INTERNATIONAL JOURNAL OF CURRENT MEDICAL AND PHARMACEUTICAL RESEARCH

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RESEARCH ARTICLE

INTRATHECAL ISOBARIC 0.75% ROPIVACAINE VERSUS ISOBARIC0.5% LEVOBUPIVACAINE – A DOUBLE BLINDED RANDOMIZED CONTROL STUDY

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ARTICLE INFO

Article History:

Received 29th November, 2016
Received in revised form 17th December, 2016
Accepted 6th January, 2017
Published online 28th February, 2017

Key words:

Isobaric, Levo Isomer, Levobupivacaine, Ropivacaine, Sensory Block, Motor Block

ABSTRACT

Background and objective: Toxicity of the earlier local anaesthetics was well known and the research for an alternative agent provided Ropivacaine and levobupivacaine. Our aim is to compare the onset, duration, sensory and motor blockade of intrathecal isobaric ropivacaine and isobaric levobupivacaine in inguinal hernia surgery

Materials and methods: After the approval of institutional ethical committee this randomized control trial was done between august and December 2014. A total of 50 patients were randomly allotted in two groups. R group received 3 ml of 0.75% Ropivacaine and L group received 3 ml of 0.5% Levobupivacaine. Duration and intensity of motor block was assessed by using modified Bromage scale and visual analogue scale was used to assess the duration of sensory block

Results: Analysis of the results showed that there was no significant difference in the onset of sensory block was 35.6±7.53 in R and 37.4±7.22 in L group and the onset of motor block between the two groups was 27.5±8.03 in R group and 25.54±10.01 in L group. The mean duration of sensory block was 212.1 ± 22.01 in R group and215.9 ± 22.38 in L group and the duration of motor block was145.7 ± 14.30 and 118.5 ± 10.61 in R and L group respectively. Both the values observed in the groups were clinically equal and statistically insignificant.

Conclusion: Both ropivacaine and levobupivacaine have equal efficacy in onset duration of sensory and motor block and also in the degree of motor block.

INTRODUCTION

The most common anaesthetic procedure done all over the world is sub arachnoid block. SAB is simple, economical and is relatively safe and it also gives a satisfying intra operative and postoperative condition for the patient, anaesthesiologist and the surgeon. Therefore it is quite popular among the anesthesiologists and the surgeons alike as the onset is fast and it provides excellent operating conditions with its sensory and motor blockade. Spinal anaesthesia enjoys the popularity all over the world for its high degree of success and in avoiding the risk of GA such as intubation difficulties, airway catastrophes, aspiration, pot operative drowsiness, respiratory depression, venous thrombosis etc. Density of the local anaesthetic divided by that of the cerebro spinal fluid at 37^0 C is called baricity. Isobaric solutions have similar density, hyperbaric solutions more and hypobaric solutions less than that of CSF.

Lidocaine and bupivacaine was used for many decades before the ban of lidocaine due to its CNS toxicity[1, 2]. The cardio toxicity of bupivacaine is also well known in high doses or by inadvertent intravascular injection[3, 4]. The search for an alternative long acting local anaesthetic discovered ropivacaine. During the research it was found out that cardiotoxity of bupivacaine is due to the dextro component of bupivacaine which is a racemic mixture. The levo isomer separated from the racemic mixture which was named levobupivacaine, likewise the research elsewhere lead to the discovery of ropivacaine[4, 5].

Aim

To compare the onset, duration of motor and sensory blockof isobaric ropivacaine and levobupivacaine in spinal anaesthesia

MATERIALS AND METHODS

This study was conducted at Institute of Road and Transport Perunthurai medical college hospital between September 2013 and March 2014. After obtaining approval from the institutional ethical committee, 50 patients belonging to American society of Anesthesiologists (ASA) grade I and II in the age group of 25 – 50 years who were scheduled for inguinal hernia repair were randomized for this double blind study after a formal written informed consent. Other inclusion criteria included men and range of weight between 45 -65 Kgs.

Patients categorized into ASA III and IV, history of coagulation disorders, neurologic, respiratory, cardiac disorders, local sepsis and those who were not willing for the study or regional technique were excluded.

Local anaesthetic sample preparation and numbering was done by an anaesthesiologist who played no part of this study or observation and the observer involved in this study was completely unaware of the type of local anaesthetic allotted to the patient. It was during the data entry for statistical analysis the observer was aware of the sample issued.

Preoperative investigations as per hospital protocol which included basic investigations like complete hemogram including, blood grouping and coagulation profile, renal function tests, Chest X-Ray and Electrocardiography. Patents were received an hour before the scheduled time in the holding area and vitals viz HR, BP, SPO2, RR were noted down. Visual analogue scale was explained during the preoperative visit and once again in the OR. IV access with 18G Cannula cited in the dorsum of the hand opposite to the side of the site of the procedure and injections midazolam 2mg, Ranitidine 50 mgs and ondansetron 4mg were given.

In the OR, Electrocardiogram, pluseoxymetry, and non-invasive blood pressure were connected and a liter of ringers lactate was given as a preload.

Under strict aseptic precautions space at the inter Cristal line was chosen for the lumbar puncture and 3 ml of the given sample solution was injected. Patient demographic data and the observational data were recorded as per scheduled protocol.

Onset time – time interval between the local anesthetic injection into CSF and loss of cold perception at T_{10} dermatome level

Levels of sensory block – highest level of loss of pin prick 30 minutes after injection.

Duration of sensory block was accepted until the patients VAS was 5.

Motor block assessed with the modified Bromage scoring every 5 min for the first 30 minutes and later on every 15 minutes until the score was zero and duration of motor block taken as time of score at zero [6,7]. (Table 1)

Table 1

	Modified Bromage Scale
0	Free movement of leg and feet
1	Inability to raise leg but moves knee and feet
2	Inability to flex knees but move feet
3	Unable to move knee and feet

OBSERVATION AND RESULTS

Patient's demographic profiles like age, weight and ASA grades were quite similar and they were also statistically insignificant. Heart rate in R group was 82.03±6.07 and for L group it was 82.16±5.56 and it showed no statistical significance with a P value of more than 0.05. The Systolic blood pressure was 110.80 ± 15.08mmHg in R group and in L group it was 110.50 ± 14.64 mmHg (P >0.05).Diastolic BP in R group was 62.8 ± 12.20 mmHg and in L group it was at 63.96 ± 10.98 (P>0.05). The Mean BP in R group was 90.96±8.04 mmHg and it was 91.36±7.09 mmHg L group (P>0.05). Respiratory rate observed was 14.98 ± 0.75 per min in R group and in L group it read at 15.34 ± 0.58 per min (P >0.05).Oxygen saturation noted in L group was 98.6 ± 1.12 % and in L group it was at 99.04 ± 0.93% (P >0.05). It can be note that both the groups had a similar outcome statistically and were not significant. (Table 2)

Table 2

Patient Demography	R group	L group
Age (Yrs.)	42.26±12.12	43.40±12.46
Weight (Kgs)	57.02±6.84	58.34±5.98
ASA PS (I / II)	20/10	22/8
P Value -Not significant		

Table 3

Vitals	R-GroupMean±SD	L-GroupMean±SD	P-value
Heart rate(beats/min)	82.03±6.07	82.16±5.56	>0.05
Systolic BP (mmHg)	110.80 ± 15.08	110.50 ± 14.64	>0.05
Diastolic BP (mmHg)	62.8 ± 12.20	63.96 ± 10.98	>0.05
Mean BP (mmHg)	90.96±8.04	91.36±7.09	>0.05
Respiratory Rate/min	14.98 ± 0.75	15.34 ± 0.58	>0.05
SpO_2	98.6 ± 1.12	99.04 ± 0.93	>0.05

The onset of sensory block was 47.4±7.22 seconds with Ropivacaine and it was 45.6±7.53 seconds in Levobupivacaine respectively with the P value of more than 0.05. Onset motor blockade when noted was also similar in both the groups with Ropivacaine at 57.5±8.03 secand Levobupivacaine at 55.54±13.01 which was statistically insignificant. The duration of motor blockade was 145.9 ± 12.17 in R - group and was 147.7 ± 14.30 in L – group (P>0.05) which also gave similar statistical outcome without any significant differences. Two segment regression time was also in equal ranges between the groups with a mean of 118.5 ± 10.61in R – group and 117.2 ± 12.5in L – group (>0.05).the duration of analgesia which was taken until the visual analogue scale of 5 was 212.1 ± 22.01 R - group and 209.9 ± 22.38 in the L – group(P >0.05). None of the results that were observed were statistically significant as both showed equal values. Highest level of sensory blockade attained in both the groups was till T_4 in both with a range between $T_4 – T_9$ in R group and between $T_4 – T_8$ in L – group which was also statistically insignificant. (Table 4)

Table 4

Time	R Group Mean±SD	LGroup Mean±SD	P-value
onset Sensory(sec) T_{10}	47.4±7.22	45.6±7.53	>0.05
Onset motor (sec)	57.5±8.03	55.54±10.01	>0.05
Duration of motor (min)	144.7 ± 14.30	147.9 ± 12.17	>0.05
2 segment regression(min)	117.2 ± 12.5	118.5 ± 10.61	>0.05
Duration of Sensory (min)	212.1 ± 22.01	215.9 ± 22.38	>0.05

Adverse effects

Adverse events like hypotension and bradycardia was noted were noted in both the groups, 5 patients in R group (16.66%) and 4 patients in L group (13.33%) had hypotension treated with a 6 mg dose of ephedrine and 3 patients (10%) in R group and 4 patients (13.33%) in L group had bradycardia that required a 0.3 mg of atropine. Though few studies reported inadequate block we did not come across any such incidence. No other adverse events were noted.

Statistical analysis

Using Microsoft office excel 2010 data entry was done and the recorded data was analyzed using IBM SPSS15.0 software. Student 't' test to compare between measurement and for nonparametric data Chi-square test. P value of less than 0.05 was significant.

DISCUSSION

Bupivacaine toxicity is well known and therefore the alternative long acting local anaesthetic research gave ropivacaine and when the toxicity was studied levobupivacaine was found to be safer. Hence we compared the efficacy of both the drugs intrathecally.

Review of the pharmacologic profile of ropivacaine and levobupivacaine

	Ropivacaine	Levobupivacaine
Molecular weight	274	288
Lipid solubility	775	3420
Protein binding	94	95
pKa @ 25^0C	8.1	8.1

More the lipid solubility (defined with partition coefficient), more the potency, higher the protein binding, longer the duration and lesser the pKa, faster will be t onset time[9].

McClellan KJ[10,11] *et al* in an article on levobupivacaine claimed that levobupivacaine could be an alternative to bupivacaine due its equally potent and similar pharmacological profile. The same author in an update of ropivacaine in regional anaesthesia mentioned that the effect is similar to that of bupivacaine with a reduced CNS and cardiac toxicities and also it had a lower motor block.

Markham A *et al*[12]declared that in vitro studies ropivacaine blocked A delta and C fibers more completely than A beta fibers this could explain the lower motor blocking potentials of ropivacaine.

Lee YY *et al*[13] compared the effective dose of Bupivacaine, Levobupivacaine and Ropivacaine intrathecally and concluded that bupivacaine and levobupivacaine possessed similar potency and less for ropivacaine.

Camorcia M *et al*[14] studied the relative potencies for motor block after intrathecal ropivacaine, levobupivacaine and bupivacaine and concluded the effect as low for ropivacaine, intermediate for levobupivacaine and high for bupivacaine.

Mantouvalou M *et al*[15] compared plain ropivacaine, bupivacaine and levobupivacaine for lower abdominal surgery and recorded that the onset of sensory block was similar. But the motor block was less in ropivacaine and also the duration of sensory block and motor block was equal in bupivacaine and levobupivacaine than ropivacaine. Hypotension was more in bupivacaine than in levobupivacaine and it was least in ropivacaine

Fettes PD *et al*[16] Compared plain and hyperbaric solutions for spinal anaesthesia and concluded that Plain solutions are less reliable for surgery above the level of L_1 dermatome.

McNamee DA[17] *et al* compared plain solutions of ropivacaine in strengths of 0.75% and 1.0%and found that both had given a good block but the duration of sensory and motor was prolonged in 10mg/ml solution.

Kallio H *et al*[18] Compared hyperbaric and plain ropivacaine in spinal anaesthesia for lower limb surgery observed that intrathecal hyperbaric ropivacaine produced a faster onset, greater success rate of analgesia at the level of T_{10} dermatome, and faster recovery of the block.

Review of the literature shows dose related superiority of levobupivacaine over ropivacaine, but it is worth making a note that most of the inferences obtained in the studies were done with 0.5% ropivacaine rather than 0.75% Ropivacaine. Moreover those studies also showed that the duration of motor blockade was less when compared and also the studies also states that if a higher concentration of the drug is used the potency increases.

When we compared 0.75% ropivacaine to that of levobupivacaine we found that both the drugs possesses similar efficacy in terms of onset and duration of sensory as well as motor block. This is significant since these drugs could be very useful in situations wherever prolonged sensory or motor blockade is not needed or in day care procedures where faster recovery is necessary for patient discharge.

Both being less cardio and neuro toxic could be useful in places were large amount of local anaesthetic is required such as the intercostal block. However the choice of local anaesthetic depends on the experience and discretion of the individual anaesthesiologist. This study has its own limitations, though we compared equal volumes of R & L there was a difference in the concentration of the drug that showed similar profile of outcome and hence a larger study may be necessary to make specific suppositions. Nevertheless it can be said that both the drugs could be a very useful local anaesthetic.

This study also observed a slightly increased value of levobupivacaine with a minimal edge over ropivacaine but the statistical significance could not be attained. This could be related to the pharmacodynamics of both the drugs on the type of nerve fibers.

CONCLUSION

In our study both levobupivacaine and ropivacaine has been equally potent as local anaesthetic with a similar efficacy.

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