STUDY COMPARING BUPIVACAINE WITH ROPIVACAINE AND LEVO-BUPIVACAINE IN SUB UMBILICAL SURGERIES UNDER EPIDURAL ANAESTHESIA

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ABSTRACT: BACKGROUND: Epidural blockade is becoming one of the most useful and versatile procedures in modern anesthesiology. Levobupivacaine and Ropivacaine, the two new long-acting local anaesthetics, have been developed as an alternative to Bupivacaine, after the evidence of its severe toxicity. MATERIALS AND METHODS: It is a prospective, randomized, double blind study on 90 Patients to evaluate the time of onset and duration of sensory and motor blockade and hemodynamic effects of Bupivacaine 0.5% Ropivacaine 0.75% and Levobupivacaine 0.5% when administered epidurally for sub umbilical surgeries of age group 18-60yr of ASA I and II physical status under epidural anesthesia. RESULTS: Ropivacaine has short duration of motor block when compared with Bupivacaine and Levobupivacaine. The onset of sensory and motor blocks, highest level of sensory block, degree of motor block and duration of sensory analgesia with Ropivacaine and Levobupivacaine are similar to that of Bupivacaine. The hemodynamic changes and side effect profile of Ropivacaine and Levobupivacaine is not significantly different from that of Bupivacaine. CONCLUSION: Ropivacaine and Levobupivacaine can be used as a safe alternative to Bupivacaine, shorter duration of motor block with Ropivacaine suggest that it could be effectively used for early mobilization of patients in the post-operative period.

KEYWORDS: Levobupivacaine, Ropivacaine, Bupivacaine, Epidural blockade.

INTRODUCTION: Providing comfort to the patient by prevention and relief of pain and monitoring and maintenance of normal physiology during the perioperative period is the primary goal of an anaesthetist.¹ Regional anesthesia and analgesia has the potential to provide excellent operating conditions and prolonged post-operative pain relief.² Epidural blockade is becoming one of the most useful and versatile procedures in modern anesthesiology. It is unique in that it can be placed at virtually any level of the Spine, allowing more flexibility in its application to clinical practice. It is more versatile than spinal anaesthesia, giving the clinician the opportunity to provide anaesthesia and analgesia, as well as enabling chronic pain management. It can be used to supplement general anaesthesia, decreasing the need for deep levels of general anaesthesia, therefore providing a more hemodynamically stable operative course.

It provides better postoperative pain control and more rapid recovery from surgery. For orthopaedic Surgery, the provision of pain relief enables early post-operative mobilization, accelerates rehabilitation and return to normal function.³ Bupivacaine is a long acting amide local anesthetic which has been in use for more than 40 years.
Its introduction in 1957 is a very important step in the evolution of regional anaesthesia. It is commercially available as a racemic mixture containing equal proportions of the S (−) and R (+) isomers. It is widely used for subarachnoid block, epidural block, caudal block, nerve blocks, infiltration, post-operative and labor analgesia.

The modification of the concentration of the drug causes differential sensory and motor block. Despite its popularity, it is associated with a number of side effects like unwanted motor blockade, neurotoxicity and cardiotoxicity. There have been many reports of death attributable to Bupivacaine induced cardiotoxicity after accidental intravenous injection. These cases resulted in the continued search for new and safer local anaesthetic agents.⁴

Levobupivacaine and Ropivacaine, the two new long-acting local anaesthetics, have been developed as an alternative to Bupivacaine, after the evidence of its severe toxicity. Both of these agents are pure left-isomers and, due to their three-dimensional structure, seem to have less toxic effects on the central nervous system and on the cardiovascular system.

Levobupivacaine and Ropivacaine have a clinical profile similar to that of racemic Bupivacaine, and that the minimal differences reported between the three anaesthetics are mainly related to the slightly different anaesthetic potency, with racemic Bupivacaine > Levobupivacaine > Ropivacaine. However, the reduced toxic potential of the two pure left-isomers suggests their use in the clinical situations in which the risk of systemic toxicity related to either overdosing or unintended intravascular injection is high, such as during epidural or peripheral nerve blocks.⁵ The present study is designed to evaluate the time of onset and duration of sensory and motor blockade and hemodynamic effects of Bupivacaine 0.5% Ropivacaine 0.75% and Levobupivacaine 0.5% when administered epidurally for sub umbilical surgeries.

**MATERIALS AND METHODS:** Adult patients of age group 18-60 yr of ASA I and II physical status scheduled to undergo various sub umbilical surgical procedures under epidural anaesthesia at Gandhi Hospital, Musheerabad, Secunderabad.

A prospective, randomized, double blind study was conducted on 90 Patients of ASA I and II between the age group of 18-60yrs undergoing various sub umbilical surgical procedures. Patients were randomly allocated into three groups.

Group A: 30 Patients receiving 20 ml of 0.75% Ropivacaine epidurally, Group B: 30 Patients receiving 20 ml of 0.5% Bupivacaine epidurally, Group C: 30 Patients receiving 20 ml of 0.5% Levobupivacaine epidurally. The patients and the anaesthesia provider were blinded to the study.

**Inclusion Criteria:** Patients of ASA I and II, Age 18-60 yrs., Patients undergoing sub umbilical surgical procedures.

**Exclusion Criteria:** Any contra-indications to epidural anaesthesia like- Hypotension, Uncooperative patients, previous laminectomy, coagulation defects, Spine abnormality, Local site infection etc.

Neurologic, Cardiopulmonary or Psychiatric disease, or active Liver, Kidney disease, Drug/alcohol abuse, ASA III and IV, Pregnant Woman, Age 18-60 yr. Patients on Anti arrhythmics /Beta blockers/Anticoagulants.
All patients in the inclusion criteria were visited on the previous day of surgery, and the procedure was explained to them. A detailed pre anaesthetic examination was carried out and relevant investigations were advised. An informed valid written consent was taken from all the patients. Premedication with 10mg tablet diazepam and tablet ranitidine 150mg was given orally the night before surgery. Patients were asked to maintain nil per oral status for 6 hrs.

In the operation theatre, baseline blood pressure and pulse was recorded. An 18 G IV cannula was inserted and all patients received 20 ml/kg of Ringers lactate solution to increase their circulating fluid volume before the epidural block. Patients were placed in sitting position and skin infiltration with 2ml of 2% lignocaine was performed. Then the epidural space was identified at L2-L3 interspaces with an 18G tuohy needle using the midline approach and a loss of resistance technique.

After negative aspiration for blood, 3 ml of lignocaine with 1:200000 adrenaline test dose was administered to exclude intrathecal and intravascular placement of the needle. Then after a 5 min period, the study drug was injected over 2 min. All assessments were made by an anaesthetist who did not know the solution used. The study solution was revealed only at the end of the procedure.

**Parameters Observed:**

- Baseline pulse rate, respiratory rate and blood pressure were recorded.
- Pulse rate, respiratory rate and blood pressure every 1 min, 3 min, 5min, 10 min, 15 min, 20 min, 25 min, 30 min, 45 min, 60 min, 90 min, 120min, 180 min.
- Incidence of bradycardia - (pulse rate <60 beats per minute) and hypotension-(fall in systolic blood pressure >30% baseline).
- Pinprick sensation-every 5 min until complete loss of sensation at T10 (taken as onset of sensory block) and then every 5 min to determine the time taken for maximum height of block and thereafter every 15 min to determine the time for two segment regression and regression of sensory block at T12.(taken as duration of sensory block).
- When sensory block reached T10 motor block was assessed using a Modified Bromage score
  
  Grade 0- No block.
  Grade 1- Unable to flex the hip.
  Grade 2- Unable to flex the hip and unable to extend the leg with hip passively flexed.
  Grade 3- Grade 2 + unable to flex the ankle.

Recovery from motor block was assessed at the end of surgery. Bradycardia was treated with inj. Atropine 0.5 mg IV and hypotension with Inj. Mephentermine 6 mg IV,

**RESULTS:** Demographic data was expressed as mean ± standard deviation and analyzed data using one way analysis of variance (ANOVA). Probability values <0.05 were considered as statistically significant.
The above table is showing the distribution of the patients according to the age. The mean age in group B is 39.23 years and in group R is 36.27 years and in group L is 39.30 years. Age incidence between all the groups is comparable. (t value=0.49, P>0.05).

The above table is showing the distribution of patients according to sex. Group B has 17 male patients (57%) and 13 female patients (43%); whereas group R has 15 male patients (50%) and 15 female patients (50%) and group L has 16 male patients (54%) and 14 female patients (46%). The sex distribution in all the groups was comparable (X2=0.07, P>0.05).

The mean weight of the patients in Bupivacaine group was 54.57 kgs, in Ropivacaine group was 53.77kgs and in Levo Bupivacaine group it was 54.63 kgs. The weight distribution between all the three groups were not significant (P>0.05).
Table 4: Time of Onset and Duration of Sensory and Motor Block

The mean time for onset of sensory block of Bupivacaine group was 10.67 minutes and Ropivacaine group was 10.23 minutes and in Levobupivacaine group was 10.80 minutes. The mean time for onset of sensory block between all the three groups is not statistically significant (P>0.05).

The mean time for onset of motor block of Bupivacaine group was 28.87 minutes and Ropivacaine group was 29.50 minutes and in Levobupivacaine group was 29.03 minutes. The mean time for onset of motor block between the three groups is not statistically significant (P>0.05). In patients of Bupivacaine group 60% attained T6 level, 27% attained T7, 3% attained T8 and 10% attained T10, in patients of Ropivacaine 60% attained T6, 33% attained T7, 7% attained T10, in patients of Levobupivacaine group 60% attained T6, 23% attained T7, 6% attained T8 and 10% attained T10. This implied that there was no difference in highest level of sensory blockade in the three groups.

The mean duration of motor block in Bupivacaine was 282 minutes and in Levobupivacaine was 272.80 minutes whereas in Ropivacaine group was 241 minutes which was highly significant. This implied that the duration of motor blockade in Ropivacaine group was statistically significantly lower than other two groups.

The mean duration of sensory analgesia in Bupivacaine group was 391 minutes, in Ropivacaine group was 389 minutes and in Levobupivacaine group was 386 minutes. The duration of sensory analgesia in all the three groups was statistically insignificant.

Graph 1: Pulse Rate
Graph 2: Systolic Blood Pressure

Graph 3: Diastolic Blood Pressure

Graph 4: Respiratory Rate
| SIDE EFFECTS  | NAUSEA | %  | VOMITING | %  | HYPOTENSION | %  |
|---------------|--------|----|----------|----|-------------|----|
| BUPIVACAINE   | 2      | 7% | 1        | 3% | 3           | 10%|
| ROPIVACAINE   | 1      | 3% | 1        | 3% | 2           | 7% |
| LEVO BUPIVACAINE | 1 | 3% | 1        | 3% | 2           | 7% |

**Table 5: Side Effects**

In Bupivacaine group, 10% patients had hypotension, 7% had nausea and 3% had vomiting. In Ropivacaine group, 7% had hypotension, 3% had nausea and 3% had vomiting, and in Levobupivacaine group, 7% had hypotension, 3% had nausea and 3% had vomiting. There was no significant difference between the groups with regard to side effects.

**DISCUSSION:** Epidural anaesthesia and analgesia is considered by many as the gold standard technique for major surgery. It has the potential to provide complete analgesia for as long as the epidural is continued.⁶

In the present study the patients studied in the three groups did not vary much with respect to age, sex or weight. Majority of patients were in the age group between 18-60 years, with the mean age of 39.2±11.8 years in Group B and 36.3±10.0 in group R and 39.30±11.54 in Group L.

In our study, the mean time for onset of sensory block in Bupivacaine group was 10.67±1.5 minutes, in Ropivacaine group was 10.23±1.63 minutes and 10.8±1.67 minutes in Levobupivacaine group. The mean time for onset of motor block in Bupivacaine group was 28.87±3.35 minutes, in Ropivacaine group was 29.87±2.98 minutes and 29.03±3.35 minutes in Levobupivacaine group.

There were no statistically significant differences with regard to onset of sensory and motor block between the groups. Andrea Casati et al.⁷ conducted study on 45 ASA I-III patients undergoing elective hip replacement surgery comparing epidural block with 10ml of 0.5% Levobupivacaine, 0.5% Bupivacaine or 0.5% Ropivacaine found no difference in the time of onset of sensory and motor block. V A Peduto, et al.⁸ conducted study on 65 adult patients of ASA I-III undergoing elective lower limb procedures with 15ml of 0.5% epidural Levobupivacaine or 15 ml of 0.75% epidural Ropivacaine. They observed that the onset of sensory block was similar in both groups. A P Wolff et al.⁹ conducted a study Where there Was no statistical difference in the onset of analgesia between Bupivacaine and Ropivacaine.

The degree of motor block was tested by Modified Bromage scale. In our study, there was no difference in the degree of motor block between the groups. Andrea Casati et al conducted study on 45 ASA I-III patients undergoing elective hip replacement surgery comparing epidural block with 10ml of 0.5% Levobupivacaine, 0.5 % Bupivacaine or 0.5% Ropivacaine found quality of motor block is similar among the groups.⁷ V A Peduto et al conducted study on 65 adult patients of ASA 1-3 undergoing elective lower limb procedures giving epidural Levobupivacaine 0.5% 15 ml or epidural Ropivacaine 0.75% 15ml. they observed quality of motor block was similar in both groups.⁸
Duration of motor blockade was assessed from the time of administration of drug to complete motor recovery. In our study, the mean duration of motor block in Bupivacaine group was 282.3±21.0 minutes, in Ropivacaine group was 241.7±22.8 minutes and in Levobupivacaine group was 279.8±21.8 minutes.  

There was no statistical difference in mean duration of motor blockade of Bupivacaine and Levobupivacaine group. The mean duration of motor blockade of Ropivacaine is lower than other two groups with statistically significant difference (p<0.001). Andrea Casati et al conducted study on 45 ASA I-III patients undergoing elective hip replacement surgery comparing epidural block with 10ml of 0.5% Levobupivacaine, 0.5 % Bupivacaine or 0.5% Ropivacaine. It was concluded that Levobupivacaine 0.5% produces an epidural block of similar duration of motor block as the one produced by the same volume of 0.5% Bupivacaine, with a motor block deeper than that produced by 0.5% Ropivacaine. Our results are similar to a study done by David L Brown where the duration of motor block with 20ml of 0.5% Ropivacaine was 220±52 min and 0.5% Bupivacaine was 276±52 min and thus of longer duration.  

In our study, the mean duration of sensory analgesia in Bupivacaine group was 391.1±15.1 minutes in Ropivacaine group was 389.7 ± 16.5 minutes and in Levobupivacaine group was 386.4±19.7 minutes, indicating that there was no statistically significant difference in duration of sensory analgesia among the groups. Andrea Casati et al. conducted study on 45 ASA I-III patients undergoing elective hip replacement surgery comparing epidural block with 10ml of 0.5% Levobupivacaine, 0.5 % Bupivacaine or 0.5% Ropivacaine. It was found that there was no significant difference in the duration of sensory analgesia among all the groups. V A Peduto et al conducted study on 65 adult patients of ASA 1-3 undergoing elective lower limb procedures and were given epidural Levobupivacaine 0.5% 15 ml or epidural Ropivacaine 0.75% 15ml. The duration of sensory blockade in both the groups was similar.  

In our study, all the three groups did not differ significantly with respect to heart rate at any time interval. The changes in mean systolic blood pressure and diastolic blood pressure at any time interval were statistically and clinically insignificant. 3 patients in Bupivacaine group, 2 patients in Ropivacaine group and 2 patients in Levobupivacaine group experienced hypotension. Hypotension was corrected by small doses of Inj. Mephentermine. None of our patients experienced respiratory depression and the mean Respiratory rate between the groups was statistically not significant. D P McGlade et al. and David L Brown. observed that there was no statistically significant difference between the groups with respect to hemodynamic changes. Fesih Kara et al. studied 70 ASA I-II patients who received epidural 0.5% Bupivacaine and 0.5% Levobupivacaine in hip and lower extremity surgery found No statistically significant difference in terms of heart rate, noninvasive systolic artery pressure, diastolic artery pressure, mean artery pressure.  

In Bupivacaine group 10% patients had hypotension, 7% had nausea and 3% had vomiting, in Ropivacaine group 7% patients had hypotension, 3% had nausea and 3% had vomiting and in Levobupivacaine group 7% patients had hypotension, 3% had nausea and 3% had vomiting, indicating no significant differences between the groups with regard to these side effects.
Fesih Kara et al. studied 70 ASA I-II patients received epidural 0.5% Bupivacaine and 0.5%. Levobupivacaine in hip and lower extremity surgery found no statistically significant difference in side effects.13

CONCLUSION: Based on the present clinical comparative study 0.75% Ropivacaine has short duration of motor block when compared with 0.5% Bupivacaine and 0.5% Levobupivacaine. The onset of sensory and motor blocks, highest level of sensory block, degree of motor block and duration of sensory analgesia with 0.75% Ropivacaine and 0.5% Levobupivacaine are similar to that of 0.5% Bupivacaine. The hemodynamic changes and side effect profile of Ropivacaine and Levobupivacaine is not significantly different from that of Bupivacaine.

Hence Ropivacaine and Levobupivacaine can be used as a safe alternative to Bupivacaine for epidural anaesthesia in lower abdominal and lower limb surgeries. The shorter duration of motor block with Ropivacaine suggest that it could be effectively used for early mobilization of patients in the post-operative period.

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