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Is 0.75% Ropivacaine More Efficient than 0.5% Bupivacaine for Prolonged Sensory Blockade in Epidural Anaesthesia for Orthopaedic Hip Surgeries?

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ABSTRACT

Background: The efficiency of 0.75% Ropivacaine as a single shot epidural anaesthetic in comparison to 0.5% Bupivacaine is less studied. Our study focuses on comparing the efficiency of sensory block between 0.75% ropivacaine and 0.5% bupivacaine for epidural anaesthesia. **Methods:** The study was done with 0.75% Ropivacaine and 0.5% Bupivacaine in epidural anaesthesia in orthopedic hip surgeries given as a single shot technique for which 60 patients of ASA I/II each were chosen and 15ml of the drug was given. Onset of the sensory sensations at T12 and regression at the same level were measured with the aid of response to pin prick and thus duration of epidural anaesthesia was calculated individually in group B and group R respectively. **Results:** Onset of sensory block was faster in group R than in group B and regression was slower in group R than in group B. **Conclusion:** It can be concluded that duration of epidural anaesthesia was prolonged and longer with 0.75% Ropivacaine than 0.5% Bupivacaine.

Keywords: Epidural Anaesthesia, 0.75% Ropivacaine, 0.5% Bupivacaine, Orthopedic Hip Surgeries.

INTRODUCTION

By the year 2020, almost 20% of the Indian population will be older than 60 years, and the annual incidence of hip fractures will touch 600,000 by then.[1] Hip fractures are relatively less common in younger age groups. The joint replacement Market was expected to Grow at a Compound Annual Growth Rate of 26.7 per cent during 2010-2017 and continues to grow further.[2] All surgeries around the hip joint are preferably done under regional anaesthesia which comprises of either spinal or epidural methods. Various studies have established the superiority of regional techniques over general anaesthesia for these surgeries.[3-6]

Epidural anaesthesia has the additional advantage of prolongation of duration of anaesthesia, better hemodynamic stability and post operative pain management over spinal anaesthesia.[4] 0.5% bupivacaine has been the drug of choice for epidural anaesthesia for a very long time. Many newer drugs such as ropivacaine have been introduced for the same purpose. Ropivacaine is a long-acting amide local anaesthetic agent, less lipophilic than bupivacaine, hence, associated with decreased potential for central nervous system toxicity and cardiotoxicity than Bupivacaine.[7]

Ropivacaine is available in various concentrations such as 0.5%, 0.75% and 1% for anaesthesia purpose. The most appropriate concentration for epidural has not been established. Most studies compare 0.5% bupivacaine with 0.5% ropivacaine. Very few studies exist comparing the effects of 0.75% ropivacaine and 1% ropivacaine with 0.5% bupivacaine. Our study focuses on comparing the efficiency of sensory block between 0.75% ropivacaine and 0.5% bupivacaine.

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MATERIALS AND METHODS

The present study was done as a prospective, randomized, comparative one in 60 patients aged between 22 to 79 years involving both sexes belonging to ASA grade I and II scheduled for elective Orthopaedic Hip surgeries. They were randomly divided into two groups. Group B – (n=30) were given 0.5% Bupivacaine Hydrochloride 15ml given by epidural technique. Group R – (n=30)

were given 0.75% Ropivacaine Hydrochloride 15ml given by epidural technique. After obtaining approval for the study from Institutional ethics Committee, written consent was obtained from all the patients.

Inclusion criteria

All patients posted for Elective Orthopaedic Hip surgeries under ASA Grade I and II including both males and females.

Exclusion criteria

1. Patients who are unwilling to give consent
2. ASA Grade III, IV, V or E
3. Obese patients
4. Patients with uncontrollable hypertension
5. Patients with uncontrollable diabetes mellitus
6. Patients with severe CVS abnormalities (ischaemic heart disease, valvular heart disease, AV conduction blocks, CCF)
7. Patients with endocrine disturbances including deranged thyroid function tests
8. Patients with a H/O epilepsy or those taking anti-epileptics
9. Patients with renal or hepatic failure
10. Patients with H/O head injuries or neurological surgeries
11. Patients with spine deformities
12. Patients with coagulation defects, those on anti-coagulants, those with H/O viral fevers with thrombocytopenia

All patients were subjected to pre anaesthetic checkup on the day before surgery. On the day of surgery, the patients were shifted to the OR and were randomly assigned to Group B or Group R. Baseline vital hemodynamic parameters such as heart rate, non-invasive arterial blood pressure, oxygen saturation and ECG were noted. Intravenous line was secured with an 18G intravenous catheter and intravenous fluids were connected. Preloading was done with 500ml of Ringer's Lactate. Premedication was given with I.V. Ondansetron 4mg.

The patient is put in sitting position and under strict aseptic conditions, local anaesthetic is injected in L3-L4 space followed by tuohy needle with a loss of resistance syringe. On confirmation of loss of resistance, the catheter is threaded in a cephalic direction and 5cm of it left in the epidural space and secured accordingly. 15cc of 0.75%Ropivacaine in group R and 15cc of 0.5% Bupivacaine in group B are given in the epidural catheter.

Variables measured – onset of sensory block measured with loss of pinprick sensation at T12, return of sensory sensations at T12 measured with return of sensations to pinprick – difference between both variables gives duration of sensory blockade. Vital parameter monitoring was done periodically and were maintained within normal limits. No complications were observed.

Sample size calculation was based on a previous study. With a significance level of 95%, power of study 80%, α error of 0.05 and β error of 0.2, to show a 20% difference in the duration of analgesia, at least 25 patients per group were needed. We took 30 patients per group for our study to compensate for any drop-outs. Duration of analgesia were analyzed by the t-test. For categorical covariates (sex, nausea/vomiting, hypotension, bradycardia), the comparison was done using a chi-square test or Fisher's exact test. The significance level was defined as $P < 0.001$. Data were expressed as mean ± SD. The Statistical software namely Open Epi, Version 2.3 was used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc.

Demographic parameters like age, sex distribution and ASA grade were uniform in the both groups.

RESULTS

Table 1: Comparison Of Demographic Parameters

	Group R		Group B		p-Value
Age (Mean±SD)	55.76±14.68		56.8±15.49		0.7744
Sex	Males - 19	Females - 11	Males - 17	Females - 13	_____
ASA Grade	Grade I - 12	Grade II - 18	Grade I - 12	Grade II - 18	_____

Table 2: Comparison Of Sensory Onset At T12

GROUP R (mins)	GROUP B (mins)	p-VALUE
7.6±3.09	10.83±2.16	0.000000210

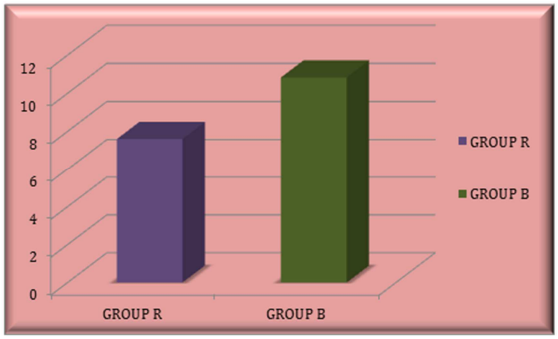

Figure 1: Comparison of Sensory Onset at T12

The onset of loss of sensations to pin prick at T12 in Ropivacaine group occurred at 7.6 ± 3.09 minutes and in Bupivacaine group at 10.83 ± 2.16 minutes with a significant p-value of 0.00000021 implying that the lesser time taken by the 0.75% Ropivacaine for the onset of sensory component was significant in comparison to 0.5% Bupivacaine. Thus, the sensory onset of 0.75% Ropivacaine was found to be faster than 0.5% Bupivacaine.

Table 3 : Comparison Of Sensory Regression At T12

GROUP R (mins)	GROUP B (mins)	p-VALUE
130.73±12.81	109.5±8.77	<0.0000001

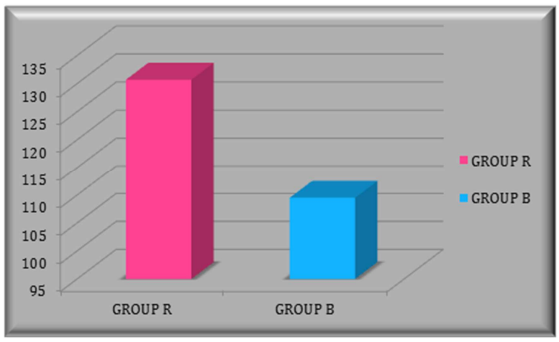

Figure 2: Comparison of Sensory Regression

Two segment regression time was compared in both the groups and they were 130.73 ± 12.81 minutes and 109.5 ± 8.77 minutes in Ropivacaine group and Bupivacaine group respectively with a significant p-value of <0.0000001 showing that 0.75% Ropivacaine had a prolonged duration of action in comparison to 0.5% Bupivacaine.

DISCUSSION

In the recent years, epidural anesthesia has become the choice of anesthesia for various lower limb surgeries especially orthopedic surgeries to facilitate better hemodynamic control than when compared to spinal anesthesia in patients with associated risk factors, in providing postoperative pain relief and early ambulation. Rapid hemodynamic responses like bradycardia, hypotension as which occur immediately post spinal administration are prevented with epidural anesthesia. Also, insertion of epidural catheter during the technique enables efficient postoperative pain relief and early ambulation, thus preventing and decreasing the incidence of deep venous thrombosis in elderly patients with lower limb orthopedic surgeries.

Local anesthetics such as lignocaine, bupivacaine and ropivacaine have been in common usage for epidural procedure. Administration of lignocaine has been limited to 3ml test dose in combination with adrenaline. Administrations of huge epidural doses of lignocaine have been associated with toxicity. Bupivacaine has been used as a frequent alternative in various concentrations, most common being 0.5%. But it was found to have been associated with cardiotoxicity. When ropivacaine was first released, it was widely promoted as a potentially superior agent to bupivacaine because of lower toxicity and less motor block. The most common concentrations used epidurally are 0.5%, 0.75% and 1%. Ropivacaine is less cardiotoxic than bupivacaine, and it takes twice the dose of ropivacaine to cause circulatory collapse and death compared to bupivacaine according to Santos A C et al,[8] in a study done on Systemic toxicity of levobupivacaine, bupivacaine, and ropivacaine during continuous intravenous infusion to nonpregnant and pregnant ewes and Nancarrow C et al9 during a study on Myocardial and cerebral drug concentrations and the mechanisms of death after fatal intravenous doses of lidocaine, bupivacaine, and ropivacaine in the sheep proved the same. Ropivacaine produces fewer arrhythmias than bupivacaine as proved by Pitkanen M et al,[10] and when given by intravenous infusion it was better tolerated, and associated with less reduction in myocardial contractility and conductivity than bupivacaine. In addition, early clinical studies showed that ropivacaine 0.5% produced less motor blockade than bupivacaine 0.5% according to Knudsen K et al,[11] and Scott D B et al.[12]

In the present study, sensory onset in Ropivacaine group was faster than in Bupivacaine group which was found to be statistically significant as was correlated in a study done by Finucaine BT et al,[13] who found that onset time for sensory block to T,[12] was shorter in 0.75% ropivacaine group when compared to 0.5% bupivacaine group and also stated that Ropivacaine exhibited a dose and strength related response which increased as the percentage increased from 0.5% to 0.75% to 1% in comparison to 0.5% Bupivacaine.

Time to regression for pin prick sensations at T,[12] level in Ropivacaine group was found to be more prolonged than in Bupivacaine group stating that the duration of epidural anaesthesia with 0.75% Ropivacaine is superior to 0.5% Bupivacaine as supported by Chandran s et al,[14] in their study where they found that duration of anaesthesia was 389.80mins in Ropivacaine group whereas it was 370.60 mins in Bupivacaine group, which is in coherence with our study. In an another study done by Katz et al,[15] the two segment regression time was significantly longer in Ropivacaine than Bupivacaine which only reiterated the fact that sensory epidural anaesthesia is prolonged with 0.75% Ropivacaine than 0.5% Bupivacaine.

CONCLUSION

A progressive, randomized, comparative clinical study was conducted involving 60 patients belonging to ASA Grade I & II posted for elective orthopedic hip surgery. They were randomly divided into 2 groups of 30 each. Group B received 15ml of 0.5% bupivacaine; Group R received 15ml of 0.75% ropivacaine. All patients were premedicated and preloaded with 500 ml of ringer lactate. Following institution of epidural block, sensory characteristics such as onset of sensory block with loss of sensations to pin prick at T12 and regression of sensory level with return of sensations to pin prick at T12 indicates duration of epidural anaesthesia were noted.

Onset of sensory block was slightly faster with Ropivacaine. And also the duration of anaesthesia was longer with 0.75% Ropivacaine than 0.5% Bupivacaine.

REFERENCES

1. Robyn Norton AO, georgeinstitute.org (Management of Hip Fractures in Older People in India)
2. www.frost.com, Frost & Sullivan Research Service, Overview of Orthopedic Joint Replacement Market in India
3. Eroglu A (2016) Regional Anesthesia Techniques in Orthopedic Surgery. J Anesth Crit Care Open Access 5(2): 00182. DOI: 10.15406/ jaccoa.2016.05.00182
4. David L. Brown in Miller' Anesthesia, 7th edition by Ronald D. Miller, Churchil Livingstone Elsevier publications, New York 2010;1611-1638.
5. MDWilliam F.Urmey, Techniques in Regional Anesthesia and Pain Management, Volume 1, Issue 3, July 1997, Pages 123-130, https://doi.org/10.1016/S1084-208X(97)80028-6
6. Fabiano Timbó Barbosa et al, Neuraxial anesthesia for orthopedic surgery: systematic review and meta-analysis of randomized clinical trials, Sao Paulo Med. J. vol.131 no.6 São Paulo 2013
7. Gaurav Kuthiala et al, Ropivacaine: A review of its pharmacology and clinical use, Indian J Anaesth. 2011 Mar-Apr; 55(2): 104–110
8. Santos A C, DeArmas P I. Systemic toxicity of levobupivacaine, bupivacaine, and ropivacaine during continuous intravenous infusion to nonpregnant and pregnant ewes. Anesthesiology 2001; 95: 1256–1264.
9. Nancarrow C, Rutten A J, Runciman W B, et al. Myocardial and cerebral drug concentrations and the mechanisms of death after fatal intravenous doses of lidocaine, bupivacaine, and ropivacaine in the sheep. Anesth Analg 1989; 69: 276–283
10. Pitkanen M, Covino B G, Feldman H S, Authur G R. Chronotropic and inotropic effects of ropivacaine, bupivacaine, and lidocaine in the spontaneously beating and electrically paced isolated, perfused rabbit heart. Reg Anesth 1992; 17: 183–192
11. Knudsen K, Beckmann Suurkula M, Blomberg S, Sjovall J, Edvardsson N. Central nervous and cardiovascular effects of i.v. infusions of ropivacaine, bupivacaine and placebo in volunteers.Br J Anaesth 1997; 78: 507–514
12. Scott D B, Lee A, Fagan D, Bowler G M R, Bloomfield P, Lundh R. Acute toxicity of ropivacaine compared with that of bupivacaine. Anesth Analg 1989; 69: 563–569
13. Finucane BT, Sandler AN, McKenna J, Reid D, Milner AL, Friedlander M, et al. A double-blind comparison of ropivacaine 0.5%, 0.75%, 1.0% and bupivacaine 0.5%, injected epidurally, in patients undergoing abdominal hysterectomy. Can J Anaesth 1996;43:442-9
14. Chandran S, Hemalatha S, Viswanathan P N. Comparison of 0.75% ropivacaine and 0.5% bupivacaine for epidural anaesthesia in lower extremity orthopaedic surgeries. Indian J Anaesth 2014;58:336-8
15. Katz, Jeffrey A, Knarr, Donna B S N, Bridenbaugh, Phillipo. A Double-blind Comparison of 0.5% Bupivacaine and 0.75% Ropivacaine Administered Epidurally in Humans. Reg Anesth Pain Med 1990;15(5):250-52

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