

Effect of the addition of rocuronium to 2% lignocaine in peribulbar block for cataract surgery

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Abstract

Background and Aims: Peribulbar anesthesia is associated with delayed orbital akinesia compared with retrobulbar anesthesia. To test the hypothesis that rocuronium added to a mixture of local anesthetics (LAs) could improve speed of onset of akinesia in peribulbar block (PB), we designed this study. This study examined the effects of adding rocuronium 5 mg to 2% lignocaine with adrenaline to note orbital and eyelid akinesia in patients undergoing cataract surgery.

Material and Methods: In a prospective, randomized, double-blind study, 100 patients were equally randomized to receive a mixture of 0.5 ml normal saline, 6 ml lidocaine 2% with adrenaline and hyaluronidase 50 IU/ml (Group I), a mixture of rocuronium 0.5 ml (5 mg), 6 ml lidocaine 2% with adrenaline and hyaluronidase 50 IU/ml (Group II). Orbital akinesia was assessed on a 0–8 score (0 = no movement, 8 = normal) at 2 min intervals for 10 min. Time to adequate anesthesia was also recorded. Results are presented as mean \pm standard deviation.

Results: Rocuronium group demonstrated significantly better akinesia scores than control group at 2 min intervals post-PB (significant *P* value obtained). No significant complications were recorded. Rocuronium added to a mixture of LA improved the quality of akinesia in PB and reduced the need for supplementary injections.

Conclusion: The addition of rocuronium 5 mg to a mixture of lidocaine 2% with adrenaline and hyaluronidase 50 IU/ml shortened the onset time of peribulbar anesthesia in patients undergoing cataract surgery without causing adverse effects.

Keywords: Local anesthetics, neuromuscular blockade, peribulbar block, regional anesthesia, rocuronium

Introduction

Peribulbar anesthesia is mainly used for cataract surgery. This technique is associated with fewer serious complications compared with retrobulbar anesthesia.^[1] However, it has the disadvantage of a slow onset of orbital akinesia^[2] and the frequent need for block supplementation. To overcome these limitations, many adjuvant drugs^[3-5] such as adrenaline, sodium bicarbonate, and hyaluronidase

are also added to the local anesthetic (LA) mixture for peribulbar block (PB) to hasten its speed of onset; however, their effects have been variable. Neuromuscular blocking drugs, such as vecuronium^[6] and atracurium,^[7] have also been added to the LA mixture and have been shown to improve the quality of peribulbar anesthesia. Atracurium has histamine-releasing property resulting in undesirable local hyperemia. Rocuronium, on the other hand, is devoid of this adverse effect, it is having faster onset of action, and good quality of peribulbar anesthesia (onset time and requirement of supplemental injection with lower concentration of LAs)

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Access this article online

Quick Response Code:



Website:
www.joacp.org

DOI:
10.4103/joacp.JOACP_383_16

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How to cite this article: Patil V, Farooqy A, Chaluvadi BT, Rajashekhar V, Malshetty A. Effect of the addition of rocuronium to 2% lignocaine in peribulbar block for cataract surgery. *J Anaesthesiol Clin Pharmacol* 2017;33:520-3.

has not been fully explored. We hypothesized that the addition of low-dose rocuronium to the LA mixture would reduce block onset time and requirement for supplemental LA and would also reduce the concentration of LA required for adequate block, which in turn would reduce the inherent risk of LA toxicity.

Material and Methods

After obtaining the Institutional Ethical Committee clearance, informed consent to participate in this randomized double-blind study was obtained from 100 American Society of Anesthesiologists' (ASA) physical Class I–II patients scheduled for elective cataract surgery under peribulbar anesthesia.

Exclusion criteria included history of allergy to LA, orbital anomalies and coagulation abnormalities.

Using a computer-generated randomization schedule, patients were randomly allocated to one of two study groups. Group I received peribulbar anesthesia using a mixture of 0.5 ml normal saline, 6 ml lidocaine 2% with adrenaline, and hyaluronidase 50 IU/ml. Group II received a mixture of rocuronium 0.5 ml (5 mg), 6 ml lidocaine 2% with adrenaline, and hyaluronidase 50 IU/ml. All physicians, patients, nursing staff, and data collector were blinded to the patient group assignment.

Before the performance of the block, a blinded observer evaluated the patient's eyelid and ocular movement. Standard monitors were attached; oxygen was administered at 4 L/min via nasal prongs. Peribulbar anesthesia was performed, as described by Fry and Henderson,^[8] by the same anesthesiologist who was blinded to the LA drug used, without sedation. In brief, a 27-gauge, 12-mm needle was used to inject 0.5 ml of lidocaine 2% through the conjunctiva, infratemporally just posterior to the inferior tarsal plate to anesthetize the conjunctiva. After 15 s, an infratemporal transconjunctival injection of the study drug (3.0 ml) using a 25-gauge, 25-mm needle was performed followed by gentle massage for 30 s to facilitate the spread of the LA mixture.

A second injection of the study drug (3.0 ml) was given medial to the lacrimal caruncle. Injection of the required volume of the study drug was stopped when fullness of the orbit or drooping of the upper eyelid. Corneal anesthesia was evaluated using a small cotton wool at time interval of 2 min. To assess ocular akinesia, patients were asked to look lateral, medial, superior, and inferior. Ocular movement in each direction was scored as 2 if it was normal, 1 if it was limited, and 0 if there was no directional movement (total score 0–8).^[9] The patient was then asked to forcefully close his/her eyes to assess the orbicularis muscle on a scale of 0–2 (0 = complete akinesia, 1 = partial movement, and 2 = pronounced movement).^[3]

If adequate condition to begin surgery was not obtained 10 min after performing the block, supplemental injection with 2 ml of 2% lidocaine given inferotemporally or medially was administered based on the assessment and the subjects were not included in the study. Two patients in Group I and one patient in Group II were excluded from the study. At the end of surgery, all patients were asked to tell their intraoperative pain using a visual analog scale (VAS) with two points: 0 being no pain and 10 being the worst imaginable pain. All adverse events including the presence of diplopia and/or ptosis were recorded. None of the patients developed diplopia and ptosis.

Statistical analysis

Descriptive statistics such as mean, standard deviation, and percentage was used. Comparison of categorical data was done by Chi-square test, and for continuous data, unpaired “*t*” was used. $P < 0.05$ was considered statistically significant. VAS score was 2.2 ± 1.3 for Group I and 2.2 ± 1.9 for Group II. Data analysis was done using software SPSS version 16.0.IBM SSPS Software USA.

Results

Patients who met the inclusion criteria were randomized in equal numbers to two study groups, were analyzed in their respective group, and had no protocol violations. Baseline

Table 1: Comparison of age, weight, and heart rate between Group I and Group II

Characteristics	Group I	Group II	Mean difference	95% of difference	<i>t</i>	<i>P</i>
Age	59.0±9.3	53.9±10.9	5.1	1.06-9.09	2.51	0.01
Weight	52.6±6.2	53.2±8.7	0.52	-2.46-3.50	0.35	0.73
Heart rate						
Preoperative	74.7±8.8	81.2±8.8	6.46	2.96-9.96	3.67	0.0004
After drug	75.9±10.3	83.8±6.7	7.82	4.36-11.27	4.5	<0.0001
Intraoperative	73.6±6.9	84.7±6.6	11.12	8.45-13.79	8.27	<0.0001
Postoperative	74.7±7.8	84.2±7.8	9.44	6.34-12.54	6.05	<0.0001

characteristics were similar among the two study groups [Table 1], gender, operative eye, ASA status, heart rate and respiratory rate were comparable in both the groups [Table 2-5]. At 2 min after PB, ocular movement score and eyelid squeezing score [Tables 6 and 7] were both lower in Groups II compared with Group I ($P < 0.01$ for F -test of between-subjects effects); however, both the scores decreased during the assessment period in both the study groups ($P < 0.01$ for F -test of within-subjects effects). Time to adequate condition to begin surgery was significantly shorter in Group II compared with Group I (significant P value obtained) [Tables 8-11].

Discussion

This randomized double-blinded study showed that addition of a low-dose rocuronium to 2% lignocaine with adrenaline provided adequate peribulbar anesthesia and decreased the onset time in patients undergoing cataract surgery. Most of the cases who received a mixture of rocuronium 5 mg with 2% lignocaine with adrenaline achieved orbital akinesia and adequate condition to begin surgery by the end of 2 min as compared to 4 min in the cases received plain lignocaine 2% with adrenaline, saving 2 min in Group II. LA solutions were frequently combined with numerous adjuvants to enhance the quality of PB.^[10-12] Neuromuscular

blockers were used as adjuvants to LA in two trials.^[7] Reah *et al.* added a dose of 0.5 mg of vecuronium to a mixture of bupivacaine-lidocaine with 15 UI/ml of hyaluronidase; the sensitivity of the extraocular muscle fibers is more to the effect of neuromuscular muscle blockers as the muscle fibers innervated by single motor neuron are of smaller size.^[6] They found that vecuronium improves the quality of globe and lid akinesia without side effects. Alkalinized (pH-6.8) 0.75% bupivacaine is recommended for regional ophthalmic anesthesia with satisfactory globe akinesia and lid akinesia.^[3] pH adjustment (pH-6.8 \pm 0.1) of solution of bupivacaine and hyaluronidase with sodium bicarbonate hastens the onset time and improves the initial success rate of PB.^[4] Aissaoui *et al.*^[13] have reported that the addition of rocuronium 0.06 mg/kg of the LA mixture of 2% lidocaine and 0.5% bupivacaine improves the akinesia scores. The current study differed from that of Aissaoui *et al.* using a fixed low dose of rocuronium as opposed to a variable dose based on body weight. The addition of neuromuscular blockers to LA does not affect analgesia, but because of their effect on motor nerves, they induce akinesia in extraocular muscles and optimize the setting for ophthalmic surgeries. The exact mechanism through which the local administration of a nondepolarizing muscle relaxant improves orbital and eyelid akinesia is not known but may be due to local effects at the muscle motor end-plate. Hyaluronidase in concentrations of 300 and 50 IU/ml also improved the quality of the block at 5 min compared with the control, reducing the need for adjuvant injection.^[14] There is no change observed in heart rate and respiratory rate with the addition of rocuronium with 2% lignocaine and adrenaline; hence, this study has shown that rocuronium can be used for of akinesia without any side effects. The majority of patients have shown akinesia of globe at 2 min with rocuronium mixture, rather than when measured at intervals after 4 min or later where orbital akinesia has been achieved in both the groups. Therefore, rocuronium has shown to cause faster onset of condition wherein surgery can be begun.

Limitations of the study

The patients bypassed the postanesthesia care unit and were directed to day care unit for discharge; hence, the time to complete recovery of eyelid akinesia and orbital akinesia was not assessed in this study.

Table 2: Comparison of gender between Group I and Group II

Gender	Group I (%)	Group II (%)	χ^2	P
Male	19 (38)	22 (44)	0.16	0.68
Female	31 (62)	28 (56)		

Table 3: Comparison of operative eye between Group I and Group II

SITE	Group I (%)	Group II (%)	χ^2	P
Left	18 (36)	13 (26)	0.75	0.39
Right	32 (64)	37 (74)		

Table 4: Comparison of the American Society of Anesthesiologists status between Group I and Group II

ASA Status	Group I (%)	Group II (%)	χ^2	P
ASA I	37 (74)	33 (66)	0.43	0.51
ASA II	13 (26)	17 (34)		

ASA=American Society of Anesthesiologists

Table 5: Comparison of respiratory rate between Group I and Group II

Timing	Group I	Group II	Mean difference	95% of difference	t	P
Preoperative	12.7 \pm 1.8	12.96 \pm 1.9	0.24	-0.49-0.97	0.65	0.52
After drug	13.0 \pm 1.8	13.2 \pm 1.7	0.22	-0.46-0.91	0.63	0.53
Intraoperative	12.9 \pm 1.8	13.1 \pm 2.0	0.18	-0.57-0.93	0.48	0.63
Postoperative	12.98 \pm 1.8	13.1 \pm 1.8	0.14	-0.56-0.85	0.39	0.69

Table 6: Comparison of eyelid movement (0 grade) between Group I and Group II

Time Interval	Group I (%)	Group II (%)	χ^2	P
2 min	40 (80)	48 (96)	4.64	0.03
4 min	50 (100)	50 (100)	0.0	1.0
6 min	50 (100)	50 (100)	0.0	1.0
8 min	50 (100)	50 (100)	0.0	1.0

Table 7: Comparison of present for corneal sensation between Group I and Group II

Time Interval	Group I (%)	Group II (%)	χ^2	P
2 min	10 (20)	2 (4)	4.64	0.03
4 min	0	0	0.0	1.0
6 min	0	0	0.0	1.0
8 min	0	0	0.0	1.0

Table 8: Ocular movement of superior between Group I and Group II

Superior (min)	Group I (%)			Group II (%)		
	0 grade	1 grade	2 grade	0 grade	1 grade	2 grade
2	0	8 (16)	42 (84)	27 (54)	20 (40)	3 (6)
4	20 (40)	30 (60)	0	50 (100)	0	0
6	42 (84)	8 (16)	0	50 (100)	0	0
8	50 (100)	0	0	50 (100)	0	0

Table 9: Ocular movement of inferior between Group I and Group II

Inferior (min)	Group I (%)			Group II (%)		
	0 grade	1 grade	2 grade	0 grade	1 grade	2 grade
2	0	9 (18)	41 (82)	35 (70)	14 (28)	1 (2)
4	9 (18)	41 (82)	0	50 (100)	0	0
6	43 (86)	7 (14)	0	50 (100)	0	0
8	50 (100)	0	0	50 (100)	0	0

Table 10: Ocular movement of medial between Group I and Group II

Medial (min)	Group I (%)			Group II (%)		
	0 grade	1 grade	2 grade	0 grade	1 grade	2 grade
2	0	9 (18)	41 (82)	27 (54)	14 (28)	9 (18)
4	4 (8)	46 (92)	0	50 (100)	0	0
6	39 (78)	11 (22)	0	50 (100)	0	0
8	50 (100)	0	0	50 (100)	0	0

Table 11: Ocular movement of lateral between Group I and Group II

Lateral (min)	Group I (%)			Group II (%)		
	0 grade	1 grade	2 grade	0 grade	1 grade	2 grade
2	0	9 (18)	41 (82)	24 (48)	15 (30)	11 (22)
4	30 (60)	19 (38)	1 (2)	50 (100)	0	0
6	50 (100)	0	0	50 (100)	0	0
8	50 (100)	0	0	50 (100)	0	0

Conclusion

The addition of rocuronium 5 mg to 2% lignocaine with adrenaline shortened the onset time of peribulbar anesthesia in patients undergoing cataract surgery without causing adverse effects.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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