Comparison of 0.75 % Ropivacaine with 0.5 % Bupivacaine in Peribulbar Block in Ophthalmic Surgeries

Parag Yashwant Dongre¹, Aruna V. Chandak²

¹Department of Anaesthesia, Datta Meghe Institute of Medical Sciences, Sawangi (Meghe), Wardha, Maharashtra, India. ²Department of Anaesthesia, Datta Meghe Institute of Medical Sciences, Sawangi (Meghe), Wardha, Maharashtra, India.

ABSTRACT

BACKGROUND

Bupivacaine as local anaesthetic has cardiovascular and neurological toxic effects; ropivacaine on the other hand is known to have fewer side effects. Its safety and some its ability to reduce intra ocular pressure has led to its widespread usage. The aim of our study was to compare the efficacy of inj. Ropivacaine 0.75 % + hyaluronidase 50 IU / mL with inj. bupivacaine 0.5 % + hyaluronidase 50 IU / mL in cataract surgeries under regional anaesthesia.

METHODS

We evaluated 60 patients who were posted for small incision cataract surgeries. They were randomly divided by drawing chits in to 2 groups according to the anaesthetics used (ropivacaine / bupivacaine). Evaluation of these patients was done on the basis of sensory onset, motor onset using akinesia score, requirement of rescue analgesic, and time of motor and sensory offset of the local anaesthetic.

RESULTS

Inj. ropivacaine 0.75 % showed greater reduction in IOP ($p < 0.05$). Other parameters such as motor block, sensory block, akinesia score, and requirement of rescue analgesia were comparable between the two groups ($p > 0.05$).

CONCLUSIONS

In patients posted for intra ocular / cataract surgeries, ropivacaine 0.75 % and bupivacaine 0.5 % are comparable, with ropivacaine having better haemodynamic profile and also reduces intra ocular pressure.

KEY WORDS

Ophthalmic Surgeries, Bupivacaine, Ropivacaine, Peri Bulbar Block, Motor Block, Sensory Block, Reduction in Intra Ocular Pressure

Corresponding Author:

Dr. Parag Y Dongre,
F-5, Raghobaji Boys Hostel,
DMIMS, Sawangi (Meghe), Wardha,
Maharashtra, India.
E-mail: paragdongre21@gmail.com

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BACKGROUND

Cataract surgeries are the most common ophthalmic surgeries done all over the world and local or regional anaesthesia is preferred for these surgeries. It is must and very important acquired skill for an anaesthesiologist and ophthalmic surgeons to provide anaesthesia to such ophthalmic surgeries. To avoid general anaesthesia for such patients optimal surgical conditions (analgesia and akinesia) can be achieved with block techniques for the population of patients who are often elderly with other co-morbidities.¹ There arose a need for search of a local anaesthetic drug which can have adequate analgesic properties with akinesia, and which will decrease the intra ocular pressure and relax extra ocular muscles as well adequately.

Ropivacaine a first produced pure enantiomer with long-acting properties of local anaesthetic agent. It provides effects of local anaesthesia by reversibly inhibiting the voltage gated sodium channels and the associated proteins in the neurons. It is metabolised by the hepatic P450 enzyme through^{2,6} pipercoloxylidide and 3, hydroxy ropivacaine and Ropivacaine is less lipophilic than bupivacaine and is less likely to penetrate large myelinated motor fibres, resulting in a relatively reduced motor blockade. The lipid solubility of the ropivacaine is somewhere in between lidocaine and bupivacaine and is highly bound to alpha 1 acid glycoprotein.²

Bupivacaine is a long acting local anaesthetic which has been around since quite a long time and was discovered in 1957, which like all amide anaesthetics which is associated with considered toxic to heart when administered intravascularly or when given in higher concentrations. Possible pathways through which bupivacaine is metabolised include aromatic hydroxylation, N - dealkylation, amide hydrolysis, the allergic responses are associated majorly with zoic acid. Onset of action in dose dependent which is around 1-17 mins and duration of action which is also dose dependent, around 2 - 9 hrs. bupivacaine has 95% of protein binding and half - life in adults is approximately around 2.7 hrs. It hepatic as well as renal elimination route.

Ropivacaine is a long - acting regional anaesthetic agent which is similar to Bupivacaine structurally. It is a pure S (-) enantiomer, unlike Bupivacaine, which is a racemate, developed for the purpose of reducing potential toxicity and improving relative sensory and motor block profiles.³ This article review us with comparison of bupivacaine and ropivacaine for peribulbar blocks in ophthalmic patients posted for ophthalmic surgeries under regional anaesthesia.

METHODS

This observational study was conducted in AVBRH Sawangi, Wardha, Maharashtra. After obtaining ethics committee approval and informed consent, patients belonging to ASA class I and II with age between 18 and 60 yrs. old and scheduled for intraocular surgery were included in the study.

Pulse oximetry, noninvasive blood pressure and electro - cardiogram monitoring was established in the operating theatre and intravenous access was secured on the patient.

Patients were divided in two groups with chit system randomly as shown below-

1st Group - Receiving 0.5 % Bupivacaine in Peribulbar Block

2nd Group -Receiving 0.75 % Ropivacaine in Peribulbar Block

4 % Lignocaine / paracaine drops were instilled into the conjunctival sac to provide topical anaesthesia so that the patients are comfortable while the anaesthesiologist is administering the block.

As patients posted for cataract surgeries are generally in the geriatric population categories this topical anaesthesia with some counseling will ease out some of their anxiety and patients will be hemodynamically stable.

The topical anaesthetic agent sets its action after 2 min so after that 5 mL of the test solution was injected at the site with a 25G needle which is 2.5 cm in length. The same anaesthesiologist, will be blinded to the local anaesthetic which he will be using, and will perform all peribulbar injection blocks for cataract surgeries and these were scored on the key observations such as, progression of akinesia, motor block, sensory block, and analgesia. Akinesia for each of the four rectus muscles, orbicularis oculi and levator palpebrae superioris was observed and recorded every 2 min for 16 mins, then every 5 min until the intra ocular cataract surgery was performed and patient was shifted to the recovery room.³

Akinesia of each extra ocular muscles was scored and assessed as 3 (full movement), 2 (partial movement), 1 (almost no movement) to 0 (akinesia). Full movement in all muscles therefore scored 18. A maximum block scored 0 and a score of 6 will be deemed adequate for surgery. If the block was inadequate for surgery at 6 min, a further bolus of test solution was administered with a medial canthus injection. A third injection will be administered if the block was still inadequate after 12 min, the site chosen depending on the deficiency of the block.

The target volume for each dose was 5 mL, but if intraorbital pressure, as assessed by digital palpation method were high patients were considered drop outs if they required a third dose of injection and if they appeared to rise quickly in single dose, then a smaller volume was administered.⁴ Digital compression was applied after all peri orbital blocks at the site of injection.

The surgeons were asked to grade the block in terms of akinesia of the extra ocular muscles, analgesia achieved by the local anaesthetic used, hyperaemia and intra ocular pressure using a grading scale of 0 for good, 1 for satisfactory and 2 for poor. Immediately after surgery, the patients were asked to score the surgical pain by using visual analogue scale (VAS).

In Visual analogue score the patients were asked to grade pain on the scale of 1 to 10 points, 1 being least pain experienced by the patient and 10 being the maximal pain experienced by the patient.⁵

Statistical analysis will be done by using descriptive and inferential statistics using chi square test and student unpaired t test and software used in the analysis will be SPSS 24.0 version and GraphPad prism 7.0 version and p < 0.05 is considered as level of significance.

RESULTS

	Group R	Group B	P Value
Age	59.50+9.66	63.80+10.80	0.10
Sex M	14	13	1.0
F	16	17	
Height	142.18+11.4	146.08+7.4	0.12
Weight	49.90+10.2	48.8+16.2	0.75

Table 1. Demographic Data of the Study Population

There was no statistical difference in akinesia score observed between the 2 groups at 1

Time	Group R + SD	Group B + SD	P Value
Before block	9.0	9.0	1
1 minute after block	3.77	3.77	
3 minute after block	3.40	3.86	
5 minute block	2.15	2.35	
10 minutes block	1.70	1.73	
15 minutes block	1.57	1.07	

Table 2. Return of Ocular Movement

	Group R	Group B	P Value
Time	277.83 + 76.49	256.83+71.64	0.27

Table 3. Time to Rescue Analgesia

Above table shows the time for first rescue analgesic requested by the patient, in which ropivacaine group needed analgesia after 277.83 + 76.49 mins, whereas group bupivacaine required after 256.83 + 71.64 mins

	R (Map)	B (Map)	P Value
0 Min	92 + 4.5	94 + 4.2	0.08*
1 Min	102 + 4.4	104 + 4.2	0.07*
3 Mins	88 + 4.1	90 + 4.3	0.07*
5 Mins	90 + 3.7	88 + 3.8	0.05*
10 Mins	92 + 3.8	84 + 4.0	0.05*
15 Mins	88 + 3.6	84 + 3.4	0.05*

Table 4. Comparison of Mean Arterial Blood Pressure in Both Groups

*the p Values were Statistically Insignificant

Time / IOP mm hg	Group R + SD	Group B +SD	P Value
Before	15	15	-
1 Min	15 + 2.6	16 + 2.1	0.10*
3 Mins	14 + 2.7	15 + 2.3	0.12*
5 Mins	9 + 2.4	10 + 2.7	0.13*
10 Mins	7 + 2.4	8 + 2.7	0.13*
15 Mins	7 + 2.2	8 + 2.5	0.10*

Table 5. Intra Ocular Pressure in Both the Groups

*the p - Values were Significant stating that group Ropivacaine has better Reduction in the Intra Ocular Pressures than Bupivacaine

There was statistically significant difference between the two groups in terms of IOP before injection, in both the groups IOP reduced significantly from the baseline at 15 mins after block. On comparison reduction in IOP was significant at 1, 3, 5, 10 and 15 mins in group R than group B.

DISCUSSION

In peribulbar block, local anaesthetic is deposited above and below the orbit into the muscle orbicularis oris. In this technique ciliary nerves are blocked, as well as CN III and VI, optic nerve is not blocked in this kind of local anaesthesia. As the deposition of the local anaesthetic is outside the muscle thus intraocular or intradural injection is of very rare incidence. Peribulbar block is very easy to give and it

decreases the overall risk of haemorrhage within the muscle and injury to optic nerve is also decreased. Getting a dense block is quite difficult in this technique of Peribulbar block but still this kind of regional block is used widely due to its lower complication rates.

Complications of peribulbar block can be mentioned as follows - patient's contralateral eye can be affected by the local anaesthetic used, ecchymoses can be seen in the periorbital region and, the most dangerous one is transient loss of vision to the patient contraindication to Peribulbar and Retrobulbar Block can be discussed as the patients - Age less than 15, operating Procedures lasting more than 90 - 120 minutes, patient with Uncontrolled cough or tremors, patient having Disorientation, mental impairment, excessive anxiety or claustrophobia, patients with Language barrier or deafness or Bleeding or coagulopathies and perforation of the globe.

Ropivacaine is recently available in the Indian markets and it has a better safety profile compared to all the other local anaesthetics, there is wide scope for research in the field of local anaesthesia with ropivacaine.⁶ For an intra - ocular ophthalmic surgery intraoperative pain relief, akinesia with post - operative comfort are the most important parameters to be assessed. Bupivacaine and ropivacaine are both long acting local amide type of anaesthetics used in this study. Bupivacaine in a racemate compound where as Ropivacaine is a pure enantiomer. The penetration time of the solution is determined by the proton binding ability of a local anaesthetic (pKa), and specific pKa values for lidocaine is 7.7 whereas it is 8.3 for both bupivacaine as well as ropivacaine, which will majorly determine the onset of analgesia. Rapid onset of analgesia is associated with lower values of pKa of the local anaesthetic. The binding rate of plasma to the protein is 94 % for bupivacaine, and it is 95 % for ropivacaine, respectively. More the binding ability of the local anaesthetic agent, more will be duration of action. Bupivacaine is believed to provide faster onset of analgesia and for longer duration as well. Vasoconstrictive effect is the major contributor in lowering the intra ocular pressure by reducing the intra ocular volume.⁷ We have compared the efficacy and tolerability of 0.75 % ropivacaine and 0.5 % bupivacaine for peribulbar anaesthesia. We have not been able to signify statistical significance between the efficacy and tolerability of 0.75 % of ropivacaine and 0.5 % bupivacaine in peribulbar anaesthesia, whereas ropivacaine appears to provide slightly faster onset of action for globe and lid akinesia.⁸

Apart from the dose, the dependency of maximum plasma concentration is by absorption from the site of injection, the volume of distribution and drug elimination.⁹ bupivacaine has a greater volume of distribution due to the higher N - heptane buffer partition coefficient and has a greater propensity of fat accumulation and accumulation in the nerve tissue as compared with ropivacaine, it can be a possibility that more lipophilic bupivacaine is accumulated in the fat tissue of the orbital space slowing down the release of it in the system¹⁰. The high volume of distribution and its comparatively slower systemic absorption from the orbit space most probably explains the higher concentration of ropivacaine achieved after peribulbar administration^{11,12}

CONCLUSIONS

In the above tested subjects, quality of anaesthesia and post-operative analgesia achieved were similar with 0.5% bupivacaine + hyaluronidase 50 IU / mL and ropivacaine. However, 0.75 % ropivacaine was found to be better than 0.5% bupivacaine under the standard conditions as it decreased intraocular pressure secondary to relaxation of extra ocular muscles. Patient in whom ropivacaine was used did not develop any of the side effects whereas two patients in bupivacaine group developed bradycardia immediately after block which was managed. This has proven that ropivacaine provided better haemodynamic stability compared to bupivacaine in regional anaesthesia in intra ocular surgeries such as cataract surgeries.

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