

COMPARING 0.75% ROPIVACAINE AND 0.5% LEVOBUPIVACAINE FOR PERIBULBAR BLOCKADE IN VITRECTOMY SURGERY TOWARDS INTRAOCULAR PRESSURE

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ABSTRACT

Peribulbar blockade is a regional anesthetic technique that can be used for vitrectomy surgery. Ropivacaine and levobupivacaine are local anesthetics that have the advantage of a long duration of action and a lower complication rate than bupivacaine. This study aims to find the effect of intraocular pressure from ropivacaine and levobupivacaine. The study design was a double-blind randomized controlled trial on 60 patients underwent vitrectomy at Netra Ophthalmic Clinic Bandung with peribulbar blockade. Twenty-nine subjects received 0.75% ropivacaine and thirty-one subjects received 0.5% levobupivacaine for peribulbar blockade. Assessment of eye intraocular pressure was assessed before the block, 5 minutes, 10 minutes, and 15 minutes. The 0.75% ropivacaine group obtained an average of 4.42mmHg at 15 minutes, while the 0.5% levobupivacaine group averaged 2.33mmHg after 15 minutes after injection. Statistical results obtained p value <0.05 which means significant intraocular pressure of the two drugs. Intraocular pressure of ropivacaine 0.75% lower than levobupivacaine 0.5% in peribulbar blockade in vitrectomy surgery.

Keywords: *levobupivacaine, peribulbar blockade, ropivacaine, vitrectomy*

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INTRODUCTION

Anesthesia for vitreoretinal surgery is a challenge for anesthesiologists, because the operation time is relatively long (Kumar & Dodds, 2006; Wulff, 2018). In the past, general anesthesia was the anesthetic of choice for vitreoretinal surgery. The development of regional anesthesia and local anesthetic drugs, making regional anesthesia in the eye better known, especially retrobulbar blockade and peribulbar blockade (Pacella et al., 2013; Ribeiro et al., 2020). Peribulbar technique is performed by injecting the anesthetic solution in the orbit around the equator of the eye ball (outside the muscle cone) using sharp needle (Athar et al., 2016; Govêia & Magalhães, 2010; Pacella et al., 2013).

The goal of ideal local anesthesia is to obtain complete anesthesia and akinesia of the eye ball and low intraocular pressure in order to provide optimal surgical conditions (Gioia et al., 2004; Miranda et al., 2021; Nicholson et al., 1999; Pacella et al., 2013; Ribeiro et al., 2020; Wulff, 2018). Peribulbar blockade is the preferred technique compared to retrobulbar blockade, because peribulbar blockade has fewer complications such as brainstem anesthesia, optic nerve injury (Di Donato et al., 2006; Varshney et al., 2017).

Intraocular pressure varies from 10 to 21.7 mmHg. Chronically high intraocular pressure (IOP) can interfere with normal corneal metabolism. During anesthesia, increased IOP can cause permanent vision loss. Patients with high IOP, accompanied by further increases can trigger acute glaucoma. Therefore, proper control of IOP is essential. Levobupivacaine and ropivacaine are local anesthetics of the amide class which can be used for regional eye block (Chaudhary et al., 2018; Di Donato et al., 2006; Licina et al., 2016; Ribeiro et al., 2020; Senapathi et al., 2021; Varshney et al., 2017).

This study was aimed at comparing the changes in intraocular pressure after peribulbar blockade with levobupivacaine and ropivacaine in vitrectomy surgery.

METHOD

The study design is a prospective experimental study, using a double-blind randomized controlled trial design. The study subjects were patients who underwent elective surgery according to the inclusion criteria and did not include exclusion. The inclusion criteria were a minimum age of 18 years, physical status according to the American Society of Anesthesiologists (ASA) I and II, and vitrectomy elective patients, while the exclusion criteria were patients refusing action; allergy reaction to amida type of drugs; suffering from blood clotting disorder, and panophthalmitis. The study was conducted at Hasan Sadikin Hospital, Bandung, Indonesia in 2023. This study has passed ethical clearance from the Ethics Committee of dr Hasan Sadikin Hospital Bandung No. LB.02.01/2.3/2250/2023 and permission from the Director of Human Resources, Education, and Research of RSUP Dr. Hasan Sadikin Bandung.

The study sampling technique was carried out by consecutive sampling by taking each research subject that met the inclusion and exclusion criteria based on the order of patient arrival. Randomization was carried out using the simple random sampling method. The sample size was determined based on the sample size calculation formula by determining the 95% confidence level and 90% power test. Subjects were divided into 2 groups; group L received 0.5% levobupivacaine, group R received 0.75% ropivacaine.

Patients were explained and informed consent was taken, intraocular pressure (IOP) was measured before anesthesia injection (t0). IOP was measured by tonometry icare, topical tetracaine 2% eye drops was given. Aseptic and antiseptic were performed using sterile gauze with 10% povidone iodine on the skin around the palpebra. The patient was placed an intravenous line and given sedation using 0.3 mg/kg propofol. The injection was made in the lateral third of the orbital margin where the indentation was palpable as the inferotemporal peribulbar injection site in a perpendicular direction. If the needle is in contact with the bone, then the mid-cephalad angle is adjusted until the needle enters about 2 cm. Aspiration is carried out, then slowly local anesthetic drug is injected. Patients were given 0.5% levobupivacaine (group L) and 0.75% ropivacaine (group R).

Intraocular pressure was measured after the needle was removed from the injection site 5 minutes (t1), 10 minutes (t2), and 15 minutes (t3). After the block was successful, the patient was transferred to the operating room and prepared for surgery.

Statistical analysis was performed to compare the means of numerical variables between 2 groups using an unpaired T-test because the data were normally distributed. For statistical analysis of categorical data, the chi-square test was used. Statistical test results were determined by the p-value, declared meaningful if the p-value <0.05. The data obtained were processed using Statistical Product and Service Solution (SPSS) version 25.0 for Windows.

RESULTS AND DISCUSSION

This study involves 60 subjects who underwent elective vitrectomy surgery and met the inclusion criteria at Dr Hasan Sadikin Hospital.

Table 1. Subjects Characteristics (N=60)

Characteristics	Vitrectomy Patients		P value*
	0.5 % Levobupivacaine (n=31)	0.75% Ropivacaine (n=29)	
1. Age (years)			
Mean ± SD	53.1±8.7	52±10.15	0.654
Median	52	53	
Range (min-max)	37-69	33-77	
2. Gender			
Men	17 (54.8%)	14 (48.3%)	0.198
Women	14 (45.2%)	15 (51.7%)	
3. ASA			
1	15 (48.4%)	12 (41.4%)	0.377
2	16 (51.6%)	17 (58.6%)	
4. Weight			
Mean ± SD	58.7±5.6	64.5±8.85	0.054
Median	60	68	
Range (min-max)	50-70	50-76	
5. Height			
Mean ± SD	1.59±0.04	1.60±0.04	0.300
Median	1.59	1.60	
Range (min-max)	1.50-1.70	1.50-1.70	
6. BMI			
Mean ± SD	23.35±2.65	25.27±3.67	0.053
Median	23.87	26.95	
Range (min-max)	18.37-27.41	18.14-30.80	

*p value is calculated based on the unpaired T test if the data is normally distributed. Alternative Mann-whitney test if the data is not normally distributed. P-value is significance if p <0.05

Based on Table 1, the results of the independent T-test show p-value of >0.05 so it can be concluded that there is no significant difference in proportion between variables on both groups.

Table 2. Comparison of Intraocular Pressure between 0.5% Levobupivacaine Group and 0.75% Popivacaine Group (N=60)

Intraocular Pressure (mmHg)	Group		P value*
	0.15% Levobupivacaine (n=31)	0.75% Ropivacaine (n=29)	
Pre-injection			
Mean + SD	11.81±4.02	13.24±2.49	0.105
Median	12	13	
Range (min-max)	3-19	9-19	
5 minutes post injection			
Mean + SD	11.97±3.41	12.1±3.32	0.877
Median	12	12	
Range (min-max)	7-18	7-20	
10 minutes post injection			
Mean + SD	11.06±3.47	10.34±3.05	0.399
Median	11	10	
Range (min-max)	5-18	5-15	
15 minutes post injection			
Mean + SD	9.48±3.75	8.82±2.56	0.041*
Median	10	8	
Range (min-max)	3-16	4-14	

*p value is calculated based on the unpaired T test if the data is normally distributed. Alternative Mann-whitney test if the data is not normally distributed. P-value is significance if $p < 0.05$

Based on Table 2, the average IOP 15 minutes after injection in the 0.5% levobupivacaine group was 9.48 ± 3.75 mmHg. Whereas in the 0.75% ropivacaine group, the average intraocular pressure was 8.82 ± 2.56 mmHg. The results of the independent t-test showed a p-value of 0.041 ($p < 0.05$) which indicated that there was a significant difference between the intraocular pressure of the 0.5% levobupivacaine group and the 0.75% ropivacaine group at 15 minutes post-injection.

Based on Table 3, the mean difference of patients' intraocular pressure before and 15 minutes post-injection of the 0.5% levobupivacaine group was 2.33mmHg. Whereas in the 0.75% ropivacaine group, the mean difference in the patient's average intraocular pressure before and 15 minutes post-injection was 4.42mmHg. The RM Anova test in both groups showed a p value of 0.0001 so it can be concluded that there was a significant change in intraocular pressure in various measurements.

Table 3. Patient's condition During LMA Insertion (N=60)

Variable	Measurement time								
	t ₀	t ₁	Δ Mean t ₀ -t ₁	t ₂	Δ Mean t ₁ -t ₂	t ₃	Δ Mean t ₂ -t ₃	Δ Mean t ₂ -t ₃	P-value
Intraocular Pressure (mmHg)									
Kelompok levobupivacaine									
0,5%	11,81±4,02	11,97±3,41	0,16	11,06±3,47	0,91	9,48±3,75	1,58	2,33	0,0001
Mean ± SD	3-19	7-18		5-18		3-16			
Min-max									
Kelompok ropivacaine									
0,75%	13,24±2,49	12,1±3,32	1,14	10,34±3,05	1,76	8,82±2,56	1,52	4,42	0,0001
Mean ± SD	9-19	7-20		5-15		4-14			
Min-max									

Based on Table 3, the mean difference of patients' intraocular pressure before and 15 minutes post-injection of the 0.5% levobupivacaine group was 2.33mmHg. Whereas in the 0.75% ropivacaine group, the mean difference in the patient's average intraocular pressure before and 15 minutes post-injection was 4.42mmHg. The RM Anova test in both groups showed a p value of 0.0001 so it can be concluded that there was a significant change in intraocular pressure in various measurements.

Discussion

In the 0.5% levobupivacaine group, there was an increase in IOP at 5 minutes post-injection (11.97 ± 3.41), this is in line with Nociti et al's study that the peribulbar anesthetic technique can increase IOP in the first few minutes due to block peribulbar itself which causes the volume in the eye socket to increase so that the pressure in the eyeball also increases. Furthermore, there was a decrease in IOP a few minutes later due to relaxation of the extraocular muscles thereby reducing ocular globus pressure (Mehta et al., 2018; Saputra et al., 2021).

The 0.5% levobupivacaine group had an average difference in the patient's intraocular pressure before and 15 minutes post-injection was 2.33mmHg with the lowest intraocular pressure 9.48 ± 3.75. Whereas the 0.75% ropivacaine group had an average difference in the patient's intraocular pressure before and 15 minutes post-injection was 4.42mmHg with the lowest intraocular pressure 8.82 ± 2.56. Thus, 0.75% Ropivacaine has a greater effect on reducing intraocular pressure compared to 0.5% levobupivacaine in peribulbar blockade for vitrectomy surgery (Anker & Kaur, 2017; Chaudhary et al., 2018; Kapoor et al., 2021; Mehta et al., 2018; Nociti et al., 2001; Saputra et al., 2021; Zhou et al., 2017). In line with the study by Pacella et al which stated that levobupivacaine caused lower IOP in several types of eye surgery compared to bupivacaine, levobupivacaine-hyaluronidase, and racemic bupivacaine-hyaluronidase (Pacella et al., 2013). Varshney et al. (2017) state that ropivacaine has an effect of reducing IOP 8-9 mmHg in peribulbar blockade while levobupivacaine has an effect of reducing IOP 1-2 mmHg (Jaffe & Samuel, 2014; Jaichandran et al., 2020).

Ropivacaine has a vasoconstrictive effect which causes a decrease in blood volume in the choroid so that the production of aqueous humor decreases and minimizes the increase in intraocular pressure (IOP) after peribulbar injection (Kapoor et al., 2021; Kumar & Dodds, 2006; Zhou et al., 2017).

CONCLUSION

Intraocular pressure of ropivacaine 0.75% lower than levobupivacaine 0.5% in peribulbar blockade in vitrectomy surgery.

REFERENCES

- Anker, R., & Kaur, N. (2017). Regional anaesthesia for ophthalmic surgery. *BJA Education*, 17(7). <https://doi.org/10.1093/bjaed/mkw078>
- Athar, M., Ahmed, S. M., Ali, S., Doley, K., Varshney, A., & Siddiqi, Mohd. M. H. (2016). Levobupivacaine or ropivacaine: A randomised double blind controlled trial using equipotent doses in spinal anaesthesia. *Colombian Journal of Anesthesiology*, 44(2). <https://doi.org/10.1016/j.rcae.2016.02.012>
- Chaudhary, R. A., Khaqan, H. A., Ahmad, A., Imtiaz, U., Raza, H., & Shabbir, U. (2018). Comparison of topical versus peribulbar anesthesia for 23G pars plana vitrectomy. *Journal of the College of Physicians and Surgeons Pakistan*, 28(6). <https://doi.org/10.29271/jcpsp.2018.06.452>
- Di Donato, A., Fontana, C., Lancia, F., & Celleno, D. (2006). Efficacy and comparison of 0.5% levobupivacaine with 0.75% ropivacaine for peribulbar anaesthesia in cataract surgery. *European Journal of Anaesthesiology*, 23(6). <https://doi.org/10.1017/S026502150600041X>
- Gioia, L., Fanelli, G., Casati, A., Nuti, U., Mennella, R., Scarioni, M., Cerchierini, E., Sciascia, A., Garassino, A., Torri, G., Fasce, F., & Bolognesi, G. (2004). A prospective, randomized, double-blinded comparison of ropivacaine 0.5%, 0.75%, and 1% ropivacaine for peribulbar block. *Journal of Clinical Anesthesia*, 16(3). <https://doi.org/10.1016/j.jclinane.2003.07.004>
- Govêia, C. S., & Magalhães, E. (2010). Ropivacaine in Peribulbar Anesthesia – Vasoconstrictive Properties. *Brazilian Journal of Anesthesiology*, 60(5). [https://doi.org/10.1016/s0034-7094\(10\)70061-1](https://doi.org/10.1016/s0034-7094(10)70061-1)
- Jaffe, R., & Samuel, S. (2014). Ophthalmic surgery. In A. J. Richard, A. S. Clifford, & G. Brenda (Eds.), *Anesthesiologist's Manual of Surgical Procedures* (5th ed.). Lippincott Williams & Wilkins.
- Jaichandran, V., Srinivasan, S., Raman, S., Jagadeesh, V., & Raman, R. (2020). A prospective comparison of the efficacy of 0.5% bupivacaine vs 0.75% ropivacaine in peribulbar anesthesia for vitreoretinal surgery. *Indian Journal of Ophthalmology*, 68(1). https://doi.org/10.4103/ijo.IJO_239_19
- Kapoor, S., Rather, S., & Gupta, D. (2021). Complications of classic double injection technique of peribulbar anaesthesia given in supine position before cataract surgery. *Asian Journal of Medical Sciences*, 12(3). <https://doi.org/10.3126/ajms.v12i3.32871>
- Kumar, C. M., & Dodds, C. (2006). Ophthalmic regional block. *Annals of the Academy of Medicine Singapore*, 35(3). <https://doi.org/10.47102/annals-acadmedsg.v35n3p158>
- Licina, A., Sidhu, S., Xie, J., & Wan, C. (2016). Local versus general anaesthesia for adults undergoing pars plana vitrectomy surgery. *Cochrane Database of Systematic Reviews*, 2016(9). <https://doi.org/10.1002/14651858.CD009936.pub2>
- Mehta, S., Laird, P., Debiec, M., Hwang, C., Zhang, R., Yan, J., Hendrick, A., Hubbard, G. B., Bergstrom, C. S., Yeh, S., Fernandes, A., & Olsen, T. W. (2018). Formulation of a Peribulbar Block for Prolonged Postoperative Pain Management in Vitreoretinal Surgery: A Randomized Clinical Trial. *Ophthalmology Retina*, 2(4). <https://doi.org/10.1016/j.oret.2017.07.011>
- Miranda, D. B., Bastos, M. M. A., Govêia, C. S., Silva, R. E., & Rodrigues, F. W. (2021). Efficacy of ropivacaine versus bupivacaine in preventing peribulbar block failure: A meta-

- analysis. *European Journal of Ophthalmology*, 31(5).
<https://doi.org/10.1177/1120672120969370>
- Nicholson, G., Sutton, B., & Hall, G. M. (1999). Ropivacaine for peribulbar anesthesia. *Regional Anesthesia and Pain Medicine*, 24(4). <https://doi.org/10.1097/00115550-199924040-00010>
- Nociti, J. R., Serzedo, P. S. M., Zuccolotto, E. B., Nunes, A. M. M., & Ferreira, S. B. (2001). Intraocular pressure and ropivacaine in peribulbar block: A comparative study with bupivacaine. *Acta Anaesthesiologica Scandinavica*, 45(5). <https://doi.org/10.1034/j.1399-6576.2001.045005600.x>
- Pacella, E., Pacella, F., Troisi, F., Dell'Edera, D., Tuchetti, P., Lenzi, T., & Collini, S. (2013). Efficacy and safety of 0.5% levobupivacaine versus 0.5% bupivacaine for peribulbar anesthesia. *Clinical Ophthalmology*, 7. <https://doi.org/10.2147/OPHTH.S43553>
- Ribeiro, J. A. S., Ribeiro, D. S., Scott, I. U., Abrão, J., & Jorge, R. (2020). Pain during pars plana vitrectomy following sub-tenon versus peribulbar anesthesia: A randomized trial. *PLoS ONE*, 15(8 August). <https://doi.org/10.1371/journal.pone.0236624>
- Saputra, K., Yadi, D. F., & Adli, M. (2021). Blokade Peribulbar pada Geriatri dengan Hipertensi Tidak Terkontrol yang Mengalami Cedera Bola Mata Terbuka. *Jurnal Anestesi Perioperatif*, 9(3). <https://doi.org/10.15851/jap.v9n3.2589>
- Senapathi, T. A., Widnyana, I. G., Ryalino, C., & Wibawa, I. G. D. (2021). Ropivacaine 0.75% for peribulbar block in vitrectomy. *Bali Journal of Anesthesiology*, 5(1). https://doi.org/10.4103/BJOA.BJOA_146_20
- Varshney, R., Sharma, V., Palaria, U., & Kashyap, A. (2017). ROPIVACAINE VERSUS BUPIVACAINE-LIGNOCAINE MIXTURE IN PERIBULBAR BLOCK- A COMPARATIVE STUDY. *Journal of Evolution of Medical and Dental Sciences*, 6(48). <https://doi.org/10.14260/jemds/2017/799>
- Wulff, L. (2018). Anesthesia with Peribulbar Block: Lidocaine-Bupivacaine vs Lidocaine-Bupivacaine-Fentanyl. *Anesthesia & Clinical Care*, 5, 1–5. <https://doi.org/10.24966/ACC-8879/100029>
- Zhou, Y. L., Tong, Y., Wang, Y. X., Zhao, P. Q., & Wang, Z. Y. (2017). A prospective, randomised, double-masked comparison of local anaesthetic agents for vitrectomy. *British Journal of Ophthalmology*, 101(8). <https://doi.org/10.1136/bjophthalmol-2016-309780>