Original Research Article

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Evaluation of Low Dose Bupivacaine with Clonidine for Unilateral Spinal Anesthesia in Lower Limb Surgeries

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Abstract

Introduction: Unilateral spinal anaesthesia has been extensively studied for short duration elective lower limb surgeries with favorable results i.e when block is desired on operative side only with absence of block on non-operative side. Unilateral block minimizes cardiovascular effects, avoids motor block of nonoperative limb thereby early ambulation and early discharge.

Aim: The aim of this study was to determine the sensory and motor block characteristics and haemodynamic variables (HR, MAP, RR) by comparing 7.5 mg of 0.5% hyperbaric bupivacaine used alone and along with 30μg clonidine.

Methods: It was a prospective, double blind , hospital based study undertaken at Department of Anaesthesiology, Gandhi Medical College, Bhopal after approval of the Institutional Ethics Committee. 60 patients of either sex aged 20-60years with ASA grade I and II scheduled for elective lower limb surgery with informed consent were randomly allocated into two groups. All patients received subarachnoid block with 7.5 mg of 0.5% hyperbaric bupivacaine. In group BC 30 μg of clonidine and in group BS 0.2 ml of Normal Saline was added to bupivacaine and the volume was kept similar (1.7 ml) for each group.

Statistical Analysis Used: Chi-Square (c^2) test and Unpaired Student's *t*-test

Results: Although there was not much significant difference between the haemodynamic parameters in both the groups, the onset of sensory block (6.0±0.58 mins in group BS and 3.9±0.48 mins in group BC) and the onset of motor block (10.08±0.54 mins in group BS and 7.03±0.57 mins in group BC) was significantly earlier and the average duration of analgesia and motor block was significantly prolonged in patients receiving clonidine as an adjuvant along with bupivacaine. Likewise, the time for the first rescue analgesic request (258±20 & 331±23 mins respectively in groups BS & BC, $p<0.0001$) was delayed in patients receiving clonidine as an adjuvant.

Conclusion: From our study we conclude that 7.5mg of 0.5% hyperbaric bupivacaine used along with clonidine is superior than 7.5mg of 0.5% bupivacaine used alone in prolonging duration of analgesia and motor block while maintaining the unilaterality of spinal block and haemodynamic stability.

Keywords: Low Dose 0.5% Hyperbaric Bupivacaine with Clonidine; Unilateral Subarachnoid Block; Lower Limb Surgeries.

Introduction

An exclusively unilatearal block affects sensory, motor and sympathetic function on one side of body only and offers the advantage of subarachnoid block without typical side effects associated with conventional block. Conventionally used dose of bupivacaine is associated with hemodynamic instability, delayed recovery of motor functions, urinary retention and therefore require prolonged postoperative observation [1]. To overcome these consequences small dose of bupivacaine is gaining popularity for ambulatory anaesthesia.

Unilateral spinal block procedure is advantageous over conventional spinal anaesthesia in producing extreme longer lasting block in the

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operative limb reduced incidence of hypotension, faster recovery and increased patient satisfaction [2].

Various adjuncts to local anesthetics have been studied for improving the quality of subarachnoid block. Intrathecal administration of clonidine increases the duration of both sensory and motor block, as well as postoperative analgesia.

The purpose of this study was to compare the effectiveness of 7.5 mg of hyperbaric bupivacaine with or without clonidine (30 μg) in unilateral spinal anaesthesia for lower limb surgery.

Material and Methods

Institutional Ethics committee approval and informed consent from the patients were taken for the study. This study was conducted in 60 patients of either sex, aged 20-60years with ASA grade I and II scheduled for elective lower limb surgery. Patients with any contraindication for subarachnoid block were excluded from the study.

All these patients underwent a pre-anaesthetic check-up a day prior to surgery, and all the routine and specific investigations were noted. The patients were kept nil by mouth 6 hours prior to surgery. Before surgery a written and informed consent was taken from the patients. An intravenous line was secured, standard monitors like electrocardiogram, pulse oximeter and non-invasive blood pressure were applied. All patients were hydrated with 500ml of Ringer's lactate and subarachnoid block was performed under aseptic precautions in L3-L4 interspinous space using 25 G Quincke spinal needle in lateral decubitus position with the limb to be operated in the dependent position. All patients received 7.5 mg of 0.5% hyperbaric bupivacaine. In group BC 30 μg of clonidine and in group BS 0.2 ml of Normal Saline was added to bupivacaine and the total volume was kept similar (1.7 ml) for each group. The patients were maintained in the same position for 10 minutes before turning supine.

- Haemodynamic parameters (Heart rate, respiratory rate, MAP) were recorded immediately before spinal injection and every 5 minute after spinal injection for first 30 minutes and then every 15 minutes till completion of surgery. Hypotension was labeled as significant if fall was more than 30% from baseline and bradycardia if heart rate decreased below 50 bpm.
- The level of sensory and motor block was determined on both operated and nonoperated limbs. Assessments were done immediately after spinal injection and at 5 minutes interval for 20 minutes and every 15 minutes until end of surgery and regression of block to L2 level. Time of complete motor recovery was also recorded. Sensory testing was done by pricking 20 G hypodermic needle at the mid-clavicular line bilaterally after the end of block from caudal to cephalad and analgesic level was defined as the cephalad most dermatome at which the patient had decreased sharp sensation.
- The degree of motor block was assessed using the Modified Bromage scale(0-no block, 1-hip blocked, 2-hip and knee blocked, 3- hip, knee and ankle blocked).

Ramsay Sedation Score [3]

Was measured using the following scale at 15, 30 and 60 minutes after tracheal extubation:

1= anxious, agitated, or restless;

2= cooperative, oriented, and tranquil;

3= responsive to commands

4= asleep, but with brisk response to light, glabellar tap, or loud auditory stimulus

5= asleep, sluggish response to glabellar tap, or auditory stimulus

6= asleep, no response. Patients will also be asked for recalling of intra operative events or any sign of awareness.

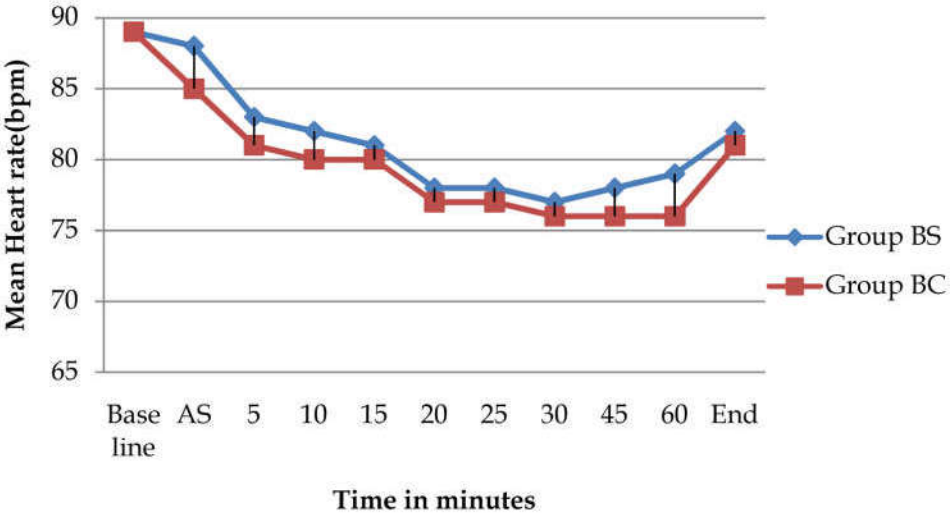
- Postoperatively all the patients were observed for 2 hours in recovery room before returning to the ward. Side effects like Nausea, vomiting, hypotension, bradycardia, & urinary retention if any were noted. HR,MAP, RR were recorded continuously.
- All the observations were recorded and the results were analysed. Statistical analysis was performed using SPSS version 20. The two-sample unpaired student 't' test was used to compare demographic data and times for readiness to surgery, block resolution. Ordinal data were analysed using the contingency table analysis with the Chi-square test. A p value < 0.05 was considered significant.

Results

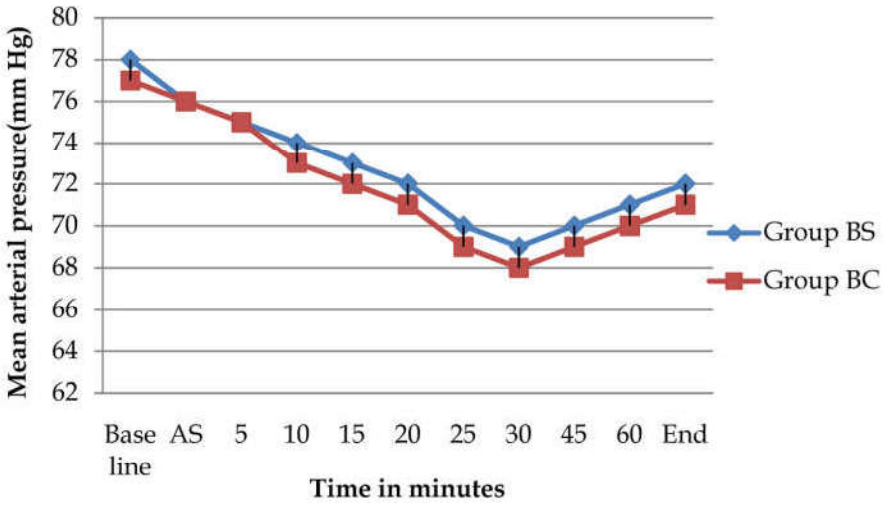
Mean age, weight, sex distribution, ASA status and duration of surgery in both groups were comparable and found to be statistically insignificant.

Table 1: Demographic data & Duration of surgery

Variables	Group BS	Group BC	p value
Age (years):	40.10± 9.57	38.10±9.46	0.419
Weight(kg)	54.57 ±3.26	53.77± 3.47	0.869
Sex ratio(M/F)	19:11	17:13	0.522
ASA status (I/II)	21/9	23/7	0.340
Duration of surgery (mins)	99±22	100±20	0.854



AS=immediately after subarachnoid block
Fig. 1: Mean Heart rate



AS=immediately after subarachnoid block
Fig. 2: Changes in Mean arterial pressure

Table 2: Sensory block characteristics

Variables	Group BS	Group BC	P value
Onset of sensory block (min)	6.033±0.586	3.933±0.487	<0.0001
Peak sensory level	T10	T10	
Operated limb	(T12 – T9)	(T12 – T8)	>0.05
Non-operated limb	L3(T12-S3)	L2(T12-S1)	>0.05
Time to reach peak(T10) level (min)	14.73±1.4	10.33±2.11	<0.0001
Time of regression of sensory block till L2(mins)	140±13.43	190±15.04	<0.0001

Haemodynamic Variables

Intraoperative and postoperative haemodynamic parameters(HR, MAP & RR) in both the groups were comparable and there was no significant difference. Cardiovascular parameters were stable throughout in both the groups[except for one case where intra-operative bradycardia was noted but it was not considered significant as the patient's baseline PR was 60bpm].

Table 2 shows that the onset of sensory block was faster and time of regression of sensory block till L2 in group BC was significantly prolonged than group BS.

Sensory level was significantly higher and motor block was more intense (Modified Bromage scale >2) in operative limb as compared to non-operative limb in both the groups (p>0.05).

Table 3 shows onset of motor block was earlier and time of complete recovery of motor block was significantly higher in group BC as compared to group BS.

Table 3: Motor block characteristics

	Group BS	Group BC	p value
Onset of motor block (mins)	10.083±0.543	7.033±0.571	<0.0001
Modified Bromage scale(0/1/2/3)			
Operated limb	0/2/2/26	0/1/1/28	-
Non operated limb	22/4/3/1	23/5/1/1	-
Time of complete recovery of motor in operated limb(mins)	191.9±9.90	262±20.87	<0.0001

Table 4: The time when the first rescue analgesic request was significantly higher in group BC as compared to group BS.

	Group BS	Group BC	p value
Time of first rescue analgesic required (in mins)	258.25±20.50	331±23.09	<0.0001

Table 5: Comparison of complications and side effects between the two groups

Side effects	Group BS	Group BC	Total
Hypotension	0	0	0
Bradycardia	0	1	0
Sedation	0	2	2
Nausea & vomiting	0	1	1
Urinary retention	0	0	0
PDPH	0	0	0

There were no significant adverse effects noted in either group.

Discussion

Unilateral spinal anaesthesia is used when block is desired only on operative side[4]. When surgery involves only one lower limb, such type of anaesthesia is advantageous and minimizes hemodynamic variations associated with conventional spinal anaesthesia. It also enables faster recovery, good cardiovascular stability and early discharge [5-7].

The technique to achieve unilateral distribution of spinal anaesthesia used in the present study has been discussed earlier in the studies done by Valanne et al [8].

Our results showed that the low dose of intrathecal clonidine co-administered with a low dose of bupivacaine reduced the time of onset of sensory and motor block and prolonged the duration of sensory block (from time of first request for supplemental analgesia). However, Clonidine also significantly prolonged the recovery of motor block. These results are similar to that of Singh TK et al [9].

There was significant difference in spread of anaesthesia between operative and contralateral limb. In operative limb sensory levels were much higher and motor block was denser in comparison to non-operative limb. Just after subarachnoid block, unilateral spinal anaesthesia was achieved in 88%

& 93% patients of Group BS & BC respectively. Unilateral block restricted to operative limb in more than 75% of patients with minimal changes in cardiovascular parameters has been reported by previous investigators using hyperbaric bupivacaine [10]. This is due to more anaesthetic concentration achieved near the nerve roots of operative limb.

Our study confirmed previous reports of prolongation of postoperative analgesia by addition of clonidine [11] to spinal local anaesthetic. Clonidine is a selective partial agonist for α-2 adrenergic receptors; the analgesic effect following its intrathecal administration is mediated spinally through the activation of postsynaptic α-2 receptors in substantia gelatinosa of the spinal cord [12].

In addition, there was some prolongation of motor block in patients receiving intrathecal clonidine. These findings concur with previous reports [11]. The mechanism of prolongation of motor block by clonidine remains speculative [11] and can be due to direct inhibition of impulse conduction in motor nerve fibres [13].

Relative hemodynamic stability was maintained in both the groups as observed in previous study[14] none of the patient had significant fall in BP ,this may be due to low dose of anaesthetic used and laterality of block [14]. Only one patient in group BC had bradycardia which was treated by i.v.Atropine and the same patient had complain of nausea and vomiting which was also treated. PDPH and urinary retention were not seen in any patient.

Only two patients in group BC had Rramsay sedation score of 4 at 15 minute postoperatively. But at 30 and 60 minutes postoperatively, there was no statistical significant difference in sedation score in between two groups.

Low dose of local anesthetic, slow speed of injection[14-15], lateral decubitus position [16] during and subsequently after subarachnoid block and duration of this position are main determinants of distribution of spinal block to one side. The optimum duration of lateral position is difficult to define as it is also related to dose of local anaesthetic. As we used intermediate dose of hyperbaric bupivacaine we positioned the patients in lateral position with operative side in dependent position and maintained this position for 10 minutes after subarachnoid block. Slow speed of injection minimizes mixing of local anaesthetic with CSF and thus facilitates unilateral block [16].

None of the patients had failed or inadequate block in both the groups. This may be due to high anaesthetic concentration achieved near nerve roots of operated limb which could account for slow regression of sensory block due to reduced surface available for absorption and elimination of local anaesthetic from subarachnoid space. The quality of subarachnoid block was improved by the addition of clonidine in group BC.

Conclusion

From our study we conclude that limiting the spread of subarachnoid block provides two benefits firstly better haemodynamics and secondly earlier patient mobilization however coadministration of clonidine along with 7.5mg of 0.5% hyperbaric bupivacaine is found to be superior than 7.5mg of 0.5% hyperbaric bupivacaine used alone in prolonging duration of sensory and motor block as well as postoperative analgesia in unilateral spinal anaesthesia of sufficient duration in majority of patients undergoing elective lower limb surgeries.

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Conflicts of Interest: None

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