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RESEARCH ARTICLE

COMPARISON OF 0.5% LEVOBUPIVACAINE AND 0.75% ROPIVACAINE IN EPIDURAL ANAESTHESIA – A RANDOMIZED DOUBLE BLINDED STUDY

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ABSTRACT

Background and Objective: Among the life threatening effect of local anaesthetics the cardio toxicity of bupivacaine is well known. In pursuit of an alternative, both Ropivacaine and levobupivacaine were developed. Our objective is to compare the efficacy of levobupivacaine & ropivacaine in epidural anaesthesia.

Materials and methods: With the formal institutional ethical committee clearance, 50 male patients due for inguinal hernia mesh repair surgery between April 2013 and August 2013 were studied after randomization. Samples and patients randomized in two groups of 25 where group L received Levobupivacaine and group R received ropivacaine. The onset, duration with highest level of sensory block and degree of motor were recorded and compared.

Observation and results: Onset of sensory block observed was 9.16 ± 1.50 minutes in L group, 9.40 ± 1.42 minutes in R group and lasted till 302.35 ± 40.17 minutes in R and 299.56 ± 42.50 minutes in L groups respectively. The mean dermatome level achieved was T_7 in both the groups. Intensity of motor block scored was modified Bromage 2 and 3 in both L group & in R group.

Conclusion: Both 0.5% levobupivacaine and 0.75% ropivacaine produce satisfactory analgesia with a similar efficacy in the onset, duration and quality of motor block.

INTRODUCTION

Bupivacaine contains a eutectic mixture of levo-rotatory and dextro-rotatory otherwise known as optical enantiomers. Aberg and colleagues in 1972 described the toxic effects of racemic bupivacaine and the quest for an alternate long acting local anaesthetic begun[1]. Ropivacaine a pure s-enantiomer of propivacaine was developed and it was found that the toxicity of bupivacaine is due to the dextro form of the drug and hence the less toxic levo form of s-enantiomer was isolated. Enantiomers are compounds that have similar lipid solubility, pKa and they also have identical physical and chemical properties. This study compared the efficacy of levobupivacaine and ropivacaine on randomly allocated patients with inguinal hernia.

MATERIALS AND METHODS

Upon obtaining ethical committee approval we choose 50 male patients who were scheduled for elective inguinal hernia repair aged between 20 and 50 years. This randomized double blinded study was done between April 2013 and August 2013. The observer was not aware of the local anaesthetic sample as it was allotted by another anaesthesiologist who never took part in this study and so both were blinded.

Inclusion Criteria

- ASA physical classI or II
- Weight between 45 – 65 Kilograms

Exclusion Criteria

- ASA physical class III or above
- Patients with bleeding abnormalities or disorders
- Patients with systemic illness e.g.Cardio-respiratory and neurologic disordersetc.
- History of local Anaesthetic allergy
- Local infection at the site of injection
- Patient refusal

Institutional protocol was followed to investigate the patients in a study group such as complete hemogram inclusive of hemoglobin, blood grouping, blood sugar, coagulation profile including platelet count, serum creatinine, urea, electrolytes, electrocardiograph and chest X-ray. Vitals such as heart rate, respiratory rate, blood pressure, SpO_2 were noted and during the preoperative visit visual analogue score was explained.

Upon receiving the patient in the pre anaesthetic holding area an hour before the procedure intravenous access was obtained with an 18G IV cannula and injections Midazolam 2mg, pantoprazole 40 mg and ondansetron 4 mg were given. In the

operating room a liter of ringer`s lactate solution was preloaded and 5 lead Electrocardiogram, pluseoxymetry and noninvasive blood pressure monitors were connected.

Baseline vital signs noted and recorded (Heart and respiratory rate, blood pressure and oxygen saturation). With the patient in the left lateral position and after strict asepsis intervertebral space corresponding to the intercristal line was chosen and infiltrated with 2 mls of 2% lidocaine. Epidural space identified using loss of resistance (air) technique with an 18 Gauge Tuhoy needle and catheter inserted and fixed so that 5cm of catheter is in the epidural space. Once patient was turned supine a test dose of 2% lidocaine with adrenaline (1:200000) was given and intrathecal or intravascular catheter placement were excluded. 20 mls of the given solution prepared by the anaesthesiologist (who was not involved with this study) was injected after negative aspiration for blood or cerebrospinal fluid.

Observations that were made apart from the study parameters – heart rate, respiratory rate, SpO_2, blood pressure every couple of minutes for the first ten minutes and at intervals of five minutes later on till the end of procedure.

Onset time of sensory block – loss of cold perception at the level of T_{10} from the end of epidural injection of the sample drug.

Level of sensory block – level at which there was an absence of pink prick at the end of 30 minutes after injection

Duration of sensory block – onset time till the VAS score of 5.

Motor block - by Bromage scoring

Adverse effects such as nausea, vomiting, hypotension (30% drop of baseline), bradycardia (heart rate less than 50), shivering, hypoxia, respiratory depression etc. were noted and treated accordingly.

Microsoft office Excel 2010 was used for data entry and statistical analysis for comparing the measurements was done by student't' test and for nonparametric data chi-square test with IBM SPSS15 statistical software. Significance was considered for a P value of <0.05.

Observation and results

Patient demographic distributions of mean age was at 35.08±8.34 in years group L and 34.17±9.13 in group R, similarly mean weight was 58.26±5.02 and 55.24±6.65 in L group and R group and comparable without any statistical significance (Table.1).

Table.1 Distribution of Age, Weight

	Mean	Standard Deviation	t-value/chi-square	P value
		Age (years)		
L group	35.08	8.34		
R group	34.17	9.13	0.7280	0.4703
		Weight (Kg)		
L group	58.26	5.02		
R group	55.24	6.65	0.8101	0.4220

Table.2 Distribution of heart rate, mean arterial pressure, respiratory rate and oxygen saturation

Vitals (Mean±SD)	LGroup	RGroup	P value
Heart rate (beats/min)	74.54±6.28	73.66±6.76	>0.05
Mean ABP (mmHg)	93.56±3.90	92.96±4.40	>0.05
RespiratoryRate/min	15.24 ± 1.38	15.58 ± 1.44	>0.05
SpO_2	99.10 ± 0.73	98.4 ± 1.22	>0.05

The mean heart rate recorded was 74.54±6.28 beats / minute and 73.66±6.76 beats / minute in L and R groups, the mean arterial pressure was 93.56±3.90 mmHg and 92.96±4.40 mmHg in R and L groups. Respiratory rate in L group was 15.24 ± 1.38 and 15.58 ± 1.44 in the R group. The oxygen saturation was at 99.10 ± 0.73% in L group and the same was at 98.4 ± 1.22% in R group. Vital parameters in both the groups were statistically similar without any significance preoperatively as well as intraoperatively and perioperatively (Table.2).

Both the group achieved adequate block for surgery with a mean level of T_7 in the range of block between T_5 and T_9 in L group and T_5 and T_{10} in R group respectively. The mean onset time of block was 9.16 ± 1.50 in L group and 9.40 ± 1.42 in R groups were statistically similar without any significance. None of the patients required supplementation of analgesia (Table.3).

Table.3 Sensory blockade characteristics

Sensory Block	L (n=25)	R (n=25)	P value
Mean onset time	9.16±1.50	9.40±1.42	>0.05
Mean duration	302.35±40.17	299.56±42.50	>0.05
Highest level	T_5	T_5	>0.05
Lowest level	T_9	T_{10}	>0.05

Assessment of duration of sensor block was done using the visual analogue scale which measured for ten to one and the duration of analgesia was considered at the reading of the visual analogue score 5. The mean duration of block in both the groups were alike with the mean duration in L group was 302.35 ± 40.17 and 299.56 ± 42.50 in R group. There was no statistical significance in the duration (Table.3).

Assessment of motor block was done by modified Bromage scale.

Table.4 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

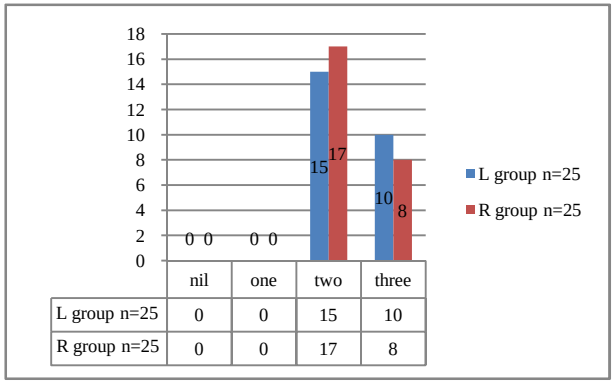

Fig.1 Level of motor block at one hour after the epidural injection.

P value > 0.05

Most of the patients had a motor blockade of two on Bromage scale, 16 in ropivacaine and 14in levobupivacaine, whereas 10 patients in levobupivacaine group had a block score of 3 compared with ropivacaine where it was present in 8 patients. Though the intensity of Bromage score was minimally different, the values did not show any statistical significance, as the calculated P value was more than 0.05 (Fig.1).

DISCUSSION

The toxicity of bupivacaine is well known and it is also quite difficult to manage. The cardiac toxic characteristic of bupivacaine established beyond doubt that it was the because of the dextro form of the racemic mixture. Therefore when the search for an alternate local anaesthetic with similar clinical profile was initiated and ropivacaine was discovered and levobupivacaine isolated since it had a safer pharmacological profile. Researchers found that the chiralic or asymmetric carbon present in local anaesthetic amide amines changes the pharmacological profiles of these enantiomers. Also they exert vasoconstriction which could reduce absorption and lower the systemic toxicity[1,2,3,4,5].

Jonathan Stewart *et al* studied the Central Nervous System and Cardiovascular Effects of Levobupivacaine and Ropivacaine in healthy volunteers and concluded that levobupivacaine and ropivacaine produced analogous effects on central nervous system and cardiovascular system when infused intravenously[6,7,8,9,10].

Benhamou D *et al*[11] studied the relative analgesic potencies of Levobupivacaine and Ropivacaine for epidural analgesia in labor and inferred that the potency of levobupivacaine might be slightly less potent than racemic bupivacaine and may provide variable analgesic results. They also concluded that levobupivacaine was 19.3% more potent than ropivacaine and that though there was a difference it was not statistically significant and both the drugs provided similar results and safety.

Casati A *et al*[12] in a double blinded randomized study on the Intraoperative epidural anesthesia and postoperative analgesia with levobupivacaine for major orthopedic surgery compared racemic bupivacaine and ropivacaine and concluded that levobupivacaine 0.5% has similar onset, quality and duration as that of the 0.5% bupivacaine but the motor block was lesser with 0.5% ropivacaine.

Peduto VA *et al*[13] in the study titled A prospective, randomized, double-blind comparison of epidural levobupivacaine 0.5% with epidural ropivacaine 0.75% for lower limb procedures concluded that both the drugs produces an epidural block with a parallel clinical effect.

Beilin *et al*[14] in their study – A Local anesthetics and mode of delivery: bupivacaine versus ropivacaine versus levobupivacaine concluded that bupivacaine, ropivacaine, and levobupivacaine all confer adequate labor epidural analgesia, with no significant influence on mode of delivery, duration of labor, or neonatal outcome.

Sah N *et al*[15] compared the efficacy of ropivacaine, bupivacaine, and levobupivacaine for labor epidural analgesia and concluded that there are no significant differences in pain VAS and Bromage scores between 0.1% ropivacaine, 0.125% bupivacaine, and 0.1% levobupivacaine given for labor epidural analgesia.

Polley LS *et al*[16] compared the relative analgesic potencies of 0.25% of levobupivacaine and ropivacaine for epidural analgesia in labor and their study demonstrated that levobupivacaine and ropivacaine are of similar potency for epidural analgesia in the first stage of labor.

Dang CP *et al*[17] in their articletitled "0.5% levobupivacaine versus 0.5% ropivacaine: Are they different in ultrasound-guided sciatic block?" hadestablishedthat there is no organizational advantage to favor one or the other local for block induction.

The mean onset of analgesia was also quite similar in both the groups and they did not show any statistical significance. The mean duration of surgery was comparable and similar in our study. The mean duration of sensory blockade and the adequacy of anaesthesia for surgery were also quite similar and none of the patients had requested for additional analgesia and these parameters also did not show any statistical significance. Though some studies have quoted that the duration of sensory blockade is more with bupivacaine, levobupivacaine and ropivacaine in the decreasing order we observed similarity in the onset, duration and quality of sensory block in both levobupivacaine and bupivacaine. However there are some studies that showed equal potency of all the three in terms of sensory block and a few studies had showed the superiority of duration in sensory block with ropivacaine compared with either levobupivacaine or bupivacaine. Our study had shown that the sensory blockade is similar in both groups and also in the onset and the quality of analgesia. There were no statistical significance in onset, duration and also the quality of analgesia in this study.

The quality of the motor blockade that was assessed with Bromage score showed equal potency without any statistical significance, however if looked upon closely the numbers show that ropivacaine has a slight higher in Bromage level two and levobupivacaine in Bromage scale three, but statistically there was no significance with a P value of more than 0.05. This limitation could be because of the fact that the study group is done in a relatively smaller sample. Earlier studies had showed an advantage with levobupivacaine as being equally potent like bupivacaine in terms of sensory and motor block. Ropivacaine was also shown to produce a less intense motor block when compared with levobupivacaine, however quite a number of studies have shown equal efficacy but none of the studies had showed a superiority of ropivacaine to levobupivacaine in terms of motor block.

5 patients (20%) in Levobupivacaine group and 3 patients (12%) in Ropivacaine group had an episode of hypotension among which 2 patients (8%) in L group required a vasopressor (6 mg of ephedrine) once to raise their mean arterial pressure. None of the patients had bradycardia that required atropine. One patient in each group had shivering and was treated with 25 mg of pethidine to control shivering. There was no incidence of any other complications like nausea, vomiting, retention of urine or local anaesthetic toxicity.

CONCLUSION

The efficacy of 0.5% Levobupivacaine and Ropivacaine 0.75% in terms of the onset, duration of sensory block and degree of motor block is similar.

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