

Original Research Article

Isobaric levobupivacaine a better and safer substitute for spinal anaesthesia in patients undergoing prolonged lower abdominal and lower limb surgeries

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ABSTRACT

Background: Bupivacaine being the drug of choice for spinal anaesthesia is associated with serious cardiac toxicity. Levobupivacaine and ropivacaine, both being the two S enantiomers of bupivacaine can be a safer alternatives with better cardiovascular safety. Hence, the clinical efficacy of both were assessed and compared in patients undergoing spinal anaesthesia.

Methods: A prospective randomized controlled double blind study was done in 68 adult posted for elective lower abdominal and lower limb surgeries under spinal anaesthesia. They were randomized into 2 groups. About 3ml isobaric levobupivacaine 0.5% (15mg) was given in group A and 3ml isobaric ropivacaine 0.5% (15mg) was given in group B. Onset, duration of sensory and motor blocks, time for maximum sensory and motor block, time for 2 segment sensory regression and haemodynamic parameters were recorded and analyzed.

Results: All patients achieved a sensory block of T10 dermatome. Onset of sensory blockade at T10 was similar in both groups, group A (5.71 ± 1.31 min) and group B (5.94 ± 1.72 min). Time from injection to two dermatomal regression was 129.68 ± 15.54 min in group A and 111.38 ± 22.35 min in group B. Onset of Bromage score of 1 in group A was 4.68 ± 1.27 min and in group B was 6.44 ± 1.64 min. The mean duration of motor and complete motor block was prolonged in group A patients (197.74 ± 18.51 min, 168.82 ± 17.90 min) as compared to group B (131.88 ± 20.41 min, 106.71 ± 10.85 min).

Conclusions: Isobaric levobupivacaine was found to be a better and safer substitute for spinal anaesthesia in patients undergoing prolonged lower abdominal and lower limb surgeries.

Keywords: Intrathecal Anaesthesia, Isobaric, Levobupivacaine, Lower abdominal Surgery, Lower Limb Surgery, Ropivacaine

INTRODUCTION

Spinal anaesthesia is a safe, reliable and inexpensive technique with the advantage of providing surgical anaesthesia and prolonged post operative pain relief.

Till recently bupivacaine 0.5% heavy was the only drug used for spinal anaesthesia after the discontinuation of lidocaine's intrathecal use. Bupivacaine has the disadvantage of fatal cardiotoxicity due to its R(+)

isomer.¹ The S(-) enantiomers of bupivacaine i.e. levobupivacaine and ropivacaine which are devoid of such side effects are expected to have better cardiovascular safety.²

Therefore, this study was conducted to evaluate and compare the effects of isobaric levobupivacaine 0.5% and isobaric ropivacaine 0.5% when given intrathecally in patients undergoing elective lower abdominal and lower limb surgeries.

METHODS

With the approval of the institutional Ethical committee and written informed consent of the patient, 68 ASA I-II patients (20-60 years) of either sex posted for elective lower abdominal and lower limb surgeries under spinal anaesthesia were prospectively enrolled. They were randomly divided by sealed envelope method into 2 groups with 34 patients in each group (n=34). Group A: To receive 3ml (15mg) of 0.5% levobupivacaine and Group B: To receive 3ml (15mg) of 0.5% ropivacaine. Pregnant females, emergency surgeries, patients with body mass index more than 28kg/m², patients shorter than 150cm or taller than 180cms, patients with known hypersensitivity to study drugs and other contraindications to regional anaesthesia were not included in the study. The patients were premedicated with tablet alprazolam 0.5mg and tablet ranitidine 150mg orally at bed time on the night before surgery. Patients were kept nil orally from 10pm onwards on the previous night. On the day of surgery an intravenous line was secured with an 18-gauge cannula and patients were preloaded with Ringer lactate 500ml half an hour before anaesthesia. ECG, Heart rate, automated non invasive blood pressure (NIBP) and pulse oximetry (SpO₂) were monitored.

All patients were placed in left lateral position. Under aseptic precautions lumbar puncture were performed at the level of L3-L4 through a midline approach using 25 G Quincke spinal needle and study drug was injected after confirmation of needle tip in the subarachnoid space by free flow of CSF. The study drugs either levobupivacaine 0.5% 3ml (15mg) or ropivacaine 0.5% 3ml (15mg) were loaded in a 5ml syringe by the senior anaesthesiologist who was not involved in the study. All the subarachnoid blocks were performed by the same anaesthesiologist who was also the observer of the study. Thus, double blinding was achieved where both the observer and the participant were blinded to the study drugs. Patients were made to lie down in the supine posture immediately after the subarachnoid injection of the study drug, keeping the table flat. Pinprick method with a hypodermic needle was used to test the Sensory blockade at 1min interval for the first 5min after the spinal injection, followed by at 3min interval in the next half an hour, and every 15min interval till the completion of surgery and thereafter every half an hour interval until complete recovery. To assess the motor block modified Bromage scale was used (grade 0- no loss of motor power to grade 4 -complete paralysis).

Using a preformed structured proforma the following parameters were recorded: Onset of sensory blockade to T10 level, Onset of motor blockade (Bromage scale 1), maximum dermatomal level of sensory blockade attained and the time to achieve it, two segment sensory regression time, maximum grade of motor blockade attained and the time to achieve it, total duration of analgesia (time to regression to L1) and duration of motor blockade (regression to Bromage 0).

Other parameters such as total duration of surgery, total intraoperative fluid given, total duration of post-operative analgesia i.e. time to first request for analgesia by the patient and adverse effects if any were noted. Hemodynamic monitoring was done till the full recover of sensory and motor block. Hypotension (SBP <90mmHg or >30% fall in SBP from the baseline value) was treated with rapid IV fluid boluses and if needed inj. Mephenteramine 3mg IV was given. Bradycardia (HR <60bpm) was treated with injection atropine 0.6mg IV. Patients were also monitored for any adverse effects like nausea and vomiting, pruritus and any hypersensitivity reactions for the drug.

The data collected was entered into a computer spreadsheet for analysis. The statistical tests applied included proportions, student t-test, Fischer's exact probability test and Chi-square tests for significance of associations. All the statistical calculations were done through SPSS 16.0 (2007) for windows. P<0.05 was considered to be statistically significant.

RESULTS

Both the groups were comparable with respect to their demographical characteristics, ASA grading, type and duration of surgery and total irrigating fluid given (Table 1).

Table 1: Type of surgery.

Surgery	Group A	Group B
Orthopaedic	4	5
Gynaecological	14	12
Hernia	5	4
Appendicectomy	2	2
Anal	3	2
Urethral	2	3
Hydrocele	4	6

Onset of sensory blockade at T10 was achieved by 5.71±1.31 minutes in Group A and 5.94±1.72 minutes in patients of group B. This was not clinically or statistically significant. All the patients attained a level of T10 sensory blockade in both the groups which was sufficient for surgery. Highest level of block achieved was T6 in both the groups. Time from injection to two dermatomal regression was 129.68±15.54 minutes in group A and 111.38±22.35 minutes in group B (P= 0.001). Time required for sensory level to regress below T10 dermatomal level was 178.38±16.72 minutes for group A and 172.24±15.03 minutes for group B (P=0.100). The mean time required for the onset of Bromage score of 1 in group A was 4.68±1.27 minutes and in group B was 6.44±1.64 minutes. The results were clinically and statistically highly significant with P-value of <0.001. The mean duration of motor block in group A patients was 197.74±18.51 minutes and in group B was 131.88±20.41 minute which was statistically highly

significant as P-value is <0.001. The mean duration of complete motor block in group A patients was 168.82±17.90 minutes while that of group B was

106.71±10.85 minutes which were clinically and statistically highly significant as P-value is <0.001. (Table 2).

Table 2: Comparison of sensory and motor block characteristics.

Parameter	Group A, Mean±SD	Group B, Mean±SD	P* value, sig.
Sensory block at T10(min)	5.71 ±1.31	5.94±1.72	0.5 NS
Two dermatomal regression (min)	129.68±15.54	111.38±22.35	<0.001 HS
Regression of sensory block to below T10(min)	178.38±16.72	172.24±15.03	0.1 NS
Bromage scale 1(min)	4.68±1.27	6.44±1.64	<0.001 HS
Duration of motor blockade (min)	197.74±18.51	131.88±20.41	<0.001 HS
Duration of complete motor blockade (min)	168.82±17.90	106.71±10.85	<0.001 HS

(NS =Not significant, HS = Highly significant)

There were no significant hemodynamic changes reported in either of the groups statistically or clinically. About 2 patients in each group developed bradycardia. There was no immediate incidence of nausea, vomiting, shivering, Oxygen desaturation or late post dural puncture headache or transient neurological symptoms in either of the groups.

DISCUSSION

The cardiotoxicity of bupivacaine generated the search of an alternative local anaesthetic. Thus, levobupivacaine and ropivacaine which are pure S(-) enantiomers local anaesthetics were introduced. Both are found to be identical to Bupivacaine in terms of onset, quality and duration of sensory block with a better cardiac safety profile.² Intrathecal administration of levobupivacaine and ropivacaine are well tolerated and provide similar, effective anaesthesia for lower abdominal and lower limb surgeries. In equal mg dose Ropivacaine produces a shorter duration of motor and sensory block than Levobupivacaine.³ Because of sensory motor dissociation, ropivacaine could be a favourable local anaesthetic for day-care surgery and could be associated with early postoperative mobilization than levobupivacaine. Advantages claimed are shorter duration of motor block with similar sensory block properties compared to levobupivacaine (McDonald SB).^{4,5} It minimizes the psychological discomfort of being immobile for long time. Isobaric solutions of both agents were used in order to overcome the denser and prolonged motor blockade which hyperbaric solution would offer.⁶ Sell A et al, estimated minimum effective local anaesthetic dose of isobaric levobupivacaine and ropivacaine administered via a spinal catheter for hip replacement surgery. It was 15.2±4.0mg (mean ±SD) for Levobupivacaine and 15.5±3.1mg dose for Ropivacaine.⁷ Hence in the present study, 15mg (3ml of 0.5%) isobaric solutions of these two drugs were used for lower limb and lower orthopaedic surgeries.

About 18mg of hyperbaric ropivacaine was used for caesarean delivery and Chan- Jong Chung found that

onset time of block to T10 was 3.2min.⁸ In our study, we noted that mean time for onset at T10 was 5.71 (4.5-7) min with Levobupivacaine and 5.97 (4-7.5) min with 15 mg Ropivacaine which is comparable to a study conducted by YY Lee.⁹

Namee M and colleagues used 3.5ml of 5mg/ml (17.5mg) isobaric ropivacaine for total hip arthroplasty and found to have a median onset time of 2min (2-5min).¹⁰ Luck JF, and colleagues found no significant differences between the three groups with respect to times.¹¹ Median range to time of analgesia to pinprick at T10 for Bupivacaine was 2-5 min, Levobupivacaine was 2-15 min and Ropivacaine was 2-15 min.

Gautier et al, used plain preparation of bupivacaine and ropivacaine, compared the extent of sensory block and concluded that extent of sensory block were similar.¹² In our study, we noted highest level of sensory block was similar between the two groups which was comparable to studies done by McDonald and colleague, C. O. Ogun 30 and Y. Y. Lee.^{2,13}

Luck JF and colleagues observed that the times of sensory block regression, both to T10 [bupivacaine 129min (58-178min), levobupivacaine 131min (50-205min), and ropivacaine 84min (45-145min)] and complete regression were shorter in the ropivacaine group than other two groups.¹¹ We also observed that two dermatomal regression with ropivacaine was faster compared to levobupivacaine and this augers well with results of above mentioned study. Lee YY et al, also observed time from injection to two dermatomal regression was 69-149min in ropivacaine group and 97-143min in bupivacaine group.¹³

Lee YY et al, observed that time to regression of sensory block to below T10 was 141-211min in ropivacaine group and 154-209min in bupivacaine group.¹³ Chung CJ and others noted that time of regression of block to S1 was longer (188.56±28.2min) in bupivacaine group when compared to ropivacaine group (162.56±20.2 min).¹⁴ In our study, results were comparable in both the groups and

this concurs with observation of Khaw KS et al who noted that regression to S1 was comparable when either intrathecal isobaric ropivacaine or bupivacaine was used.¹⁵

Lee YY et al, observed that onset time to Bromage score of 1 was 2.5-6.3min for bupivacaine and 2.5-9.4min for ropivacaine.¹³ Mantouvaloy M, noted that mean time of onset to achieve Bromage score 1 with bupivacaine was 2 ± 1 min, ropivacaine 3 ± 1 min and levobupivacaine 2 ± 1 min.¹⁶ Gautier P et al, compared the effects of intrathecal bupivacaine (8mg), levobupivacaine (8mg), ropivacaine (12mg), for caesarean section and found that the mean time for onset of Gr3 Bromage motor block was 9min and 14min for bupivacaine and ropivacaine respectively.¹²

We noticed that the mean time for onset of motor blockade to Bromage score of 1 was 4.68 ± 1.27 min with levobupivacaine and 6.44 ± 1.64 min with ropivacaine. In our study, patients receiving ropivacaine had delayed onset of motor blockade compared to levobupivacaine, this is in agreement with the above mentioned studies.

Sanli et al, noted that duration of motor blockade was 118 min with 15mg isobaric ropivacaine when used for caesarean section.¹⁷ Lee YY et al, observed that duration of motor block was shorter in ropivacaine group (93-162min) compared with bupivacaine group (157-234min).¹³ In our study, duration of motor blockade was 197.74 ± 18.51 min for levobupivacaine while that of ropivacaine was 131.88 ± 20.41 min. We observed a shorter duration of motor blockade with ropivacaine compared to levobupivacaine. Our findings are in affirmation with that of Chung CJ and colleagues, JK Luck and Helena Kallio and others who also found shorter duration (120min) of motor blockade with Ropivacaine when compared to Bupivacaine.^{14,11,18} Khaw KS and colleagues also noted shorter duration of motor block with 15mg of Ropivacaine for caesarean section.¹⁹

Lee YY et al, noted that the duration of complete motor block was shorter in ropivacaine group (63-120min) when compared with bupivacaine group (126-183min).¹³ Mcnamee DA, observed that duration of complete motor block was significantly prolonged in ropivacaine 10mg/ml compared with ropivacaine 7.5mg/mL (1.9 hrs Vs 1.2 hrs).¹⁰ Chung CJ and colleagues also observed duration of complete motor blockade was 90-135min for ropivacaine group and 105-225min for bupivacaine group.¹⁴ In our study it was 168 ± 17.9 min in levobupivacaine group and 106.71 ± 10.85 ropivacaine group. The anaesthesia was well accepted by surgeons and blinded anaesthesiologist belonging to both groups. Majority opined that the quality of anaesthesia and relaxation is good to excellent with both the drugs.

Montouvalou et al, used isobaric solutions of ropivacaine and bupivacaine for lower abdominal surgeries and concluded that intraoperative hypotension requiring

treatment occurred less in levobupivacaine group 17.5% than in ropivacaine group 25%.¹⁶ In our study, hypotension occurred in 17% of patients in group A and 26.47% of patients in group B comparable to above mentioned study. None of the patients in both groups had bradycardia. Haemodynamic parameters including heart rate, systolic blood pressure was comparable between the two groups but diastolic and mean arterial pressure at 10 and 15min showed statistically significant difference but the difference was 5mmHg which is clinically insignificant. Incidence of hypotension was comparable in both groups, which was easily managed by mephenteramine boluses. Incidence of nausea and vomiting was comparable between the two groups. There was no incidence of post dural puncture headache, transient neurological symptoms in either of the two groups.

CONCLUSION

Our study reveals that intrathecal administration of 0.5% isobaric (15 mg) Levobupivacaine and 0.5% isobaric (15 mg) Ropivacaine provides adequate anaesthesia for lower abdominal and lower limb surgeries. Both are well tolerated and provide similar and effective anaesthesia.

In equal mg doses, Ropivacaine produced a delayed onset of motor block with shorter duration of motor and sensory blockade. This is associated with rapid post-operative recovery of motor and sensory function, shorter home discharge time and less psychological distress of being immobile for a longer time.

Whereas Levobupivacaine scores over Ropivacaine in terms of duration of motor and sensory blockade. Therefore, Isobaric levobupivacaine can be a better and safer substitute for spinal anesthesia in patients undergoing prolonged lower abdominal and lower limb surgeries.

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