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Blood Pressure Variations in Patients Undergoing Phacoemulsification Surgery via Topical and Peribulbar Anaesthesia

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Abstract: ***Purpose**: To compare blood pressure changes in patients undergoing phacoemulsification surgery using either topical or peribulbar anesthesia. **Methods**: In this prospective study, patients were divided equally into two groups: one received topical anesthesia with proparacaine drops, and the other received peribulbar anesthesia using lignocaine and bupivacaine. Blood pressure readings-systolic (SBP), diastolic (DBP), and mean (MBP)-were recorded before, during, and after surgery. **Results**: There were no significant age or gender differences between groups. In the topical group, both SBP and MBP rose significantly during surgery, while DBP remained unchanged. In contrast, only SBP increased slightly in the peribulbar group. Intraoperatively, the topical group showed significantly higher SBP (152.21 vs. 135.11 mmHg) and MBP (107.00 vs. 99.63 mmHg) compared to the peribulbar group. No significant differences were found pre- or postoperatively. **Conclusion**: Topical anesthesia during phacoemulsification is associated with higher intraoperative blood pressure, suggesting the need for closer monitoring to manage potential hemodynamic changes.*

Keywords: Phacoemulsification, topical anaesthesia, peribulbar anaesthesia, systolic blood pressure, diastolic blood pressure, mean blood pressure

1.Introduction

The lens is a transparent, flexible, and avascular structure positioned between the aqueous and vitreous humors. It is asymmetrical, with a flatter anterior surface. During accommodation, ciliary muscle contraction reduces zonular tension, allowing the lens to become more curved. Unlike most tissues, it grows throughout life by adding new fibers and contributes to focusing in coordination with the cornea. At birth, it measures ~4 mm in thickness, 6 mm in diameter, and weighs 23–25 mg. Crystalline proteins maintain transparency and prevent protein clumping, which can lead to cataract formation.[1,2]

Cataract is a major global cause of blindness and a significant public health issue.It results from protein breakdown and aggregation within the lens, leading to clouding and visual impairment. Risk factors include aging, trauma, prior surgeries, and radiation. Diagnosis is made via visual acuity tests and slit-lamp exams. Management includes both medical therapy and surgical procedures like phacoemulsification, extracapsular extraction, and laser surgery.[3,4]

Phacoemulsification, the most common surgical method today, uses ultrasound to break up the lens, followed by aspiration and irrigation to remove lens material.[5,6] Anesthesia is essential for pain relief and patient comfort. Commonly used types include topical and peribulbar anesthesia.4 In peribulbar blocks, agents such as lignocaine and bupivacaine are injected outside the muscle cone. Hyaluronidase is often added to enhance diffusion. Topical anesthesia, typically with proparacaine or lignocaine gel, acts rapidly but is limited to the ocular surface.

Both anesthetic agents and surgical stress can influence hemodynamics, altering systolic, diastolic, and mean blood pressure, which may lead to serious complications like hemorrhage, stroke, or myocardial ischemia. Monitoring of vital signs is therefore critical during surgery.

This study aims to compare changes in blood pressure among patients undergoing phacoemulsification surgery under topical versus peribulbar anesthesia. Specifically, to assess the effects of these two anesthetic techniques on mean, systolic, and diastolic blood pressure during the procedure and to evaluate the differences in these parameters between the two groups.

2.Methodology

The study is an observational analysis conducted in the Ophthalmology Department of a tertiary hospital from June 2023 to November 2024, using purposive sampling to recruit 38 patients-19 receiving topical anaesthesia and 19 receiving peribulbar anaesthesia for phacoemulsification surgery. Eligible participants were those undergoing phacoemulsification under either technique with well-controlled blood pressure, with or without antihypertensive medication. Patients were excluded if they had complicated cataract, prior ocular trauma, intraoperative adverse events such as posterior capsular rent or lens drop, poorly dilating pupils, communication

barriers (e.g., dementia or language difficulty), or uncontrolled hypertension regardless of treatment status.

Patients who met the inclusion and exclusion criteria underwent a detailed preoperative evaluation in the Department of Ophthalmology. This included assessment of visual acuity, retinoscopy and refraction, review of past medical history, measurement of blood pressure levels, slit-lamp examination, and fundus examination.

Patients in Group 1 (topical anesthesia) received 0.5% proparacaine eye drops instilled every 5 minutes for a total of three times prior to surgery. Group 2 (peribulbar anesthesia) received a combination of 2% lignocaine and 0.5% bupivacaine in varying ratios, with hyaluronidase added at a concentration of 15 U/ml to enhance diffusion. Blood pressure was measured using an automated sphygmomanometer attached to a monitor, with readings taken from the right arm while the patient was in a supine position. The candidate conducting the study documented all measurements. Systolic and diastolic pressures were recorded, and mean blood pressure was calculated using the formula: diastolic pressure + one-third of the pulse pressure (where pulse pressure is the difference between systolic and diastolic values). Blood pressure was recorded at three points: one hour preoperatively, every 10 minutes intraoperatively starting from the administration of anesthesia, and one hour postoperatively.

3.Results

The mean age of the Peribulbar group was 66.63 ± 4.94 years, while that of the Topical group was 65.74 ± 5.97 years. In both groups, females comprised 47.4%, with 9 participants each, while males accounted for 52.6%, with 10 each in the Peribulbar and Topical group. (Table:1)

Table 1: Showing age and gender distribution in Peribulbar and topical group

	Peribulbar		Topical		t value	p value
	Mean	Std. Deviation	Mean	Std. Deviation		
Age	66.632	4.935	65.737	5.971	0.503	0.618
	Peribulbar (f)	Peribulbar (%)	Topical (f)	Topical (%)	chi square	p value
Female	9	47.40%	9	47.40%	11.455	0.003*
Male	10	52.60%	10	52.60%		

The systolic blood pressure (SBP) was compared between the Peribulbar and Topical groups at three time points. At Preoperative and Postoperative stages, there were no significant differences between the two groups (t = 1.103, p = 0.277 and t = 1.080, p = 0.287, respectively). However, a significant difference was observed intra operatively, with the Topical group showing a significantly higher SBP (152.21 ± 15.21 mmHg vs 135.11 ± 6.77 mmHg, t = 4.478, p < 0.001). (Table 2)

Table 2: Showing comparison of SBP across three points

SBP		Mean	Std. Deviation	f value	p value
Peribulbar	Pre	128.105	7.378	4.049	0.040*
	Intra	135.105	6.773		
	Post	131.000	9.399		
Topical	Pre	124.579	11.824	39.571	0.000*
	Intra	152.211	15.212		
	Post	127.316	11.518		

There were no significant differences in diastolic blood pressure (DBP) between the Peribulbar and Topical groups at any of the three time points (Preoperative, Intra operative, and Postoperative). The t-values and p-values (0.191, 0.85; 1.147, 0.259; 1.201, 0.238) indicate that DBP remained similar between the groups throughout the procedure. (Table 3)

Table 3: Showing comparison of DBP across three points

DBP		Mean	Std. Deviation	f value	p value
Peribulbar	Pre	81.526	4.754	0.058	.919
	Intra	81.789	8.107		
	Post	82.158	8.180		
Topical	Pre	82.053	11.053	0.941	0.400
	Intra	84.579	6.826		
	Post	85.526	9.082		

At Preoperative and Postoperative time points, there were no significant differences in mean blood pressure (MBP) between the Peribulbar and Topical groups. The t-values and p-values for these time points (Pre: t = 0.106, p = 0.916; Post: t = 0.376, p = 0.709) indicate no statistical significance. However, at the Intra operative stage, there was a significant difference in MBP between the two groups (t = 3.556, p = 0.001), with the Topical group showing a higher MBP (107.00 ± 6.725 mmHg) compared to the Peribulbar group (99.63 ± 6.030 mmHg). (Table 4)

Table 4: Showing comparison of MBP across three points

MBP		Mean	Std. Deviation	f value	p value
Peribulbar	Pre	96.579	3.271	1.479	.245
	Intra	99.632	6.030		
	Post	98.421	7.960		
Topical	Pre	96.316	10.274	10.200	0.000*
	Intra	107.000	6.725		
	Post	99.474	9.234		

4.Discussion

Similar to our study, Singh B et al [7] concluded that Systolic blood pressure in the topical anaesthesia group was significantly increased in the intraoperative phase, whereas it was significantly decreased in the peribulbar group.

A study by Cupo et al [8] showed the diastolic and mean arterial pressure to be higher in phacoemulsification under topical anaesthesia than those under peribulbar anaesthesia. Unlike in our study where DBP had no significant difference in between the 2 groups.

Just like our study, YC Yap et al's [9] study showed that there is a significant rise in systolic blood pressures especially in females during topical phacoemulsification, the increase in blood pressure intraoperatively was thought to be a response to pain.

5.Conclusion

Intra operative SBP and MBP were significantly higher in the Topical group compared to the Peribulbar group, with DBP remaining stable in both. These findings suggest that stricter blood pressure monitoring may be needed during topical anesthesia procedures due to their greater hemodynamic impact.

Disclosure

The Authors report no conflict of interest in this work.

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