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Original Article

Comparative Clinical Outcomes of Lidocaine versus Bupivacaine in Ophthalmic Surgeries

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ABSTRACT

Background; Regional anesthesia plays a pivotal role in glaucoma surgery by ensuring adequate analgesia, ocular akinesia, and patient comfort while minimizing systemic risks. Lidocaine and bupivacaine are commonly used local anesthetics in ophthalmic practice; however, their comparative clinical performance in glaucoma surgery warrants further evaluation.

Objective; To compare the clinical efficacy of lidocaine and bupivacaine for regional anesthesia in patients undergoing glaucoma surgery.

Methods; This comparative observational study included 60 patients (60 eyes) who underwent antiglaucomatous surgery between 2022 and 2024. Patients were allocated into two equal groups: one group received 2% lidocaine and the other received 0.5% bupivacaine for retrobulbar anesthesia combined with Van Lint facial nerve block. The primary outcomes assessed were onset and duration of anesthesia, degree of ophthalmoplegia, and intraoperative pain intensity measured using a visual analogue scale (VAS). Secondary outcomes included the need for additional sedation, hemodynamic stability, and early postoperative comfort.

Results; Adequate regional anesthesia was achieved in all patients, allowing successful completion of surgery. Lidocaine provided a faster onset of anesthesia (5–7 minutes) but a shorter duration of effect (40–50 minutes). In contrast, bupivacaine showed a slower onset (10–14 minutes) with a markedly longer duration of anesthesia (approximately 3 hours) and a higher rate of complete ophthalmoplegia (70% vs 33%). Pain-free surgery was more frequent in the bupivacaine group, and mean VAS scores were lower compared with the lidocaine group, although the difference was not statistically significant ($p = 0.3$). Postoperative comfort was superior in patients receiving bupivacaine.

Conclusion; Both lidocaine and bupivacaine are effective for regional anesthesia in glaucoma surgery. However, bupivacaine offers prolonged anesthesia, improved ocular akinesia, and greater postoperative comfort, making it a preferable option for such procedures.

Keywords: *Glaucoma surgery; regional anesthesia; lidocaine; bupivacaine; retrobulbar block; ophthalmic anesthesia; pain assessment.*

INTRODUCTION

Glaucoma remains one of the leading causes of irreversible blindness worldwide and continues to represent a major public health challenge despite advances in medical and surgical management [1]. Surgical intervention is often required when intraocular pressure cannot be adequately controlled with pharmacological therapy alone. The success of glaucoma surgery depends not only on surgical technique but also on the quality of anesthesia, which plays a critical role in ensuring patient comfort, intraoperative stability, and optimal surgical conditions [2].

Patients undergoing glaucoma surgery are frequently elderly and often present with multiple systemic comorbidities, including cardiovascular disease, diabetes mellitus, and generalized atherosclerosis. These factors increase the importance of selecting an anesthetic technique that provides effective analgesia while minimizing systemic adverse effects [3]. In addition, glaucoma patients may experience significant preoperative ocular pain, particularly in cases of angle-closure glaucoma with elevated intraocular pressure, further emphasizing the need for reliable regional anesthesia [4].

Regional anesthesia is widely used in ophthalmic surgery because it allows patients to remain conscious while providing sufficient analgesia and ocular akinesia. Techniques such as retrobulbar and peribulbar blocks are commonly employed and are often combined with facial nerve blocks to enhance ophthalmoplegia [5]. The choice of local anesthetic agent for these blocks is crucial, as it influences the onset, duration, and quality of anesthesia, as well as postoperative pain control [6].

Lidocaine is a commonly used local anesthetic in ophthalmic surgery due to its rapid onset of action and favorable safety profile. However, its relatively short duration of effect may be insufficient for prolonged procedures or extended postoperative analgesia [7]. In contrast, bupivacaine is a long-acting amide local anesthetic that provides prolonged sensory blockade and improved postoperative pain relief. Its use in ophthalmic anesthesia has been associated with enhanced surgical stability and reduced need for supplemental analgesics [8].

Several studies have compared lidocaine and bupivacaine in various ophthalmic surgical settings, including cataract and vitreoretinal surgery, with mixed results regarding their relative efficacy and safety [9–11]. While lidocaine offers the advantage of rapid anesthesia onset, bupivacaine has been shown to provide longer-lasting analgesia and improved ocular akinesia in some reports. However, data specifically addressing their comparative performance in glaucoma surgery remain limited.

Therefore, the present study was designed to compare the clinical efficacy of lidocaine and bupivacaine for regional anesthesia in glaucoma surgery, with particular emphasis on onset and duration of anesthesia, degree of ophthalmoplegia, intraoperative pain intensity, and early postoperative comfort.

MATERIALS AND METHODS

Study Design and Reporting Guidelines

This study was conducted as a comparative observational clinical investigation designed to evaluate the anesthetic efficacy of lidocaine and bupivacaine in patients undergoing glaucoma surgery. The study was reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines to ensure methodological transparency and reproducibility. In addition, a CONSORT-style flow diagram was used to clearly depict patient enrollment, allocation, and inclusion in the final analysis.

Study Setting and Duration

The investigation was carried out at the Department of Ophthalmology over a two-year period from 2022 to 2024. All surgical and anesthetic procedures were performed in a standardized operating theater environment, ensuring consistency in perioperative care and minimizing procedural variability among patients.

Study Population

A total of 60 adult patients (60 eyes) undergoing surgical treatment for glaucoma were included in the study. The study population consisted of 28 male and 32 female patients aged between 45 and 80 years. Both primary open-angle glaucoma and primary angle-closure glaucoma cases were represented, reflecting the clinical spectrum typically encountered in tertiary ophthalmic practice. A substantial proportion of patients had concomitant systemic diseases, including hypertension, ischemic heart disease, diabetes mellitus, and generalized atherosclerosis.

Eligibility Criteria

Patients were eligible for inclusion if they were 45 years of age or older, had a confirmed diagnosis of glaucoma requiring surgical intervention, and were suitable candidates for regional ophthalmic anesthesia. Patients were excluded if they had severe systemic illnesses that contraindicated regional anesthesia, active inflammatory ocular conditions such as conjunctivitis, keratitis, or uveitis, known hypersensitivity to amide local anesthetics, or neurological or psychiatric disorders that could interfere with intraoperative cooperation.

Preoperative Evaluation

All patients underwent comprehensive preoperative assessment that included a detailed medical and anesthetic history, general physical examination, and thorough ophthalmic evaluation. Ophthalmic investigations comprised visometry, biomicroscopy, perimetry, ophthalmoscopy, gonioscopy, and tonography. Laboratory investigations were performed

according to institutional protocols, and consultations with a physician and anesthesiologist were conducted to optimize management of coexisting systemic conditions prior to surgery.

Surgical Procedure

All patients underwent deep sclerectomy with basal iridectomy using a standardized surgical technique. The procedures were performed by experienced ophthalmic surgeons to minimize operator-related variability. The average duration of surgery ranged from 15 to 20 minutes, and no major intraoperative surgical complications were recorded.

Anesthetic Technique

Standardized premedication was administered to all patients, consisting of intramuscular analgin (50%, 2.0 mL) and diphenhydramine (1%, 1.0 mL). Sedation was achieved using intravenous fentanyl. Regional anesthesia was provided using a combination of Van Lint facial nerve block to achieve ocular akinesia and retrobulbar block to provide sensory anesthesia. The retrobulbar injection was administered through the lower eyelid using a 4 cm intramuscular needle, with careful aspiration prior to injection to avoid intravascular administration. A total volume of 3.0 mL of the anesthetic solution was slowly injected behind the eyeball.

Group Allocation

Patients were allocated into two groups of equal size based on the local anesthetic used for the retrobulbar block. One group received a 2% lidocaine solution, while the other group received a 0.5% bupivacaine solution. The two groups were comparable in terms of age, sex distribution, type and stage of glaucoma, and baseline clinical characteristics.

Outcome Measures

The primary outcome measures included onset time and duration of anesthesia, degree of ophthalmoplegia, and intraoperative pain intensity assessed using a visual analogue scale. Secondary outcomes included intraoperative patient cooperation, need for additional sedatives or analgesics, hemodynamic stability, and early postoperative comfort. Pain intensity was categorized according to standard visual analogue scale thresholds.

Ethical Considerations

Written informed consent was obtained from all participants prior to enrollment. The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. As this observational study was performed as part of routine clinical practice, formal approval from an institutional ethics committee was not required under local regulatory guidelines.

Statistical Analysis

Collected data were analyzed using descriptive statistical methods. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Comparative analysis between the lidocaine and bupivacaine groups was performed, and a p-value of less than 0.05 was considered statistically significant.

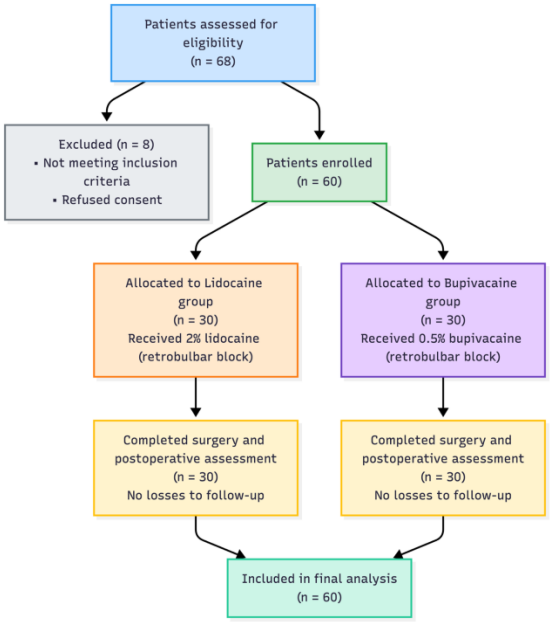

Figure 1 CONSORT / STROBE Flow Diagram

A CONSORT/STROBE-style flow diagram illustrates the process of patient selection, group allocation, and final analysis. Of the 68 patients assessed for eligibility, 8 were excluded due to failure to meet inclusion criteria or refusal to participate. The remaining 60 patients were enrolled and allocated equally to the lidocaine and bupivacaine groups. All enrolled patients completed surgery and follow-up and were included in the final analysis.

RESULTS

1.Overall Anesthetic Effectiveness:

All 60 patients (60 eyes) achieved an adequate level of regional anaesthesia, allowing completion of antiglaucomatous surgery without interruption. The mean duration of surgery was 15–20 minutes in both groups. No serious anesthetic related complications were observed.

2. Onset, Duration of Anaesthesia, and Ophthalmoplegia

Clear differences were observed between lidocaine and bupivacaine with respect to onset time, duration of anaesthesia, and degree of ocular akinesia.

Table 1. Regional Anaesthesia Characteristics in the Two Study Groups

Parameter	Lidocaine group (n = 30)	Bupivacaine group (n = 30)
Onset of anesthesia	5–7 minutes	10–14 minutes
Mean onset (approx.)	~6 minutes	~12 minutes
Duration of anesthesia	40–50 minutes	~180 minutes (≈3 hours)
Full ophthalmoplegia	10 patients (33%)	21 patients (70%)
Additional sedation required	6 patients (20%)	0 patients

Lidocaine provided a rapid onset of anaesthesia but a relatively short duration. In contrast, bupivacaine demonstrated a slower onset but significantly prolonged anaesthetic effect and a higher rate of complete ophthalmoplegia.

3. Anesthetic Profile

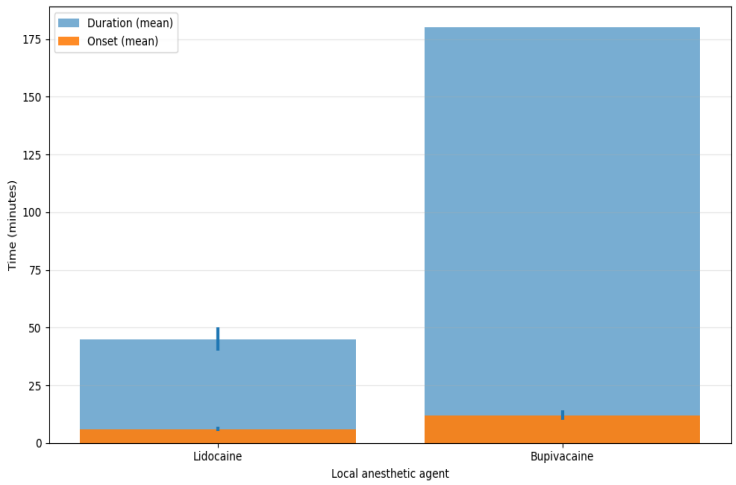

Figure 2 . Regional anesthesia profile of lidocaine and bupivacaine showing onset and duration of action.

Figure 3 illustrates the pharmacodynamic profiles of lidocaine and bupivacaine using range bars with mean markers. Lidocaine shows a narrow onset range (5–7 minutes) and short duration (40–50 minutes). Bupivacaine demonstrates a wider onset window (10–14 minutes) and markedly prolonged duration of anesthesia (~180 minutes), highlighting its sustained analgesic effect.

4. Intraoperative Pain Assessment (VAS)

Pain intensity during surgery was evaluated using a visual analogue scale (VAS). Most patients in both groups reported no or minimal pain; however, pain-free surgery was more frequent in the bupivacaine group.

Table 2. Distribution of Intraoperative Pain Intensity (VAS Scores)

VAS category	Lidocaine (n = 30)	Bupivacaine (n = 30)	Total (n = 60)
No pain (0)	12 (40%)	15 (50%)	27 (45%)
Minor pain (1–2)	11 (37%)	11 (37%)	22 (37%)
Moderate pain (3–5)	5 (17%)	3 (10%)	8 (13%)
Severe pain (6–10)	2 (6.7%)	1 (3.3%)	3 (5%)

Table 3. Mean Intraoperative Pain Scores

Parameter	Lidocaine	Bupivacaine
Mean VAS score (Mean ± SD)	2.0 ± 0.4	1.4 ± 0.3
Statistical comparison	-	p = 0.3

Although mean pain scores were lower in the bupivacaine group, the difference between groups was not statistically significant..

5. Pain Distribution

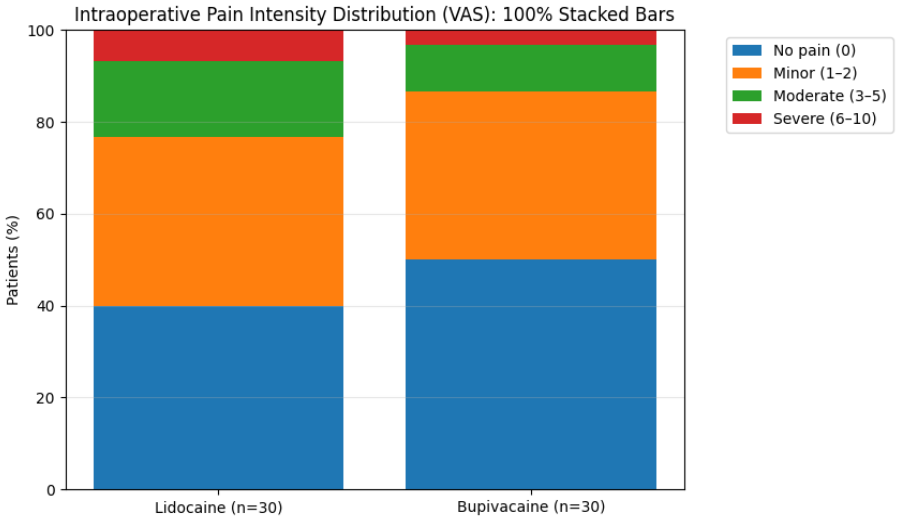

Figure 3 . Intraoperative Pain Intensity Distribution (VAS)

Figure 3 presents a 100% stacked bar chart comparing pain intensity categories between groups. The bupivacaine group shows a higher proportion of patients with complete absence of pain and fewer cases of moderate-to-severe pain compared with the lidocaine group.

6. Postoperative Comfort and Hemodynamics

Moderate intraoperative blood pressure elevation (140/70–180/90 mmHg) was observed in all patients and normalized within 7–10 minutes after sedation, with no differences between groups. Postoperatively, all patients reported good general well-being, with no nausea or vomiting. Patients receiving bupivacaine experienced greater postoperative comfort, characterized by prolonged analgesia and gradual recovery of ocular movements and sensitivity.

DISCUSSION

Effective regional anesthesia is a critical component of successful glaucoma surgery, as it directly influences intraoperative stability, patient comfort, and early postoperative recovery. In the present study, both lidocaine and bupivacaine provided adequate anesthesia in all patients, allowing completion of surgery without interruption. However, important differences were observed in their pharmacodynamic profiles, degree of ophthalmoplegia, and postoperative comfort.

The rapid onset of lidocaine observed in this study (5–7 minutes) is consistent with its well-known pharmacological characteristics and previous reports describing its suitability for short ophthalmic procedures [12,13]. This rapid onset is advantageous in busy surgical settings; however, the relatively short duration of anesthesia (40–50 minutes) limited its ability to maintain prolonged analgesia and akinesia. As a result, a subset of patients in the lidocaine group required additional sedatives and analgesics to maintain adequate surgical conditions.

In contrast, bupivacaine demonstrated a slower onset of action (10–14 minutes) but provided a markedly prolonged duration of anesthesia, averaging approximately three hours. This prolonged effect was associated with a significantly higher rate of complete ophthalmoplegia (70%) compared with lidocaine (33%). Adequate ocular akinesia is essential during glaucoma surgery to ensure surgical precision and reduce intraoperative complications. Similar findings have been reported in studies evaluating long-acting local anesthetics in ophthalmic surgery, which highlight the superiority of bupivacaine in maintaining stable operative conditions [14–16].

Pain control is another key determinant of anesthetic quality. In the present study, most patients in both groups reported no or only minor intraoperative pain. Although mean VAS scores were lower in the bupivacaine group, the difference did not reach statistical significance. Nevertheless, pain-free surgery was achieved more frequently with bupivacaine, and fewer patients experienced moderate-to-severe pain. These findings align with earlier studies demonstrating that bupivacaine provides more sustained analgesia compared with lidocaine, particularly during longer procedures and in the early postoperative period [17–19].

Postoperative comfort was noticeably better in patients receiving bupivacaine. Prolonged analgesia and gradual recovery of ocular movements contributed to improved patient satisfaction and reduced psychoemotional stress. Importantly, no increase in anesthetic-related adverse effects or hemodynamic instability was observed, supporting the safety of bupivacaine when used in appropriate concentrations for regional ophthalmic anesthesia. Previous investigations have similarly reported favorable safety profiles for bupivacaine and levobupivacaine in peribulbar and retrobulbar blocks [20,21].

Taken together, the findings of this study suggest that while lidocaine remains a useful agent when rapid onset is required, bupivacaine offers distinct clinical advantages in glaucoma surgery due to its longer duration of action, superior ophthalmoplegia, and enhanced postoperative comfort.

CONCLUSION

Both lidocaine and bupivacaine are effective and safe local anesthetics for regional anesthesia in glaucoma surgery. Lidocaine provides a rapid onset of anesthesia, making it suitable for short procedures. However, bupivacaine offers a significantly longer duration of anesthesia, higher rates of complete ophthalmoplegia, reduced need for supplemental sedation, and improved postoperative comfort.

Based on these findings, bupivacaine may be considered the preferred agent for regional anesthesia in glaucoma surgery, particularly when prolonged surgical stability and sustained postoperative analgesia are desired.

Limitations:

As this was a single center study with a comparatively short sample size, results of this study cannot be generalized. Generalization requires the support of results from similar large studies

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REFERENCE

1. Trivedi L, Trivedi H, Tripathi D, Jha P, Bhalani K, Raval P. Comparison of ropivacaine 0.75% and bupivacaine 0.5% in peribulbar block for cataract surgery. **Int J Anesthesiol.** 2009;23(2):2.
2. Goveia CS, Magalhães E. Ropivacaine in peribulbar anesthesia: Vasoconstrictive properties. **Rev Bras Anestesiol.** 2010;60(5):495–512. doi:10.1016/S0034-7094(10)70061-1
3. Kuthiala G, Chaudhary G. Ropivacaine: A review of its pharmacology and clinical use. **Indian J Anaesth.** 2011;55(2):104–110. doi:10.4103/0019-5049.79875
4. Schönfeld CL, Hierneis S, Kampik A. Preemptive analgesia with ropivacaine for pars plana vitrectomy: A randomized controlled trial on efficacy and required dose. **Retina.** 2012;32(5):912–917. doi:10.1097/IAE.0b013e318232c34c
5. Khan B, Bajwa SJ, Vohra R, Singh S, Kaur R, Vartika, et al. Comparative evaluation of ropivacaine and lignocaine with ropivacaine, lignocaine and clonidine combination during peribulbar anaesthesia for phacoemulsification cataract surgery. **Indian J Anaesth.** 2012;56(1):21–26. doi:10.4103/0019-5049.93339
6. Jaichandran V. Ophthalmic regional anaesthesia: A review and update. **Indian J Anaesth.** 2013;57(1):7–13. doi:10.4103/0019-5049.108552
7. Sinha S. Minimally invasive vitreous surgery: 20-gauge to 27-gauge. In: Sinha S, editor. **Introduction to anesthesia.** New Delhi: Jaypee Brothers Medical Publishers; 2013. p. 5–6.

8. Egashira T, Fukasaki M, Araki H, Sakai A, Okada M, et al. Comparative efficacy of levobupivacaine and ropivacaine for epidural block in outpatients with degenerative spinal disease. **Pain Physician.** 2014;17(6):525–529.
9. Jaichandran VV, Raman R, Gella L, Sharma T. Local anesthetic agents for vitreoretinal surgery: No advantage to mixing solutions. **Ophthalmology.** 2015;122(5):1030–1033. doi:10.1016/j.ophtha.2014.11.026
10. Gozdemir M, Muslu B, Sert H, Usta B, Demircioglu RI, Kasikara H. Transient neurological symptoms after spinal anesthesia. **Clin Invest Med.** 2016;39(6):S106–S110. doi:10.1007/s00101-002-0345-2
11. Varshney R, Sharma V, Palaria U. Ropivacaine versus bupivacaine–lignocaine mixture in peribulbar block: A comparative study. **J Evol Med Dent Sci.** 2017;6(48):3703–3706.
12. Moolagani VR, Burla SR, Neethipudi BR, Upadhyayula SM, Bikkina A, Arepalli NR. Ropivacaine plus lidocaine versus bupivacaine plus lidocaine for peribulbar block in cataract surgeries: A prospective, randomized, double-blind, single-center comparative study. **J Anaesthesiol Clin Pharmacol.** 2019;35(4):498–503.
13. Jaichandran VV, Srinivasan S, Raman S, Jagadeesh V, Raman R. A prospective comparison of the efficacy of 0.5% bupivacaine versus 0.75% ropivacaine in peribulbar anesthesia for vitreoretinal surgery. **Indian J Ophthalmol.** 2020;68(1):153–156. doi:10.4103/ijo.IJO_239_19
14. Baladaniya M. Comprehensive approach to workplace injury prevention: Strategies and technological solutions. **J Phys Med Rehabil Stud Rep.** 2024;6(4):1–7. doi:10.47363/JPMRS/2024(6)196.
15. Weiss JL, Deichman CB. A comparison of retrobulbar and periocular anaesthesia for cataract surgery. **Arch Ophthalmol.** 1989;107:96–98.
16. Demediuk OM, Dhaliwal RS, Papworth DP, et al. A comparison of retrobulbar and periocular anaesthesia for vitreoretinal surgical procedures. **Arch Ophthalmol.** 1995;113:908–913.
17. Wong DHW. Regional anaesthesia for intraocular surgery. **Can J Anaesth.** 1993;40:635–657.
18. Ozcan AA, Ozdemir N, Günes Y, et al. Intraocular pressure, quality of block, and degree of pain associated with ropivacaine in peribulbar block: A comparative randomized study with bupivacaine–lidocaine mixture. **Eur J Ophthalmol.** 2003;13:794–796.
19. Albright GA. Cardiac arrest following regional anaesthesia with etidocaine or bupivacaine. **Anesthesiology.** 1979;52:285–287.
20. Heath M. Deaths after intravenous regional anaesthesia. **Br Med J.** 1983;285:913–914.
21. McLeod GA, Burke D. Levobupivacaine. **Anaesthesia.** 2001;56:331–341.
22. Foster RH, Markham A. Levobupivacaine: A review of its pharmacology and use as a local anaesthetic. **Drugs.** 2000;59:551–579.
23. Stewart J, Kellett N, Castro D. The central nervous system and cardiovascular effects of levobupivacaine and ropivacaine in healthy volunteers. **Anesth Analg.** 2003;97:412–416.
24. McLure HA, Rubin AP, Westcott M, et al. A comparison of 1% ropivacaine with a mixture of 0.75% bupivacaine and 2% lignocaine for peribulbar anaesthesia. **Anaesthesia.** 1999;54:1178–1182.