

A Comparison of the Effectiveness of Post-operative Analgesia for Single Dose Epidural 0.125% Levobupivacaine and 0.2% Ropivacaine in Patients Posted for Elective Lower Limb Surgeries

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Abstract

Central neuraxial blockade in the form of epidural is very popular for lower abdominal and lower limb surgeries as these techniques avoids the disadvantages associated with general anaesthesia like airway manipulation, poly pharmacy and other untoward effects like postoperative nausea, vomiting, need for supplemental intravenous analgesic. Despite of many different local anaesthetics we are still looking for the ideal one. Levobupivacaine and ropivacaine are getting more popularity due to their prolonged duration of action and less cardio/neurotoxicity. This randomized prospective study on sixty patients aged between 20-60 years of either sex belonging to ASA class I and class II posted for elective lower limb orthopaedic surgeries compared single dose epidural 0.125% levobupivacaine and single dose epidural 0.2% ropivacaine for post-operative analgesia and showed that levobupivacaine produces higher postoperative analgesia as compared to ropivacaine.

Keywords: Epidural; Levobupivacaine; Ropivacaine; Pot-Op Analgesia.

Introduction

Regional anaesthesia and analgesia has the potential to provide excellent operating conditions and prolonged post operative pain relief [1]. Epidural blockade is becoming one of the most useful and versatile procedures in modern anaesthesiology. 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 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 [2]. Different local anaesthetics are used for epidural anaesthesia, most popular in India being lignocaine and bupivacaine. The drawback of lignocaine is its short duration of action.

Levobupivacaine [3,4] is a long acting local anaesthetic with a clinical profile closely resembling that of bupivacaine. Based on findings that the cardiotoxicity infrequently observed with racemic bupivacaine shows enantioselectivity, i.e. it is more pronounced with the R(+)-enantiomer, the S(-)-enantiomer (levobupivacaine) has been developed for clinical use as a long acting local anaesthetic. The majority of in vitro, in vivo and human pharmacodynamic studies of nerve block indicate that levobupivacaine has similar potency to bupivacaine.

However, levobupivacaine had a lower risk of cardiovascular and CNS toxicity than bupivacaine in animal studies. Levobupivacaine, the pure S(-)-enantiomer of bupivacaine, has strongly emerged as a safer alternative for regional anaesthesia than its racemic sibling, bupivacaine.

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Received on 03.07.2017, Accepted on 22.07.2017

Ropivacaine is also a new, long acting amino amide local anaesthetic which is chemically homologous with Bupivacaine and Mepivacaine. It is similar to the 'S' enantiomer of Bupivacaine, except that a propyl group is present in place of butyl group on the piperidine ring's tertiary nitrogen atom [5,6,7]. Ropivacaine exhibits less cardio toxicity and CNS toxicity.

It produces effective analgesia as that of Bupivacaine and that motor block appears to regress considerably more rapidly than sensory block [7]. This makes Ropivacaine potentially well suited for administration through epidural route for epidural anaesthesia and has got all the advantages of bupivacaine for epidural anaesthesia [5].

Ropivacaine with its efficacy, lower propensity for motor block and reduced potential for Central Nervous System (CNS) and cardiac toxicity appear to be important option for regional anesthesia and for management of postoperative pain and labour

This is a randomized prospective study of single dose epidural 0.125% levobupivacaine and single dose epidural 0.2% ropivacaine for post-operative analgesia in patients undergoing elective lower limb orthopaedic surgeries.

Aims and Objectives

To compare the effectiveness of single dose epidural 0.125% levobupivacaine and single dose epidural 0.2% ropivacaine in patients posted for elective lower limb orthopaedic surgeries regarding:

- Onset and duration of analgesia
- Quality of postoperative analgesia
- Degree of motor blockade
- Haemodynamic changes: blood pressure and heart rate
- Any adverse effects

Materials and Methods

Sources of Data

Sixty patients aged between 20-60 years of either sex belonging to ASA class I and class II posted for elective lower limb orthopaedic surgeries at MGM Medical College, Kamothe, Navi Mumbai are selected for the study. The study will be conducted from January 2015 to January 2016. The study population is randomly divided into two groups with 30 patients in each group (n=30).

GROUP A: will receive 8 ml of 0.125% levobupivacaine

GROUP B: will receive 8 ml of 0.2% ropivacaine

Time of epidural injection – patient VAS score of 4.

Adult patients of either sex, aged between 20-60 years belonging to ASA Class I and II scheduled for elective lower limb orthopaedic surgeries will be included in the surgery.

Drug Solution used and Dosage

- Total volume of solution in both groups was 8ml.

A wide bore intravenous line was taken and preloading was done with 500ml of Ringer's solution about 15minutes before the intended time of drug administration. Vital parameters were observed throughout the procedure.

Technique

- After pre anaesthetic checkup, patients were kept fasting from previous night and premedicated with tablet ranitidine 150 mg and tablet alprazolam 0.5 mg.
- A vein in the dorsum of hand was cannulated with 18 or 20 G cannula for I/V infusion and administration of drugs and all patients were preloaded with 500 ml of Ringer lactate solution about 15minutes before the intended time of drug administration.
- Patients was placed in sitting position. Under aseptic precautions, epidural space was identified at L2-L3 using 20G Tuohy's needle by loss of resistance technique, epidural catheter threaded into the epidural space and fixed 3 cms inside epidural space.
- The epidural catheter was tested for intravascular or subarachnoid placement with 3 ml of 2% lidocaine containing 1:200000 epinephrine.
- After epidural catheter insertion, spinal anaesthesia was given with 0.5% hyperbaric bupivacaine 15-18 mg.

Once surgery was completed patient was shifted to post-operative room, pain was assessed using visual analogue scale (0= no pain till 10= maximum pain).

The Following Parameters were Studied Postoperatively

- *Onset of Analgesia:* The onset of analgesia was assessed by VAS score. The time of onset was taken

from the time of injection of drug on VAS score of 4 into epidural space to regression of pain .

• *Quality of Analgesia:* At the end of the operation, the quality of anesthesia will be assessed according to the following numeric scale:

Excellent (4): no complaint from patient, good (3): minor complaint with no need for supplemental analgesic moderate (2): complaint which requires supplemental analgesic

Unsuccessful (1): Patient needs multiple drug therapy.

• *Duration of Analgesia:* It will be assessed after the successful epidural block, and on the following parameters-Pain severity was measured using: 1- Visual Analogue Scale (VAS)

0-no pain

10- worst imaginable

Time taken for reappearance of VAS score 4 from the time of the injection will be considered as total duration of analgesia.

The parameters such as heart rate, non invasive blood pressure, ECG and SpO₂ were periodically monitored every 1 minute from the time of epidural dose for first 5 minutes, then every 5 minutes for half an hour interval and then at 15 minutes interval until the patient complained of pain or VAS of 4 in the postoperative period.

• *Motor Blockade:* The time interval between administration of drug into epidural space and the patient's inability to lift the straight extended leg was recorded as onset time for motor block.

The duration of motor block was taken from time of injection to complete regression of motor block (Ability to lift the extended leg i.e. modified Bromage scale- 0.

Observations and Results

Descriptive data presented as mean±SD and percentage. Bonferroni test followed by student unpaired t-test. Chi-square test is also used for some pair wise comparisons. For all tests a p-value of ≤ 0.05 was considered as significant.

Both groups were comparable in respect to mean age, sex, height, weight and ASA grading. There was no significant change in the Systolic BP, diastolic BP, pulse rate, respiratory rate and SpO₂ of the patients in both groups pre and post operatively. The mean time of onset of pain was higher but not statistically significant in ropivacaine group (9±1.5 min) as compared to levobupivacaine group (8±1.5 min). The mean duration of postoperative analgesia was significantly higher in levobupivacaine group (240 ±45 min) as compared to ropivacaine (180±16 min)

Table 1: Pre operative Systolic BP, diastolic BP, pulse rate, respiratory rate and SpO₂ amongst study population

	Group Code	Mean	Std. Deviation	P value
Systolic	1	124.87	10.355	0.821 (>0.05NS)
	2	124.13	14.277	
Diastolic	1	77.87	9.217	0.556 (>0.05NS)
	2	76.60	7.224	
Pulse	1	74.57	13.913	0.202 (>0.05NS)
	2	78.23	6.986	
RR	1	15.77	13.731	0.277 (>0.05NS)
	2	13.00	1.486	
SPO ₂	1	98.90	0.960	0.554 (>0.05NS)
	2	99.03	0.765	

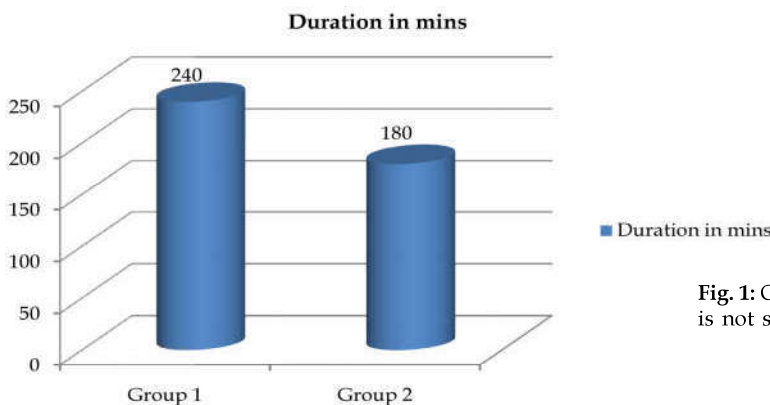


Fig. 1: Onset of action between the two groups is not significant (P>0.05)

Table 2: Comparison of onset and duration of post-operative analgesia among study groups

	Code	N	Group Statistics			T value	P value
			Mean	Std. Deviation	Std. Error Mean		
Onset	1	30	8.33	1.241	.227	0.459	>0.05 (NS)
	2	30	8.20	0.997	.182		
Duration	1	30	240.00	45.863	8.373	6.740	0.000**
	2	30	180.00	16.557	3.023		

Onset of action between the two groups is not significant (P>0.05)

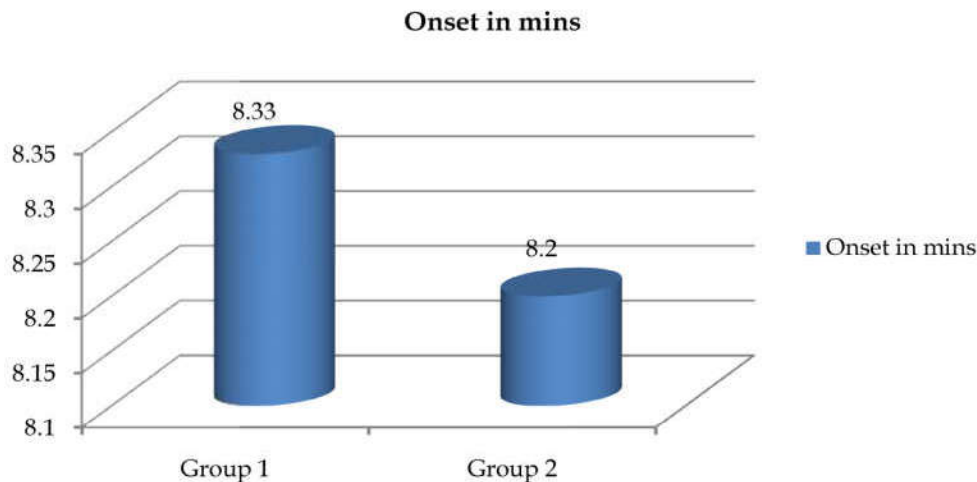


Fig. 2: Duration is ** Highly Significant (P<0.01)

and no motor blockade was noted in either of the groups.

The mean duration of postoperative analgesia was significantly higher in levobupivacaine group (240 ± 45 min) as compared to ropivacaine (180 ± 16 min).

Discussion

Regional anaesthesia is noted for its simplicity, safety, and effectiveness. Anaesthesia with an efficient block, having least onset time and which can be prolonged with least complications is one of the challenges faced by the anaesthesiologist.

Orthopedic surgeries are usually associated with perioperative pain which is a potent trigger for the stress response and autonomic system and is thought to be an indirect cause of various adverse effects like myocardial ischaemia, infarction, thromboembolic phenomena, impaired pulmonary function, ileus, fatigue, muscle catabolism, postoperative infection and postoperative confusional states.

Epidural local anaesthetics are widely used in the management of postoperative pain. It provides high

quality analgesia with minimal adverse effects. Epidural analgesia also blunts the autonomic and somatic reflex responses to pain. Epidural analgesia needs comparatively small doses and low concentration of local anaesthetics [9]. It is used in thoracic, abdominal and lower limb surgeries successfully. This technique has gained popularity in labour analgesia as epidural local anaesthetics tend to reduce the pain and sympathetic response without causing any motor deficits.

Epidural techniques are particularly effective at providing dynamic analgesia, allowing the patient to mobilize and resume normal activities unlimited by pain. It also improves the postoperative outcome and attenuates the physiologic response to surgery, in particular, significant reduction in pulmonary infections, pulmonary embolism, ileus, acute renal failure and blood loss [10].

Epidural analgesia for pain control after surgery might provide with some specific benefits [11]:

- Better pain control than intravenous narcotics,
- Early recovery of bowel function,
- Less need for systemic opioids (narcotics) and less nausea as a result.

- Better participation in physical therapy

It reduces incidence of hemodynamic changes as a result of sympathetic blockade as it produces segmental analgesia unlike subarachnoid block anaesthesia.

The benefit of good quality epidural analgesia includes improved respiratory functions, decreased post-operative cardiac complications, earlier mobilization and less chances of deep vein thrombosis with shorter hospital stay.

Different local anaesthetics are used for epidural anaesthesia, most popular in India being lignocaine and bupivacaine. The drawback of lignocaine is its intermediate duration of action and bupivacaine is its cardiotoxicity.

Bupivacaine has, until recently, been the drug of choice for postoperative epidural infusions. Despite a reasonable safety profile, bupivacaine is currently being replaced by many anesthesiologists with new local anesthetics: levobupivacaine and ropivacaine. These local anesthetics are associated with less risk for cardiac and central nervous system toxicity and are also less likely to result in unwanted postoperative motor blockade [11,12].

Ropivacaine is a long-acting amide local anaesthetic agent and first produced as a pure enantiomer. Ropivacaine is less lipophilic than bupivacaine and is less likely to penetrate large myelinated motor fibres, resulting in a relatively reduced motor blockade. Thus, ropivacaine has a greater degree of motor sensory differentiation, which could be useful when motor blockade is undesirable. The reduced lipophilicity is also associated with decreased potential for central nervous system toxicity and cardiotoxicity [8].

Levobupivacaine [3,4] is a long acting local anaesthetic with a clinical profile closely resembling that of bupivacaine. Levobupivacaine, the pure S(-)-enantiomer of bupivacaine, has strongly emerged as a safer alternative for regional anesthesia than its racemic sibling, bupivacaine. Levobupivacaine has a lower risk of cardiovascular and CNS toxicity than bupivacaine.

Various studies have been done using different concentrations of levobupivacaine and ropivacaine like in study by Deepali Valecha et al [13], comparing 0.2% ropivacaine with 0.125% bupivacaine in labour epidural analgesia, quality and intensity of analgesia as assessed by VAS score without unwanted motor blockade and side effects and haemodynamic stability was found to be better in ropivacaine group. Muldoon et al [14] used 0.2% solutions of both drugs for

comparing post operative analgesia and Jorgensen et al [15] used the same concentrations in solutions at 8ml/hr. Both the studies concluded that both are effective in providing analgesia but motor blockade was found to be higher in bupivacaine group than in ropivacaine group.

S. J. V. Kameshwara Rao et al [16] in their study compared 0.5% bupivacaine with 0.75% ropivacaine and 0.5% levobupivacaine in sub umbilical surgeries under epidural anaesthesia and found high concentrations of these drugs were associated with significant hypotension, motor blockade and high incidence of side effects.

Hence, for our study, we chose concentration of levobupivacaine as 0.125% and ropivacaine as 0.2% since such low concentrations of these local anaesthetic drugs is unlikely to result in unwanted postoperative motor blockade with adequate analgesia and lesser incidences of side effects.

Thus, the aim of this investigation was to compare the effect of a postoperative single epidural dose of these two local anesthetic drugs on motor blockade and pain relief after lower limb orthopaedic surgeries.

Onset of Analgesia

There was no statistically significant difference with regard to onset of analgesia between the groups. This findings correlate well with the study conducted by Charles PD [17] in which 0.5% levobupivacaine and 0.5% ropivacaine has no significant differences in onset times in ultrasound guided sciatic block.

Duration of Post Operative Analgesia and Quality of Analgesia

All patients were given bolus dose of epidural after appearance of VAS score of 4 and the VAS score was reassessed after the bolus dose of epidural was given. Following the dose, VAS score reduced to either 1 or 2 in all patients among both the groups. Hence, both groups were comparable in respect to quality of analgesia.

In the present study, the VAS score of 1 or 2 was maintained for 240 ± 45 mins in levobupivacaine group and 180 ± 16 mins in ropivacaine group. Hence, the mean duration of postoperative analgesia was significantly higher in levobupivacaine group as compared to ropivacaine. This findings correlate well with the study conducted by Pujol E et al [18] in which levobupivacaine group had higher duration of postoperative analgesia after surgery as compared to ropivacaine group. Goyagi T et al, 2010 [19] reported

that the post-operative epidural analgesia was higher in levobupivacaine group as compared to ropivacaine group. In the study conducted by Elske Sitsen [20], the time for repeat dose of epidural was higher in levobupivacaine group than ropivacaine group.

Motor Blockade

No motor block was observed in any patient in both the groups. In the study conducted by *De Negri P* [21], significantly less unwanted motor blockade was associated with postoperative epidural infusions of 0.125% levobupivacaine or ropivacaine in children after hypospadias repair as compared with a similar infusion of bupivacaine. Similarly in the study by *G De Cosmo* [22] et al, no motor block was seen using 0.2% ropivacaine and 0.125% levobupivacaine for epidural analgesia following lung surgery.

Clinical studies in various patient populations suggest that levobupivacaine and ropivacaine are equally potent when used for epidural analgesia [23,24,25]. It is believed that ropivacaine because of its lower lipid solubility has the advantage of a stronger differentiation between sensory and motor blocks, a feature that is particularly useful when early mobilization is important to enhance recovery. Both levobupivacaine and ropivacaine are associated with lesser degree of motor block compared to bupivacaine when used for spinal anesthesia [26].

Conclusion

We conclude that single epidural 0.125% levobupivacaine produces higher postoperative analgesia as compared to single dose epidural 0.2% ropivacaine for post operative analgesia in patients undergoing elective lower limb orthopaedic surgeries.

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