Partial paresis - Flex ankles
- 3- Partial paresis - Flex toes only
- 4- Full paresis - No movements

Intra-operative fluid management : In addition to the loading dose of intravenous fluids, patients received a maintenance infusion of lactated Ringer's solution as calculated according to the conventional formulae. Intra-op blood loss was replaced as indicated.No additional sedative medications were given during the operation. The protocol allowed for conversion to general anesthesia as deemed necessary by the blinded anesthesiologist.

Statistical tools: Data were entered and analyzed with the Graph Pad.com. Statistical tests used for comparison is Student's t-test. Results are presented as mean (SD) and number (%) of cases as appropriate. The level of significance was set at P < 0.05, and 95% confidence intervals were calculated for the main outcome measures.

Result: The observations made were tabulated and analyzed using appropriate statistical tools as shown in table and graph below.

Demographics: The table 1 shows that both the groups were comparable with respect to their age and height (Mean ± SD) and gender ratio. The average duration of surgery in both the groups was 120 to 150 minutes.

Table 1: Demographics

Parameters	Group A	Group B
Age(yrs)	50.9	45.1
Height (cm)	164.3 ± 5.8	163.4 ± 5.5
Male/ Female ratio	24/6	24/6
Duration of surgery (mins)	135 ± 30.6	128.8 ± 32.4
Time for onset of adequate block at T10 level (sec.)	95±10	126±14

Onset Of Adequate Block (T10): Table 1; The time of onset of adequate level of sensory block (T10) was longer for group B (126±14sec.) than group A (95±10sec.). This delay in onset of block for group B was found to be statistically significant. (P=<0.001)

Motor Block: The motor block assessment is presented in table 2. Duration of motor block is longer in group B as compared to group A and it was statistically significant (P value <0.05).None of the patients needed supplementation of analgesia during operation and surgeons were satisfied with the intensity of sensory and motor block in both the groups.

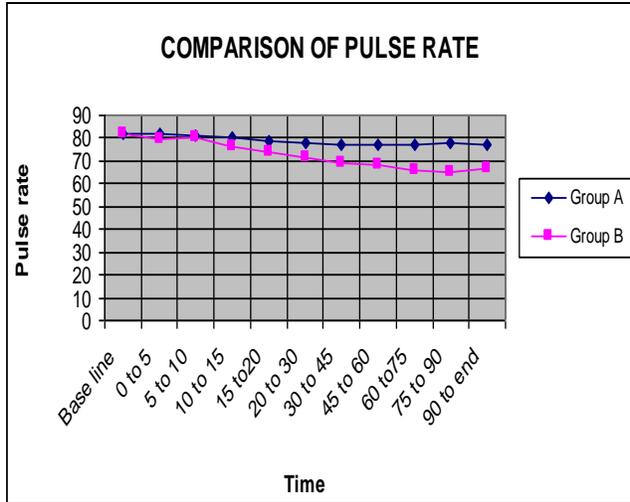
Table 2: Intensity of Motor Block

Bromage Scale	Group A	%	Group B	%
1	0	0	0	0
2	0	0	0	0
3	7	23.3	8	26.6
4	23	76.6	22	73.3

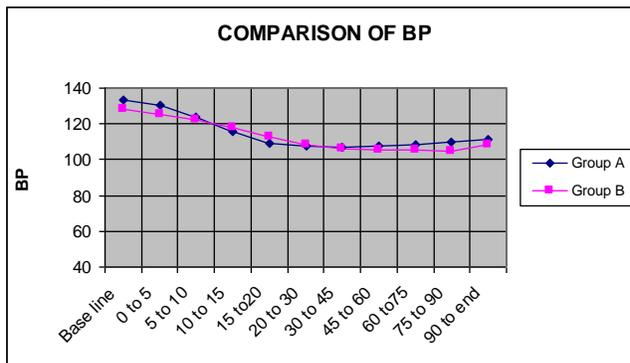
As shown in Table 2 in our study we assessed the motor block using modified bromage scale which showed almost similar scoring for both groups.⁷ None of the patients, in either group, had a bromage score of less than 3. For lower limb orthopedic procedures a bromage score of 3 is considered to be satisfactory. Duration of motor block is longer in group B (274.8±14.4min) as

compared to group A (162.5±7.51min) and it was statistically significant (P value <0.0001).

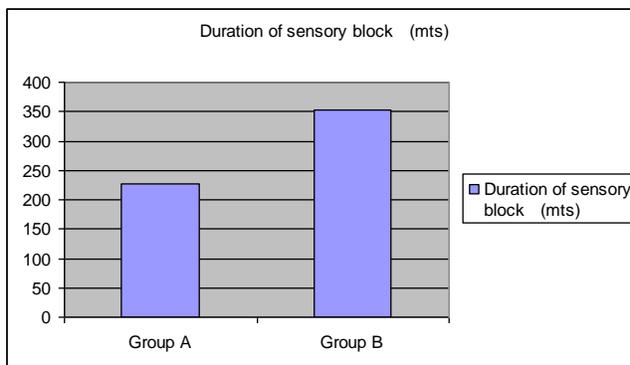
Graph 1: Comparison of Pulse rate



Graph 2: Comparison Of Blood Pressure (Mean Systolic B.P. At Different Time Intervals)



Graph 3: Duration of sensory block (mins)



Hemodynamic Changes: Graph 1 shows statistically significant lower pulse rates for the clonidine group but within acceptable limits. (p=0.003). Graph 2 shows systolic B.P. at different time intervals, with maximum fall occurring at 15 minutes, after giving

spinal anesthesia in both the groups. Fall in blood pressure in both groups were quite comparable and statistically insignificant. (p=0.64)

The incidence of hypotension and thus use of vasopressor was higher in group B (40%) than group A (26.6%). This difference was found to be statistically insignificant.

The incidence of bradycardia and thus use of atropine was higher in group B (13.3%) than group A (10%). This difference was not found to be statistically significant. (Table 3)

Duration Of Sensory Block: Graph 3: The total duration of sensory block was higher for Group B (351.9±17.5) than in Group A (227.6±9.89), And this was found to be statistically highly significant.(p=0.0001)

Table 3 Complications

	Group A	Group B
Hypotension Vasopressor used	8 (26.6%)	12 (40%)
Bradycardia Atropine used	3 (10%)	4 (13.3%)
Urinary retention	0	0
Nausea & Vomiting	0	0
Sedation	0	0
Shivering	2 (6.66%)	1(3.33%)
Respiratory depression	0	0

Intraoperative Complications: Table 3 shows the incidence of intra-operative complications. The incidence of hypotension and shivering was significantly higher in group A as compared to group B. The incidence of bradycardia is higher in group B; but is within acceptable limits. No patients suffered from nausea and vomiting in both the groups. None of the patients in either group developed respiratory depression.

Discussion: As we know that marked hemodynamic derangement is seen following spinal anesthesia. So especially in lower limb surgery, we use much titrated dose of local anesthetic drugs but the duration of sensory and motor effects and postoperative analgesia are often not sufficient. Many previous studies have used intrathecal clonidine combined with opioids and local

anaesthetics for labour analgesia and orthopedic surgery.^{8,9,10.}

Recommended dose of bupivacaine: The recommended level of regional anesthesia for lower limb surgeries is T10. The standard recommended dose for this using hyperbaric bupivacaine 0.5% is 3 ml or 15mg.⁴

Combination with clonidine: In our present study we have added 30 µg of clonidine, an alpha2 agonist to 15mg of hyperbaric bupivacaine 0.5% and compared the hemodynamic parameters – blood pressure and heart rate changes as well as various known side effects of clonidine and the sensory, motor profiles of the block.

Hema Saxena et al concluded that the 30 µg provides maximum benefit and minimum side effects. It is recommended when prolongation of spinal anaesthesia is desired as, for example in patients scheduled for long, lower abdominal and lower extremity orthopaedic procedures.¹¹

Time for adequate onset of block: There was statistically significant increase in the time for onset of adequate block among the combination group B with 126±14 seconds, while Group A which contains 3 ml(15mg) of bupivacaine alone showed only 95 ± 10.32 seconds which was similar to the finding of Grandhe et al who found higher time taken with higher dose of clonidine.¹² However the clinical significance of this observation in an elective surgery may be neglected, but the time parameters shows significant differences.

Duration of sensory block: The total duration of sensory block for Group A was 227.6±9.8min while Group B which contains 30 µg of clonidine had 351.9± 17.5 min. This difference between the two groups was statistically highly significant. Addition of clonidine enhances the duration of sensory block as concluded in the studies done by Hema Saxena et al in which total duration of sensory block for control Group was 99.75±.21.91mins while in Group B which contains 30 µg of clonidine had 264.75± 44.34 mins.¹¹ Both are lesser than our study which may be due to use of 13.5 mg bupivacaine.

Degree and duration of motor blockade: We found in our study that total duration of motor block for group A was 162.5±7.51 mins while in group B had 274.8±14.4 mins which is similar to study of M.Kerci et al in which this difference between the two groups was statistically highly significant (duration of motor bloc 186± 30 mins in clonidine group while In control group, duration of motor block was 152±40 mins) the difference is due to lesser dose of bupivacaine e.g. 12.5 mg in that study.¹³ The degree of motor block was compared using modified bromage score which showed almost similar degree of motor block in both groups.

Cardiovascular effects: We compared the hemodynamic stability of hyperbaric bupivacaine alone and its combination with clonidine. In our study 8(26.6%) patients with bupivacaine alone developed hypotension & needed vasopressor Whereas 12(40%) from the clonidine group experienced hypotension & needed vasopressor the finding are almost similar to study of M.Kerci et al incidence of hypotension are 27.3% & 36.6% respectively.¹³ Our study also revealed that the degree of blood pressure fall among bupivacaine alone group was amounting to 18.9 mm of Hg and among the combination group was 16.6 mm of Hg from their initial systolic blood pressure values but it was statistically not significant.

We also observed that statistically significant lower pulse rates were seen in clonidine group as compared to bupivacaine alone group but they were within acceptable limits. In study of Hema Saxena et al the difference in pulse rate in both groups was statistically insignificant.¹¹ In our study the incidence of bradycardia & thus need for the atropine was 3 in bupivacaine group and 4 in clonidine group which was almost comparable. In study of Kaabachi et al the difference in BP & pulserate between the two groups was not statistically significant.¹⁴

Side Effects: Incidence of hypotension and bradycardia were slightly higher in clonidine group compared to bupivacaine alone but statistically insignificant. Shivering was seen in 2 patients in group A & 1 patient in group B which was comparable. None of the patient in any group developed nausea, vomiting, respiratory

depression, urinary retention or sedation which are in agreement of study of Hema Saxena et al.¹¹, Grandhe RP et al.¹², Kerci et al.¹³, I. van Tuijl et al.¹⁵, & B.S. Sethi et al.¹⁶.

Data Quantity : Even though our sample size was not very large, it had been statistically adequate enough to make our study relevant and representative.

Conclusion: After analyzing the results of our study, we found that systolic B.P. decreased in both the groups, maximum fall occurred at 15 to 20 min in both the groups. Heart rates and BP were lower in group B as compared to group A but the difference was statistically insignificant and vitals were within acceptable limits. Group B had prolonged sensory and motor effects compared to group A which was statistically highly significant. Incidence of hypotension and bradycardia & need of vasopressor & atropine were comparable in both the groups. Therefore we conclude that subarachnoid block with 15 mg bupivacaine 0.5% and 30 µg clonidine is safe and better option, both in terms of maintaining hemodynamic stability & prolonging the sensory, motor & analgesic effects without compromising the surgical conditions in lower limb surgeries.

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