A Comparitive Study of 2% Lidocaine Plus 0.5% Ropivacaine Versus 2% Lidocaine Plus 0.5% Bupivacaine for Peribulbar Anesthesia in Cataract Surgeries

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ABSTRACT

Introduction: The goals of safe and effective anesthesia for intraocular surgery are to obtain good analgesia and akinesia without complications. Study aimed to determine efficacy and adverse cardiac effects of 2%lidocaine plus 0.5%ropivacaine in peribulbar anesthesia for cataract surgeries.

Material and Methods: In this study, 60 consenting patients posted for cataract surgery under Peribulbar anesthesia with two point injection technique were included. They were randomly categorized into two groups of 30 patients each. One group received ropivacaine with lidocaine and the other group received bupivacaine with lidocaine.

Results: Based on our observations regarding onset of action, duration of anesthesia, early recovery of motor blockade and intraocular pressure changes, Ropivacaine scored better than bupivacaine. There were no differences in effects on mean arterial pressure and ECG rhythm changes and even though bupivacaine decreased heart rate from baseline value, bradycardia did not occur in both groups.

Conclusion: Ropivacaine is a better agent than bupivacaine for peribulbar anesthesia due to its faster onset and shorter duration with less effects on intraocular pressure.

Keywords: Lidocaine, Ropivacaine Versus, Lidocaine, Bupivacaine, Peribulbar Anesthesia, Cataract Surgeries

INTRODUCTION

Regional anesthesia has been used ever since Percy first proposed the use of cocaine as a topical anesthetic in 1856.[1] Ever since Knapp[2] described retrobulbar anesthesia almost 10 decades ago, it remained the choice of anesthesia till recently, when ocular surgeons worldwide described local and systemic complications due to it. Then began the search for a safer technique to achieve analgesia and akinesia, hence peribulbar anesthesia was advocated. This technique has lesser complications and does not require a separate facial nerve block, unlike in retrobulbar anesthesia. Peribulbar anesthesia has been the anesthesia of choice for cataract surgery and is routinely performed with a mixture of local anesthetics, most commonly bupivacaine and lidocaine.[3] After the introduction of bupivacaine, it became apparent that accidental overdose was often fatal due to its cardiotoxic effect and responded poorly to conventional resuscitation methods.[1] The aminoamide, Ropivacaine, a derivative of mepivacaine, was introduced in 1996 as the safer alternative to bupivacaine. It possesses properties similar to those of bupivacaine but is less neurotoxic and cardiotoxic.[4] In 1999, Huha et al did a study in patients scheduled for cataract surgery under peribulbar anesthesia and concluded that ropivacaine group had more rapid and complete akinesia when compared to bupivacaine group.[5] So study aimed to determine efficacy and adverse cardiac effects of 2%lidocaine plus 0.5%ropivacaine in peribulbar anesthesia for cataract surgeries.

MATERIAL AND METHODS

Patients posted for cataract surgeries in Ophthalmology department of Sarojini Devi Eye Hospital, Osmania Medical College from January 2015 to September 2016. This study is a prospective, randomized study conducted over a period of two years. It consisted of 60 patients using purposive sampling technique.

Inclusion Criteria: Patients with cataract: Irrespective of the grade of cataract, between the ages of 40-70 years, of either sex, with normal intraocular pressure, with normal baseline ECG rhythm and ASA grades I or II.

Exclusion Criteria: Patients with: Profound cognitive impairment, apprehension requiring sedatives and analgesics, documented allergies to hyaluronidase and lidocaine, any preceding eye disorder other than cataract and inadequate anesthesia requiring reinjection of local anesthetics.

After approval of institutional ethics committee, 60 consenting patients fulfilling the inclusion criteria were considered for our study. A pre-anesthetic checkup was done for all patients which included a detailed history, general physical and systemic examination. Ophthalmologic examination was done. by the ophthalmologist including intraocular pressure measurement. Basic investigations including a baseline ECG were done. Patients were kept nil per oral overnight. Ophthalmology resident who was not connected with our study loaded the study drugs and the operating surgeon performed peribulbar anesthesia. Intraoperative and postoperative assessment was done

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by anesthesia resident who was blinded to study drugs. Patients were randomized into two groups of 30 each using computer generated random sequence table. GROUP A: Receiving 0.5% ropivacaine plus 2% lidocaine and GROUP B: Receiving 0.5% bupivacaine plus 2% lidocaine. In the operating room, two point peribulbar anesthesia was administered with 7ml mixture of local anesthetics at the superonasal and inferolateral quadrants in all cases with the eye in primary position of gaze. Akinesia was scored as described by sarvela et al[30] (Table 3) at 2 mins interval for the first 10mins, then every 15mins till 1hr and every half an hour for next 2hrs. Time of onset was recorded when globe akinesia score is 0. Sensory anesthesia, assessed as present or absent and intraocular pressure were measured at the recorded time of onset. Time to recovery was noted when akinesia score of 1 is obtained. Heart rate and Mean arterial pressure were recorded at 2mins interval for the first 10mins, thereafter every 15mins till 1hr and every half an hour for next 2hrs. Intraocular pressure was measured at the time of onset. Rhythm disturbances in ECG were recorded as present or absent. 10 cc plastic disposable syringes and number 23 gauge needle, 3/4th inch long were used for the block. The patient is shifted inside operation theatre and after the patient is placed in supine position, IV line is secured with 20 gauge cannula. Essential monitors were connected including pulse oximeter, non invasive blood pressure and electrocardiogram. The eyelids and the surrounding areas were cleaned with 5% povidone solution. 5 cc of anesthetic solution was taken in a 10 cc syringe with 23 gauge needle. With the eye in primary position of gaze 4ml injected at inferolateral quadrant at the junction of the medial 2/3rd and lateral 1/3rd of lower lid, with needle directed towards the floor of the orbit and the bevel facing the globe after aspiration to rule out possible intravascular entry. Then 3ml of anesthetic solution was injected in similar manner at superonasal quadrant at the junction of medial 1/3rd and the lateral 2/3rd of upper lid. Ocular compression was applied for a few minutes.

STATISTICAL ANALYSIS

Collected data was analyzed by t test, ANOVA (analysis of variance) and Chi-square test.

RESULTS

In this study 60 patients were included, 30 patients in Group A who received local anesthesia with ropivacaine plus lidocaine and 30 patients in Group B who received anesthesia with bupivacaine plus lidocaine.

Demographic data

Age distribution: In group A only 3 patients were less than 50 years and 21 patients were in the age group of 60-70 years. In group B there was almost equal Distribution of

Variable	Group A	Group B	p value
Age (yr)	63.33±8.487	61.07±6.943	0.262
Sex (male/female)	13/17	11/19	0.598
Weight (kg)	62.06±6.736	60.2±3.334	0.089

Table-1: Demographic data distribution

Group A	Eyelid akinesia grade		
Time (mins)	0	1	**2**
2	76.7	10.0	13.3
4	96.7	3.3	0
6	100.0	0	0
8	100.0	0	0
10	100.0	0	0
15	100.0	0	0
30	100.0	0	0
45	16.7	76.7	6.7
60	0	16.7	83.3
120	0	0	100.0
180	0	0	100.0
Group B	**Eyelid akinesia grade**		
Time (mins)	0	1	**2**
2	0	0	100
4	3.3	0	96.7
6	6.7	3.3	90
8	16.7	83.3	0
10	100.0	0	0
15	100.0	0	0
30	100.0	0	0
45	100.0	0	0
60	90.0	10	0
120	0	83.3	16.7
180	0	0	100

Table-2: Eyelid akinesia score in groups

Group A	Global akinesia grade		
Time (mins)	0	1	**2**
2	66.7	16.7	16.7
4	96.7	3.3	0
6	100.0	0	0
8	100.0	0	0
10	100.0	0	0
15	100.0	0	0
30	100.0	0	0
45	40.0	60.0	0
60	3.3	36.7	60.0
120	3.3	3.3	93.3
180	3.3	0	96.7
Group B	**Global akinesia grade**		
Time (mins)	0	1	**2**
2	0	0	100.0
4	0	0	100.0
6	3.3	6.7	90.0
8	16.7	60.0	23.3
10	76.7	23.3	0
15	100.0	0	0
30	100.0	0	0
45	100.0	0	0
60	93.3	6.7	0
120	0	93.3	6.7
180	0	3.3	96.7

Table-3: Shows global akinesia score in group A and B.

Time (mins)	Group A	Group B	Group A		Group B	
0	74.53 ±5.917	79.07 ±9.048	Mean Diff	PValue	Mean Diff	P Value
2	74.70 ±6.143	78.87 ±8.464	-.167	1.000	0.200	1.000
4	74.90 ±6.002	80.40 ±9.103	-.367	1.000	-1.333	1.000
6	76.20 ±6.651	80.80 ±8.923	-1.667	0.237	-1.733	1.000
8	76.47 ±7.099	82.27 ±8.878	-1.933	0.879	-3.200	0.026
10	76.20 ±7.739	81.00 ±8.449	-1.667	1.000	-1.933	1.000
15	76.53 ±7.995	80.13 ±8.788	-2.000	1.000	-1.067	1.000
30	77.80 ±8.540	81.33 ±8.841	-3.267	0.149	-2.267	0.696
45	77.87 ±8.253	81.67 ±9.038	-3.333	0.192	-2.600	0.118
60	76.80±8.130	82.20±8.588	-2.267	1.000	-3.133	0.026
120	76.30±7.544	83.33±8.409	-1.767	1.000	-4.267	0.001
180	75.93±7.817	83.13±8.165	-1.400	1.000	-4.067	0.002
0	96.87±3.702	95.73±5.866	-	-	-	-
2	97.00±4.807	95.93±5.813	0.358	1.000	-.200	1.000
4	98.20±4.649	96.40±4.910	0.432	0.294	-.667	1.000
6	98.80±5.423	97.27±5.078	0.603	0.214	-1.533	1.000
8	98.40±5.157	96.87±5.138	0.641	1.000	-1.133	1.000
10	98.07±4.683	96.80±4.254	0.611	1.000	-1.067	1.000
15	98.53±4.424	97.80±3.537	0.705	1.000	-2.067	1.000
30	98.73±4.085	97.60±3.654	0.691	0.754	-1.867	1.000
45	98.40±3.379	97.00±2.959	0.696	1.000	-1.267	1.000
60	98.40±4.561	97.53±3.267	0.728	1.000	-1.800	1.000
120	98.40±3.729	97.47±3.014	0.689	1.000	-1.733	1.000
180	98.87±3.848	97.60±3.420	0.650	0.301	-1.867	1.000

Table-4: Heart rate and mean arterial pressure from the baseline in groups.

patients in the age group of 50 – 60 and 60 – 70 years With 13 and 16 patients respectively. In Group A, the mean age was 63.33 years and in Group B 61.07 years, hence there was no significant Difference in age distribution between two groups.

As shown in the table, there were no significant differences in the distribution of age, gender and weight between the two study groups. Of the 60 patients in this study, 19(63.3%) in group A were females and 11(36.7%) were males and in group B 17(56.7%) were females and 13(43.3%) were males. thus with a p value of 0.598, the gender distribution among the two groups was not significant.

In group A, at 2 min 23(76.7%), at 4 min 29(96.7%) and at 6 min 30(100%) patients had eyelid akinesia score of grade 0. At 2 min, only 4(13.3%) patients had grade 2 and by 4 min no patients were having eyelid akinesia score of grade 2.At 45 min, grade 1 score was present in 23(76.7%) patients and by 60 min, 25(83.3%) patients had eyelid akinesia score of grade 2. Values are in percentage of patients Whereas, In group B, at 6 min, still 27(90%) patients had grade 2 and at 10 min, 30(100%) had grade 0 eyelid akinesia score. At 60 min, only 3(10%) patients had grade 1 and 120 min, still 25(83.3%) patients had grade 1 score.

Table 3 shows values are in percentage of patients.

In group A, 20(66.7%) patients had global akinesia score of grade 0 at 2 min, 29(96.7%) had grade 1 at 4min and 30(100%) patients, grade 2 at 6 min. At 4min, only 1(3.3%) had grade 1 and at 45min, 18(60%) patients had grade 1 score. By 60 min, only 1(3.3%) patient had grade 0 score of global akinesia. Values are in percentage of patients In contrast to group A, in group B, at 4 min, still all (100%) patients had global akinesia score of grade 2. At 8 min, only 5(16.7%) had grade 0. At 60 min, still 28(93.3%) patients had grade 0 of global akinesia score, and only at 120 min, 28(93.3%) patients attained grade 1 score. The time required to attain a global akinesia score of grade 0 was as follows; For group A, the minimum time required was 2 min and maximum of 6 min with average 2.77 min.

For group B, the minimum time was 6 min and maximum of 15 min with average 10.77 min**.** The difference between two groups was statistically significant with a p value of 0.00.

Mean difference from baseline p value was <0.05 and it was significant. There was no significant decrease in the heart rate in group A. However, group B showed a significant decrease in the heart rate from baseline values at 8, 60, 120 and 180 mins. However, bradycardia was not seen in either group A or group B.

This increase in intraocular pressure was highly Significant in group B when compared to group A. Both in group A and group B, ECG rhythm changes were absent in all patients during the course of the study. While comparing the time to recovery, the observations were as follows; In group A, the minimum time to recovery was 45 min and a maximum of 60 min. on an average, the patients in group A recovered from peribulbar block in 51 min. In contrast to group A, the patients in group B required an average of 116 min to recover from block. This difference was statistically highly significant with a p value 0.00.

DISCUSSION

Anesthesia plays a vital role in ophthalmic surgeries. Most cataract surgeries are done under peribulbar anesthesia. The aim of anesthesia in cataract surgery is to provide adequate analgesia and akinesia and it should be safe without any untoward side effects. The peribulbar technique has gained much popularity when compared to retrobulbar technique. Peribulbar anesthesia has an added advantage of causing hypotony of the globe due to the loss of extraocular muscle tone. The most recently introduced local anesthetic, ropivacaine, possesses properties similar to those of bupivacaine but is less neurotoxic and cardiotoxic. Ropivacaine has not yet been compared with the commonly used anesthetic mixtures for ophthalmologic surgery. Peribulbar anesthesia with two point injection technique was in frequent use in our institution Bupivacaine alone might seem more appropriate, however the lidocaine-bupivacaine mixture is currently used in our institution as combining lidocaine's faster onset of action and long postoperative pain relief of bupivacaine are more beneficial. So we compared the effects of two local anesthetics, bupivacaine and ropivacaine, each administered with lidocaine, on the quality of the block obtained after peribulbar anesthesia. A visual analog scale could not be used to assess Pain in this patient population because of their poor vision. The two groups in our study were comparable with respect to age, gender and weight distribution.

Onset and Recovery: Our study showed that in ropivacaine group, 20 patients (66.7%) had a global akinesia score of grade 0 at 2 min and all had a score of grade 0 by 6 min, as compared to the study by Huha et al[5], who reported more rapid development of akinesia with ropivacaine than bupivacaine at 2 min, this difference may be because they used a higher concentration of ropivacaine (1%). As per our observations, the average time of onset was 2.77 min in ropivacaine group and 10.77 min in bupivacaine group. This is in accordance with a study done by Nociti et al[6], who reported that Percentage of patients showing successful block was higher in ropivacaine group at 1 and 5 min intervals after the injection than bupivacaine group and at 10 min, all patients in both groups had successful peribulbar anesthesia. Thus showing that ropivacaine has a faster onset of action than bupivacaine. Results - The median time at which the block was adequate to start surgery was 8 minutes for each group. Median ocular movement scores were similar in both groups at all times. Ropivacaine produced decreased eyelid movement scores at 2 (P = .047), 6 (P = .038), and 8 minutes (P = .016). No differences were observed between the groups in the incidence of minor complications or of pain during insertion of the block. Seven patients in the ropivacaine group and 12 patients in the bupivacaine group required supplementary anesthesia. In contrast to our observations, Gioia et al[7] did a study for vitreoretinal Surgeries under peribulbar anesthesia and reported that surgical block was achieved after 8±5 min in the lidocaine-bupivacaine group as compared to 10±5 min in the ropivacaine group (without lidocaine) and concluded that ropivacaine has an onset similar to that of lidocaine-bupivacaine mixture. Although a higher concentration of ropivacaine (0.75%) was used in this study, the similar onset may be due to the confounding factor lidocaine which was added only with bupivacaine but not with ropivacaine. This is further strengthened by Perello et al[8] who showed a slower onset of akinesia using ropivacaine alone while comparing with ropivacaine plus lidocaine and bupivacaine plus lidocaine. In our study, the time to recovery from peribulbar anesthesia was 51 min in ropivacaine group and 116 min in bupivacaine group, whereas Huha etal[5] showed no difference in duration o f action between ropivacaine and bupivacaine. However, Simpson et al[9] used ropivacaine for regional Anesthesia and acute pain management and observed that ropivacaine has lower incidence of motor block than bupivacaine which is an advantage for postoperative and labour pain. This shorter duration of action and early motor recovery from ropivacaine may be particularly useful in cataract surgeries which are most commonly performed as outpatient surgeries, thus allowing early and safe discharge of the patient from hospital and also prolonged paralysis leaves the eye vulnerable to drying and trauma.

Cardiovascular effects: In a study by Luchetti et al[10], cardiac arrhythmias were more frequent in bupivacaine-mepivacaine group than ropivacaine group. Minor cardiac arrhythmias (ectopic beats) were observed in 22 patients (2.2%) with ropivacaine and 80 patients (8%) with bupivacaine-mepivacaine. Scott et al[11] studied effects of intravenous infusion of ropivacaine and bupivacaine both at a rate of 10 mg/min, although both groups showed an evidence of depression of conductivity and contractility, these appeared at lower dosage and lower plasma concentrations with bupivacaine than ropivacaine. Knudsen et al[12] also conducted similar study by intravenous infusion of ropivacaine and bupivacaine both at a rate of 10 mg/min, and recorded that bupivacaine increased QRS width during sinus rhythm compared to placebo and ropivacaine. Bupivacaine reduced both left ventricular systolic and diastolic function, while ropivacaine reduced only systolic function. Although literature suggests better cardiac profile for ropivacaine than bupivacaine, majority of those studies are either through direct intravenous infusion of drugs or conducted in animals which cannot be extrapolated for regional anesthesia and in humans respectively. While comparing the cardiovascular toxicity in our study there was no significant change in heart rate from baseline values in ropivacaine group whereas bupivacaine group showed a significant decrease in heart rate from baseline values at 8, 60, 120 and 180 mins. But this decrease was only relative and bradycardia was not observed in any patient included in our study. The changes in mean arterial pressure from baseline value were not significant in both the groups and there were no ECG rhythm changes in any patient during the course of our study. This is supported by McLure et al[13] who found no difference in the frequency of adverse cardiac effects between ropivacaine group and the

lidocaine and bupivacaine group. Fujita et al[16], in an animal study, reported that lidocaine attenuates any conduction abnormality induced by bupivacaine. However,in this study no direct comparisons with ropivacaine or bupivacaine were made, nor are there any reports in humans of this interesting effect. Thus, we concluded that both ropivacaine and bupivacaine does not produce cardiovascular toxicity when administered for peribulbar anesthesia. However, irrespective of the wider safety margin compared with other local anaesthetics, there are reports of toxic reactions with ropivacaine and care must still be taken with the administration of any highly concentrated local anaesthetia.

Intraocular pressure: The study done by Nocitti et al[6] showed that mean IOP (mm Hg) was 13.4±3.2 in ropivacaine group when compared to 20.8±4.7 in bupivacaine group, this effect is probably explained by vasoconstriction produced by ropivacaine leading to smaller intraocular blood volume. We observed a significant increase of mean IOP (mm Hg) in bupivacaine group from 13.33 to 21.63 whereas in ropivacaine group it increased from 12.77 to 13.00 after peribulbar anesthesia. Ozcan et al[14] observed that bupivacaine-lidocaine combination increased IOP from 15.1±2.5 to 17.8±2.5 after the peribulbar anesthesia, whereas ropivacaine decreased IOP from 15.8±2.3 to 13.5±2.3. This increase in IOP by bupivacaine- lidocaine mixture may be due to vasodilation caused by lidocaine. But, this confounding factor was absent in our study, as lidocaine was used in both groups. This effect Of lidocaine may have resulted in absence of any fall in IOP with ropivacaine In our study. Even though there was rise in IOP with ropivacaine, it was significantly lower when compared to that of bupivacaine group. In contrast to our study, Olmez et al[15] observed, while comparing ropivacaine alone with lidocaine with adrenaline, that although the IOP level of the ropivacaine group at 10min was significantly lower with respect to baseline level, there were no significant differences in the IOP levels between the two groups. This further explains that ropivacaine has vasoconstrictive property, as adrenaline causes vasoconstriction leading to similarity between the two groups. This is also supported by Goveia et al[17], who observed that the mean IOP level in bupivacaine group before the blockade was 13.28±2.35 mmHg, while in the ropivacaine group it was 13.1±2.26 mmHg. Five minutes after the peribulbar anesthesia, the IOP in bupivacaine group increased to 15.62±4.31 mm Hg and it reduced to 12.98±2.71 mm Hg in ropivacaine group. They attributed this difference to vasoconstrictive effect of ropivacaine.

CONCLUSION

This study showed that the combination of ropivacaine with lidocaine results in earlier onset, shorter duration and lesser intraocular pressure changes than bupivacaine with lidocaine and cardiovascular toxicity is not seen with either ropivacaine or bupivacaine when used in peribulbar anesthesia for cataract surgery. Hence, we concluded that ropivacaine is a superior alternative to bupivacaine for peribulbar anesthesia in patients posted for cataract surgeries due to its better efficacy without any cardiovascular toxicity.

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