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Comparison of 0.5% levobupivacaine, 0.5% bupivacaine, and 2% lidocaine for retrobulbar anesthesia in vitreoretinal surgery

RECEP AKSU[1], CIHANGIR BİCER[1], ABDULLAH OZKIRIS[2], AYNUR AKIN[1], ADNAN BAYRAM[1], ADEM BOYACI[1]

[1]Department of Anesthesiology
[2]Department of Ophthalmology, Erciyes University School of Medicine, Kayseri - Turkey

PURPOSE. *The authors compared the efficacy of local anesthetics levobupivacaine, bupivacaine, and lidocaine for retrobulbar anesthesia in vitreoretinal surgery.*
METHODS. *A total of 135 patients presenting for vitreoretinal surgery under local anesthesia were included in the study. Patients were randomly allocated to one of three groups. Group LB patients received 5 mL of 0.5% levobupivacaine, Group L patients received 5 mL of 2% lidocaine, and Group B patients received 5 mL of 0.5% bupivacaine for retrobulbar anesthesia via inferotemporal injection. Sensory and motor block durations were recorded. Intraoperative and postoperative pain was assessed by using verbal pain scala. Anesthesia efficiency, patient and surgeon satisfaction, and akinesia were assessed by using point scales. Hemodynamic data and adverse events were recorded.*
RESULTS. *The demographic characteristics of patients, duration of surgery, and hemodynamic data in both groups were similar. The duration of motor and sensory block was longer in levobupivacaine and bupivacaine groups than lidocaine group. Pain on injection was found more frequent in Group L and Group B than Group LB and the difference between the Groups LB and B was significant ($p<0.05$). Surgeon and patient satisfaction were also higher and intraoperative pain was less in levobupivacaine group than lidocaine and bupivacaine groups.*
CONCLUSIONS. *Levobupivacaine provides longer motor and sensory block duration and higher surgeon and patient satisfaction than lidocaine and bupivacaine when used for retrobulbar anesthesia in vitreoretinal surgery. (Eur J Ophthalmol 2009; 19: 280-4)*

KEY WORDS. *Levobupivacaine, Lidocaine, Bupivacaine, Retrobulbar anesthesia, Vitrectomy*

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INTRODUCTION

In ophthalmic surgery, local anesthesia has become the preferred option over general anesthesia because of quicker patient rehabilitation and the avoidance of possible complications from general anesthesia (1, 2). The characteristics of patients for vitreoretinal surgery, most of them elderly and with associated diseases like diabetes mellitus and cardiac problems, make local anesthesia advisable in order to reduce risks and morbidity.
Local anesthetics with long duration, rapid onset, and minimal side effects especially on cardiac and central nervous system have been popular in regional ophthalmic anesthesia. Lidocaine is an amide local anesthetic with short duration. Bupivacaine is a long-acting local anesthetic drug which has narrower therapeutic index and is associated with potential cardiac and central nervous system toxicity (3, 4). Levobupivacaine, the isolated S(-) stereoisomer of the racemic mixture bupivacaine, is also a long-acting amino-amide local anesthetic drug. Preclinical studies, from studies with volunteers to animal models, have demonstrated that levobupivacaine is significantly

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less toxic to central nervous system and cardiotoxic than bupivacaine (5, 6).

In this study, we aimed to compare the anesthetic efficacy of 0.5% levobupivacaine with 2% lidocaine and 0.5% bupivacaine for retrobulbar anesthetic block in patients undergoing primary vitreoretinal surgery. To our knowledge, this is the first reported study to evaluate the efficacy of 0.5% levobupivacaine for retrobulbar block in vitreoretinal surgery.

METHODS

All procedures were performed at Erciyes University Medical Faculty, Gevher Nesibe Hospital, Ophthalmology Department, and the local Ethics Committee of Erciyes University Medical Faculty approved the study. Informed written consent was obtained from all patients. A total of 135 American Society of Anesthesiologists (ASA) physical status I–III patients scheduled for vitreoretinal surgery were included in the study. Patients did not fast and did not receive any premedication or sedation.

Patients allergic to local anesthetic solutions; with any signs of local infection, congenital or acquired coagulation deficits, or orbital abnormalities; who had neurologic or psychiatric disorders; or who refused the anesthetic technique were not included. Before surgery, all patients were examined and routine laboratory investigations were performed. Standard monitoring of pulse oximetry, electrocardiography, heart rate, and noninvasive arterial blood pressure were commenced and an intravenous (IV) canula was placed. The topical anesthesia of conjunctiva was achieved by administering 2–3 drops of tetracaine 1%. Patients were randomly allocated to one of the three groups. The same anesthetist performed all retrobulbar blocks and all surgery was performed by the same surgeon who was blinded to the anesthetic used. Retrobulbar anesthesia was achieved by a standard percutaneous inferotemporal approach by using a 31-mm, 27-gauge needle (PrecisionGlide; Becton Dickinson, Franklin Lakes, NJ). In Group LB (n=45) retrobulbar block was performed with 5 mL of levobupivacaine 0.5% (5 mg/mL), in Group L (n=45) it was performed with 5 mL of lidocaine 2% (20 mg/mL), and in Group B (n=45) it was performed with 5 mL of bupivacaine 0.5% (5 mg/mL). Patients who had pain during the injection were recorded. At the end of the procedure, 30–50 mmHg of pressure was applied to the eye for 5 min and removed every 1 min to see the eye movements and measure the motor block onset time. It was assumed that, once motor block had been achieved, adequate sensory block was already present as this usually precedes motor block. The degree of motor block was assessed by using the akinesia scoring system in Table I. Ocular globe motility was evaluated in the four quadrants using a three-point scoring system. Total akinesia score of 4 or less was deemed suitable for surgery. If inadequate motor blockade of one or more components of ocular motion was observed 10 min after block placement, a further 3 mL of the studied anesthetic solution was injected in the involved quadrant and additional assessments were then performed 5 min later. The following parameters were evaluated: motor block onset time and akinesia score. To the patients who had pain during the operation, three drops of tetracaine 1% were administered. During the operation, oxygen was administered to the patients under the sterile drapes.

Postoperative analgesia was assessed in the postoperative period as the patients' sensation of pain by using a visual analog scale (VAS) ranging from 0 to 10 (0 = no pain, 10 = the worst pain possible). VAS score of 4 or more was deemed to have pain. The duration of surgery, motor block duration, and sensory block duration were noted.

The satisfaction of both patients and surgeon was assessed by using a three-point scale: 0 = not satisfied, 1 = moderately satisfied, 2 = satisfied. Noninvasive systolic and diastolic arterial blood pressures and heart rate were recorded at baseline, 5 min after local anesthetic injection, 5 min after the beginning of the operation, 15. min intraoperatively, and after the operation. Patients were seen the next day by the anesthetist who performed and assessed the blocks and residual akinesia was scored

TABLE I - SCORING SYSTEM FOR DEGREE OF AKINESIA

Ocular movements	
Full movement	3
Moderate movement	2
Quivering	1
No movement	0
Eyelid movement	
Full movement	2
Quivering	1
No movement	0

with the same system used before surgery and any postoperative symptoms noted.

Statistical analysis was performed using the program SPSS for Windows version 15.0 (SPSS Inc., Chicago, IL, USA). Parametric data were analyzed with analysis of variance test and the differences were further analyzed by Bonferroni test. Nonparametric data were analyzed with chi-square test. Results were considered significant if p was <0.05.

RESULTS

There were no differences between the groups with respect to patient characteristics, ASA physical status, and duration of surgery (p>0.05) (Tab. II). Hemodynamic values such as noninvasive systolic and diastolic arterial blood pressures and heart rate showed no statistically significant inter- or intragroup differences during the entire study period (p>0.05). Statistical analysis of the motor block onset times showed no significant difference between the two groups (p>0.05) (Tab. III). The akinesia scores (10 min after block) of Group LB and Group B were similar, but akinesia score of Group L was significantly higher than the other two groups (p<0.05) (Tab. III). The number of patients who had supplementary block for adequate analgesia before the operation was similar among the three groups (one patient in Group LB, four patients in Group B, six patients in Group L). Significant difference among the groups LB, B, and L was found regarding the motor block durations and sensorial block duration (p<0.05) (Tab. III). Pain on injection was more frequent in Group L (6 patients) and Group B (14 patients) than Group LB (2 patients). The difference between the groups LB and B was significant (p<0.05) (Tab. IV). The number of patients who had pain during the operation was less in Group LB (5 patients) compared with Group L (16 patients) and Group B (19 patients) (p<0.05) (Tab. IV). The postoperative analgesia necessity was significantly high in Group L (15 patients) compared with Group B (6 patients) and Group LB (no patients) (p<0.05) (Tab. IV). There was better satisfaction in patients and surgeon in Group LB compared to Groups L and B, and this was statistically significant (p<0.05) (Tab. IV). No postoperative complication was noted in any of the groups.

TABLE II - DEMOGRAPHIC DATA AND DURATION OF SURGERY

	Group LB (n=45) (mean ± SD)	**Group L (n=45) (mean ± SD)**	**Group B (n=45) (mean ± SD)**
Age, y	57.1 ± 53	55.5 ± 51	55 ± 51
Height, cm	164.8 ± 162	164.2 ± 162	164.1 ± 162
Weight, kg	70.3 ± 67	72.4 ± 68	68.7 ± 65
Male/female	23/22	25/20	21/24
Duration of surgery, min	42 ± 36	43.6 ± 37	39.6 ± 35
ASA physical status I/II/III, n	9/27/9	6/32/7	4/39/2

Level of significance p<0.05.

TABLE III - MOTOR BLOCK ONSET TIME, MOTOR AND SENSORIAL BLOCK DURATIONS, AKINESIA SCORE

	Group LB (n=45) (mean ± SD)	**Group L (n=45) (mean ± SD)**	**Group B (n=45) (mean ± SD)**
Motor block onset time, min	2.16 ± 1.19	2.04 ± 1.12	2.32 ± 1.34
Motor block duration, min	336.3 ± 309	219.5 ± 197*	375.8 ± 352
Sensorial block duration, min	251.1 ± 132	136.4 ± 64*	253.4 ± 123
Akinesia score 10 min after block, median (min–max)	0 (0–2)	1 (0–3)*	0 (0–1)

*Comparison of Groups LB and B (p<0.05) was statistically significant.

DISCUSSION

In our study, adequate motor and sensory block was achieved for vitreoretinal surgery with all of the study drugs but 0.5% levobupivacaine provides good hemodynamic stability, better patient and surgeon satisfaction, and less intraoperative pain than 0.5% bupivacaine and 2% lidocaine.

The characteristics of patients for vitreoretinal surgery, most of them elderly and with associated diseases, made local anesthesia advisable. Techniques like retrobulbar block and peribulbar block are used for local anesthesia. It is reported that conjunctival edema, a greater increase in orbital pressure, and high systemic toxicity risk is often seen after the peribulbar block. Also, a larger volume of anesthetic solution and more anesthesia support (54%) is required (7, 8). However, rapid anesthesia and akinesia are achieved with low anesthetic volume in retrobulbar block (7). We also performed retrobulbar block to achieve rapid and effective anesthesia with low anesthetic volume in our study. But retrobulbar block also has serious complications. Nicoll et al (9) reported that 16 patients developed signs and symptoms presumed to be caused by the direct spread of the local anesthetic agents to the central nervous system in 6000 patients in whom retrobulbar anesthesia was performed. Teichmann and Uthoff (10) reported postoperative ischemic neuropathy in one patient in 13,000 in whom retrobulbar anesthesia was performed by curved needle technique. No complications like perforation, retrobulbar hematoma, anesthesia of brainstem, or chemosis were noted in our study.

In a study that compared 2% lidocaine and 0.75% levobupivacaine, researchers found that the onset times to an akinesia score of 4 were shorter in lidocaine-treated group than levobupivacaine-treated group, although the akinesia scores at the end of the surgery were similar (11). Di Donato et al (12) compared 0.5% levobupivacaine with 0.75% ropivacaine for peribulbar anesthesia in cataract surgery and found that the sensory and motor block onset times were significantly less and both the offset times and akinesia scores (6 min after block) were higher in the levobupivacaine-treated group than in the ropivacaine-treated group. Gioia et al (13) performed peribulbar anesthesia with either 0.75% ropivacaine or a 2% lidocaine and 0.5% bupivacaine mixture for vitreoretinal surgery. They reported that the onset time of sensory and motor blocks required 5 min and 8 min in the lidocaine-bupivacaine-treated group and 5 min and 10 min in the ropivacaine-treated group. Resolution of motor blockade required >6 hours in 60% of patients in the lidocaine-bupivacaine-treated group and 90% of patients in the ropivacaine-treated group. In our study, both motor block duration and akinesia scores were significantly higher in the levobupivacaine and bupivacaine-treated groups than in the lidocaine-treated group.

Lai et al (14) compared 0.75% levobupivacaine and 2% lidocaine with 0.75% bupivacaine and 2% lidocaine for peribulbar anesthesia. Researchers found that 0.75% levobupivacaine in combination with 2% lidocaine was significantly less effective than 0.75% bupivacaine and 2% lidocaine for peribulbar anesthesia in terms of speed of onset of anesthesia. The onset time of motor block in all groups in our study was similar.

Newsom et al (15) reported the percentage of both mild and severe pain on injection as 15.5%; mild, moderate, and severe pain of operation as 5.57% in a study in which they performed local anesthesia for 1221 vitreoretinal procedures. The pain during levobupivacaine and lidocaine injections was less than pain during bupivacaine injections and also the pain during the operation was less in levobupivacaine group than the other two groups in our study.

TABLE IV - SUPPLEMENTARY BLOCK NEED, PAIN SCORES, AND PATIENT AND SURGEON SATISFACTION SCORES

	Group LB, n (%)	Group L, n (%)	Group B, n (%)
Supplementary block need	1 (2.2)	6 (13.3)	4 (8.9)
Injection pain	2 (4.4)	6 (13.4)	14 (31.1)*
Intraoperative pain	5 (11.1)	16 (35.6)*	19 (42.2)*
Postoperative analgesic need	0 (0)	15 (34.9)*†	6 (13.3)*
Patient satisfaction (0/1/2)	1 (2.2)/2 (4.4)/42 (93.3)	11 (24.4)/11 (24.4)/23 (51.1)*	13 (28.9)/10 (22.2)/22 (48.9)*
Surgeon satisfaction (0/1/2)	1 (2.2)/2 (4.4)/42 (93.3)	10 (22.2)/6 (13.3)/29 (64.4)*	12 (26.7)/11 (24.4)/22 (48.9)*

*Significance compared with Group LB ($p<0.05$).
†Significance compared with Group B ($p<0.05$).

Di Donato et al (16) compared 0.75% levobupivacaine with 4% lidocaine for topical anesthesia in cataract surgery and reported better patient and surgeon satisfaction scores in the levobupivacaine-treated group than in the lidocaine-treated group. Patient satisfaction was reported as 83% in lidocaine-bupivacaine-treated group and 97% in ropivacaine-treated group in a study in which peribulbar anesthesia with either 0.75% ropivacaine or a 2% lidocaine and 0.5% bupivacaine mixture for vitreoretinal surgery was performed (13). In another study, researchers reported a trend towards better satisfaction in patients administered levobupivacaine compared to ropivacaine at 24 hours following intervention after operation (12). In our study, we also found better patient and surgeon satisfaction scores in the levobupivacaine-treated group than in the lidocaine and bupivacaine-treated groups.

We conclude that 0.5% levobupivacaine alone provides good hemodynamic stability, better patient and surgeon satisfaction, and less intraoperative pain than 0.5% bupivacaine and 2% lidocaine and is a suitable choice when performing retrobulbar anesthesia for vitreoretinal surgery.

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Reprint requests to:
Recep Aksu, MD
Department of Anesthesiology
Erciyes University School of Medicine
38039 Melikgazi/Kayseri, Turkey
raksu@erciyes.edu.tr

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