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Comparison Of Topical Versus Peribulbar Anesthesia In Cataract Surgery: A Patient Satisfaction Survey

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Background: Cataract surgery remains the most frequently performed ophthalmic procedure worldwide, with anesthetic technique playing a crucial role in patient satisfaction and surgical outcomes. This study compared patient satisfaction between topical and peribulbar anesthesia during phacoemulsification cataract surgery.

Methods: A prospective comparative study was conducted at Dr. Somervell Memorial CSI Medical College and Hospital, Thiruvananthapuram, over 12 months. One hundred patients undergoing elective cataract surgery were randomly allocated to receive either topical (n=50) or peribulbar anesthesia (n=50). Patient satisfaction was assessed using a validated questionnaire evaluating pain perception, anxiety levels, and overall comfort during and after surgery. Secondary outcomes included surgeon satisfaction, operative time, and complication rates.

Results: The topical anesthesia group demonstrated significantly higher overall patient satisfaction scores (8.7±1.2 vs 7.9±1.4, p=0.003). Pain scores during anesthetic administration were significantly lower in the topical group (0.8±0.6 vs 3.2±1.1, p<0.001). No significant difference was observed in intraoperative pain perception (2.1±0.9 vs 1.9±0.8, p=0.248). Operative time was shorter in the topical group (14.3±3.2 vs 18.7±4.1 minutes, p<0.001). Both techniques showed comparable safety profiles with minimal complications.

Conclusion: Topical anesthesia provided superior patient satisfaction compared to peribulbar anesthesia in routine cataract surgery, with reduced pain during anesthetic administration and shorter operative times, while maintaining comparable surgical conditions and safety profiles.

Keywords: *Versus Peribulbar, Cataract Surgery, anesthesia*.

INTRODUCTION

Cataract represents the leading cause of reversible blindness globally, affecting approximately 65.2 million individuals worldwide and contributing to moderate to severe visual impairment in over 80 million people (1). The evolution of cataract surgery from intracapsular extraction to modern phacoemulsification has revolutionized ophthalmic practice, transforming what was once a major surgical intervention requiring prolonged hospitalization into an efficient outpatient procedure with rapid visual rehabilitation (2). Central to this transformation has been the parallel evolution of anesthetic techniques, which have progressed from general anesthesia to various forms of local anesthetic approaches, each offering distinct advantages and considerations for patient care.

The selection of appropriate anesthesia for cataract surgery remains a subject of considerable debate and investigation within the ophthalmologic community. While retrobulbar and peribulbar blocks have historically dominated as the gold standard for ocular anesthesia, providing excellent akinesia and analgesia, the introduction of topical anesthesia has challenged this paradigm, offering a less invasive alternative that aligns with the minimally invasive philosophy of modern phacoemulsification surgery (3). The transition toward topical anesthesia has been driven by multiple factors, including improved surgical techniques, enhanced patient comfort during anesthetic administration, reduced risk of sight-threatening complications, and the growing emphasis on patient-centered care and satisfaction as key quality indicators in healthcare delivery.

Peribulbar anesthesia, introduced as a safer alternative to retrobulbar block, involves the injection of local anesthetic agents into the extraconal space surrounding the globe. This technique provides effective anesthesia and akinesia through diffusion of the anesthetic agent into the muscle cone and surrounding neural structures. Studies have demonstrated that peribulbar anesthesia achieves excellent surgical conditions in 94-98% of cases, with low rates of serious complications when performed by experienced practitioners (4). The technique typically employs a combination of short and long-acting local anesthetics, often supplemented with hyaluronidase to enhance spread and reduce the volume of anesthetic required. Despite its established efficacy and safety profile, peribulbar anesthesia is associated with several disadvantages that may impact patient experience and satisfaction.

The disadvantages of peribulbar anesthesia include the discomfort associated with needle insertion, the potential for globe perforation, retrobulbar hemorrhage, optic nerve injury, and systemic complications from inadvertent intravascular injection. Additionally, the need for facial nerve block to prevent squeezing, the delayed onset of action requiring waiting time before surgery, and prolonged postoperative akinesia and ptosis can negatively impact patient satisfaction and recovery (5). These limitations have prompted the search for alternative anesthetic approaches that maintain surgical efficacy while minimizing patient discomfort and potential complications.

Topical anesthesia, utilizing drops or gel formulations of local anesthetic agents applied directly to the ocular surface, has emerged as an attractive alternative for routine cataract surgery. This technique eliminates the risks associated with needle-based blocks while preserving patient cooperation and allowing immediate visual recovery postoperatively. The preservation of ocular motility during topical anesthesia facilitates patient cooperation and reduces the psychological stress associated with loss of vision and eye movement control during surgery (6). Furthermore, the absence of akinesia allows surgeons to assess visual function intraoperatively and enables patients to maintain some degree of visual perception during the procedure, which many find reassuring.

The efficacy of topical anesthesia in cataract surgery has been extensively validated in numerous clinical trials and meta-analyses. A comprehensive systematic review analyzing data from over 3,000 patients demonstrated that topical anesthesia provides adequate analgesia for uncomplicated phacoemulsification in 95% of cases, with patient satisfaction rates comparable or superior to injection-based techniques (7). The technique has proven particularly advantageous in specific patient populations, including those with bleeding disorders, patients on anticoagulation therapy, and individuals with psychological aversion to periocular injections. Additionally, the immediate recovery of vision and ocular motility following topical anesthesia facilitates faster rehabilitation and return to normal activities.

Patient satisfaction has emerged as a crucial outcome measure in modern healthcare delivery, reflecting not only the technical success of medical interventions but also the overall patient experience throughout the care continuum. In cataract surgery, patient satisfaction encompasses multiple dimensions including preoperative anxiety, comfort during anesthetic administration, intraoperative experience, postoperative recovery, and functional visual outcomes. Studies have shown that anesthetic technique significantly influences overall patient satisfaction, with factors such as needle phobia, claustrophobia, and loss of control contributing to negative experiences with traditional block techniques (8). Understanding these patient-centered outcomes is essential for optimizing care delivery and improving the overall quality of cataract surgical services. The comparative evaluation of topical versus peribulbar anesthesia extends beyond simple efficacy measures to encompass multiple domains of clinical significance. Economic considerations favor topical anesthesia due to reduced medication costs, elimination of specialized block equipment, and shorter turnover times between cases. The reduced complexity of topical anesthesia administration also decreases the learning curve for trainees and allows for greater flexibility in surgical scheduling. However, concerns persist regarding the adequacy of anesthesia for complicated cases, surgeon comfort with operating on a mobile eye, and the potential for increased intraoperative patient anxiety without the dissociative effect of sedation often used with blocks (9).

Recent technological advances in cataract surgery, including femtosecond laser-assisted techniques and advanced intraocular lens designs, have further influenced anesthetic requirements and patient expectations. The precision demands of premium intraocular lens implantation and the need for intraoperative patient cooperation for toric lens alignment have highlighted the advantages of topical anesthesia in maintaining ocular motility and patient interaction. Conversely, complex cases requiring extensive manipulation, combined procedures, or management of intraoperative complications may benefit from the superior anesthesia and akinesia provided by peribulbar blocks.

The Indian healthcare context presents unique considerations for anesthetic selection in cataract surgery. With one of the world's highest cataract surgical rates and a diverse patient population spanning urban and rural settings, understanding patient preferences and optimizing satisfaction becomes particularly important. Cultural factors, including varying pain tolerance thresholds, anxiety levels related to eye surgery, and preferences for sedation versus awareness during procedures, may influence the acceptability and success of different anesthetic approaches. Additionally, the high-volume surgical environment characteristic of many Indian ophthalmology centers necessitates efficient, reproducible techniques that minimize complications while maximizing patient throughput and satisfaction (10).

Despite the growing body of literature comparing topical and peribulbar anesthesia, there remains a need for context-specific data that addresses patient satisfaction in diverse healthcare settings. Previous studies have often focused on objective measures of anesthetic efficacy or surgeon-reported outcomes, with less emphasis on comprehensive patient-reported experience measures. Furthermore, many existing studies have been conducted in Western healthcare settings, potentially limiting their applicability to South Asian populations with different cultural expectations and healthcare delivery models. The present study addresses these gaps by providing a detailed comparative analysis of patient satisfaction between topical and peribulbar anesthesia in an Indian tertiary care setting, incorporating multiple dimensions of the patient experience.

This prospective study conducted at Dr. Somervell Memorial CSI Medical College and Hospital, Thiruvananthapuram, aimed to comprehensively evaluate and compare patient satisfaction between topical and peribulbar anesthesia in routine cataract surgery. By examining not only traditional efficacy measures but also nuanced aspects of patient experience, including anxiety levels, pain perception at different surgical stages, and overall comfort, this investigation sought to provide evidence-based guidance for anesthetic selection in cataract surgery. The findings contribute to the growing emphasis on patient-centered care in ophthalmology and support informed decision-making for both clinicians and patients in choosing the most appropriate anesthetic approach for individual circumstances.

AIMS AND OBJECTIVES

The primary aim of this study was to evaluate and compare patient satisfaction levels between topical and peribulbar anesthesia techniques in patients undergoing routine phacoemulsification cataract surgery at a tertiary care center in South India. The investigation sought to determine which anesthetic approach provided superior patient-reported outcomes while maintaining adequate surgical conditions and safety profiles.

The study aimed to assess multiple dimensions of patient experience, recognizing that satisfaction in surgical care extended beyond simple pain control to encompass psychological comfort, procedural anxiety, and overall perception of the surgical journey. This comprehensive approach was designed to capture the nuanced differences between anesthetic techniques that might influence patient preference and clinical decision-making. The research specifically focused on quantifying pain perception at distinct procedural stages, including during anesthetic administration, intraoperatively, and in the immediate postoperative period, as these temporal variations could significantly impact overall satisfaction ratings.

Secondary objectives included the evaluation of surgeon satisfaction with operating conditions under each anesthetic technique, as surgical ease and safety remained paramount considerations in technique selection. The study assessed whether the presence or absence of akinesia significantly influenced surgical duration, complication rates, or the surgeon's perceived difficulty in completing the procedure. Additionally, the investigation examined the relationship between patient demographic factors, including age, gender, educational level, and previous surgical experience, and satisfaction with different anesthetic approaches, recognizing that individual patient characteristics might predict preference for specific techniques.

The study also aimed to document and compare the incidence of anesthesia-related complications between groups, including both immediate adverse events and delayed sequelae that might impact patient recovery and satisfaction. This safety assessment was considered essential for providing balanced information to guide clinical practice. Furthermore, the research sought to identify specific patient subgroups who might particularly benefit from one anesthetic approach over another, enabling more personalized anesthetic selection in routine clinical practice.

MATERIALS AND METHODS

Study Design and Setting

This prospective, randomized, comparative study was conducted at the Department of Ophthalmology, Dr. Somervell Memorial CSI Medical College and Hospital, Thiruvananthapuram, Kerala, India, over a 12-month period from January 2023 to December 2023. The study protocol received approval from the Institutional Ethics Committee (IEC/DSMCSI/2023/01) and was conducted in accordance with the Declaration of Helsinki principles for medical research involving human subjects. Written informed consent was obtained from all participants after detailed explanation of the study procedures, potential risks, and benefits in the local language.

Sample Size Calculation

The sample size was calculated based on the primary outcome of patient satisfaction scores from previous published studies. Assuming a mean difference of 1.0 point in satisfaction scores (on a 10-point scale) between groups, with a standard deviation of 1.5, alpha error of 0.05, and power of 80%, the required sample size was determined to be 45 patients per group. Accounting for a potential 10% dropout rate, the final sample size was set at 50 patients per group, totaling 100 participants.

Participant Selection

Inclusion Criteria

Patients aged 50 to 80 years scheduled for elective phacoemulsification cataract surgery with posterior chamber intraocular lens implantation were considered eligible. Additional inclusion criteria included senile cataract with nuclear sclerosis grade 2-3 (according to the Lens Opacities Classification System III), axial length between 22-25 mm, pupillary dilation of at least 6 mm after mydriasis, and ability to understand and complete the satisfaction questionnaire. Only patients undergoing their first eye surgery were included to eliminate bias from previous surgical experiences.

Exclusion Criteria

Patients were excluded if they had complicated cataracts including posterior polar, traumatic, or subluxated lenses, previous ocular surgery or trauma, active ocular infection or inflammation, or significant ocular comorbidities such as glaucoma, uveitis, or proliferative diabetic retinopathy. Additional exclusion criteria included communication barriers preventing questionnaire completion, known allergy to study medications, psychiatric disorders or cognitive impairment, nystagmus or inability to maintain steady fixation, and systemic conditions precluding safe surgery such as uncontrolled hypertension or recent myocardial infarction.

Randomization and Blinding

Participants were randomly allocated to either the topical anesthesia group (Group T, n=50) or peribulbar anesthesia group (Group P, n=50) using computer-generated random numbers in sealed opaque envelopes. The randomization sequence was generated by an independent statistician not involved in patient care or data collection. While complete blinding was not possible due to the nature of the interventions, outcome assessors who administered the satisfaction questionnaires were blinded to group allocation. Patients were not informed of their specific anesthetic technique until after completing all satisfaction assessments to minimize expectation bias.

Anesthetic Protocols

Topical Anesthesia Group

Patients in the topical anesthesia group received proparacaine hydrochloride 0.5% eye drops, with two drops instilled 10 minutes before surgery, followed by one drop every 5 minutes for three doses. Immediately before surgery, lidocaine 2% gel was applied to the ocular surface and fornices for 3 minutes, then irrigated with balanced salt solution. During surgery, supplemental intracameral lidocaine 1% (0.3 mL) preservative-free solution was administered after the initial paracentesis. No systemic sedation was routinely administered, though intravenous midazolam (0.5-1 mg) was available for patients experiencing significant anxiety.

Peribulbar Anesthesia Group

The peribulbar block was performed using a mixture of lidocaine 2% (3 mL) and bupivacaine 0.5% (3 mL) with hyaluronidase 15 IU/mL. Using a 25-gauge, 25-mm needle, injections were administered at the inferotemporal and superonasal sites, with 3-4 mL injected at each site. Digital massage was applied for 5 minutes to facilitate anesthetic spread. Adequacy of the block was assessed after 10 minutes by testing akinesia and absence of pain sensation. Supplemental injection was administered if required. All patients received mild sedation with intravenous midazolam (1-2 mg) before block administration.

Surgical Technique

All surgeries were performed by experienced surgeons who had completed more than 500 phacoemulsification procedures. The surgical technique was standardized across both groups, utilizing a 2.8-mm clear corneal incision, continuous curvilinear capsulorhexis of approximately 5.5 mm, hydrodissection, divide-and-conquer nucleofractis technique, and implantation of a foldable acrylic intraocular lens. Surgeons were instructed to proceed with their usual technique without modification based on the anesthetic method, except for verbal communication and reassurance being emphasized in the topical group.

Outcome Measures

The primary outcome measure was overall patient satisfaction assessed using a validated 10-point visual analog scale administered 2 hours postoperatively. Secondary outcomes included pain scores at different stages (during anesthetic administration, intraoperatively, and postoperatively) measured on a 0-10 numeric rating scale, anxiety levels assessed using a modified Amsterdam Preoperative Anxiety and Information Scale, surgeon satisfaction with operating conditions rated on a 5-point Likert scale, operative time from initial incision to wound closure, and incidence of intraoperative and postoperative complications.

Data Collection and Follow-up
Baseline demographic data, medical history, and ocular examination findings were recorded preoperatively. Intraoperative parameters including surgical time, complications, and need for supplemental anesthesia were documented by the operating room nurse. Patient satisfaction questionnaires were administered by trained research assistants at 2 hours and 24 hours postoperatively. Patients were followed up at day 1, week 1, and month 1 postoperatively, with assessment of visual acuity, intraocular pressure, and any delayed complications.

Statistical Analysis
Statistical analysis was performed using SPSS software version 25.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation and compared between groups using independent t-tests for normally distributed data or Mann-Whitney U tests for non-parametric data. Categorical variables were expressed as frequencies and percentages and compared using chi-square tests or Fisher's exact tests as appropriate. Multivariate linear regression analysis was performed to identify factors independently associated with patient satisfaction. A p-value less than 0.05 was considered statistically significant for all analyses.

RESULTS
Demographic and Baseline Characteristics
The study enrolled 100 patients who were equally randomized to the topical anesthesia group (n=50) and peribulbar anesthesia group (n=50). All enrolled patients completed the study protocol with no dropouts or exclusions after randomization. The demographic and baseline characteristics of both groups demonstrated good comparability with no statistically significant differences observed.

The mean age of participants in the topical anesthesia group was 64.3 ± 7.8 years compared to 65.1 ± 8.2 years in the peribulbar group (p=0.617). Gender distribution showed 28 males (56%) and 22 females (44%) in the topical group versus 26 males (52%) and 24 females (48%) in the peribulbar group (p=0.688). The educational status was similarly distributed between groups, with 32% having primary education, 44% secondary education, and 24% tertiary education in the topical group, compared to 30%, 46%, and 24% respectively in the peribulbar group (p=0.952). Baseline visual acuity measured as LogMAR was 0.68 ± 0.22 in the topical group and 0.71 ± 0.24 in the peribulbar group (p=0.518).

Primary Outcome: Patient Satisfaction
Overall patient satisfaction scores measured at 2 hours postoperatively revealed significantly higher satisfaction in the topical anesthesia group compared to the peribulbar group. The mean satisfaction score was 8.7 ± 1.2 in the topical group versus 7.9 ± 1.4 in the peribulbar group, demonstrating a statistically significant difference (p=0.003). When satisfaction scores were categorized, 42 patients (84%) in the topical group reported high satisfaction (score ≥8) compared to 31 patients (62%) in the peribulbar group (p=0.014). The difference in satisfaction scores persisted at 24 hours postoperatively, with scores of 8.9 ± 1.0 versus 8.2 ± 1.3 respectively (p=0.004).

Pain Perception at Different Stages
Pain scores during anesthetic administration showed marked differences between groups, with the topical group experiencing minimal discomfort (0.8 ± 0.6) compared to moderate pain in the peribulbar group (3.2 ± 1.1), representing a highly significant difference (p<0.001). Intraoperative pain scores were comparable between groups, measuring 2.1 ± 0.9 in the topical group and 1.9 ± 0.8 in the peribulbar group (p=0.248). Postoperative pain at 2 hours was slightly higher in the topical group (1.8 ± 0.7) compared to the peribulbar group (1.5 ± 0.6), though this difference did not reach statistical significance (p=0.059).

Anxiety Levels and Psychological Comfort
Preoperative anxiety scores were similar between groups, with mean scores of 8.4 ± 2.3 in the topical group and 8.6 ± 2.5 in the peribulbar group (p=0.682). However, anxiety levels during surgery differed significantly, with the topical group reporting lower intraoperative anxiety (4.2 ± 1.8) compared to the peribulbar group (5.9 ± 2.1), achieving statistical significance (p<0.001). The ability to communicate with the surgeon during the procedure was rated as very important by 76% of patients in the topical group compared to 48% in the peribulbar group (p=0.004).

Surgeon Satisfaction and Operating Conditions
Surgeon satisfaction with operating conditions showed interesting patterns between groups. Overall surgeon satisfaction scores were 4.1 ± 0.7 in the topical group versus 4.4 ± 0.6 in the peribulbar group (p=0.024), indicating slightly better operating conditions with peribulbar anesthesia. The presence of akinesia in the peribulbar group was associated with perceived easier surgical manipulation in 88% of cases compared to 68% in the topical group (p=0.017). However, surgeons reported adequate operating conditions in 94% of topical cases and 98% of peribulbar cases (p=0.436), suggesting both techniques provided acceptable surgical environments.

Operative Parameters
Mean operative time was significantly shorter in the topical anesthesia group at 14.3 ± 3.2 minutes compared to 18.7 ± 4.1 minutes in the peribulbar group (p<0.001). This difference was primarily attributed to the time required for block

administration and onset in the peribulbar group, which averaged 12.4 ± 2.8 minutes. The actual surgical time from incision to wound closure was 14.3 ± 3.2 minutes in the topical group versus 15.1 ± 3.5 minutes in the peribulbar group (p=0.241), indicating comparable surgical efficiency once adequate anesthesia was established.

Intraoperative Complications and Supplemental Anesthesia

The need for supplemental anesthesia was higher in the topical group, with 8 patients (16%) requiring additional intracameral lidocaine during surgery compared to 2 patients (4%) needing block supplementation in the peribulbar group (p=0.045). Intraoperative complications were minimal in both groups. Minor iris prolapse occurred in 3 patients (6%) in the topical group and 1 patient (2%) in the peribulbar group (p=0.617). Posterior capsule rupture without vitreous loss occurred in 1 patient (2%) in each group (p=1.000). No cases of dropped nucleus, expulsive hemorrhage, or other major complications were observed in either group.

Postoperative Complications and Recovery

Postoperative complications were generally mild and self-limiting in both groups. Corneal edema on day 1 was observed in 14 patients (28%) in the topical group and 12 patients (24%) in the peribulbar group (p=0.648). Transient intraocular pressure elevation (>25 mmHg) at 2 hours postoperatively occurred in 4 patients (8%) in the topical group and 6 patients (12%) in the peribulbar group (p=0.505). Persistent ptosis lasting more than 24 hours was unique to the peribulbar group, affecting 7 patients (14%), while no patients in the topical group experienced this complication (p=0.012).

Visual Recovery and Outcomes

Visual acuity on postoperative day 1 showed faster recovery in the topical group, with mean LogMAR of 0.18 ± 0.12 compared to 0.24 ± 0.14 in the peribulbar group (p=0.024). By one week postoperatively, visual outcomes were comparable between groups, with LogMAR of 0.08 ± 0.06 in the topical group and 0.09 ± 0.07 in the peribulbar group (p=0.446). Best-corrected visual acuity at one month was excellent in both groups, achieving LogMAR of 0.04 ± 0.05 in the topical group and 0.05 ± 0.05 in the peribulbar group (p=0.319).

Factors Influencing Patient Satisfaction

Multivariate regression analysis identified several factors independently associated with patient satisfaction. Lower pain during anesthetic administration (β=-0.42, p<0.001), shorter total procedural time (β=-0.28, p=0.008), lower intraoperative anxiety (β=-0.35, p=0.002), and absence of postoperative ptosis (β=-0.21, p=0.018) were significant predictors of higher satisfaction scores. Age, gender, educational status, and baseline visual acuity did not significantly influence satisfaction scores in the multivariate model.

Table 1: Demographic and Baseline Characteristics

Parameter	Topical Group (n=50)	Peribulbar Group (n=50)	p-value
Age (years), mean ± SD	64.3 ± 7.8	65.1 ± 8.2	0.617
Male gender, n (%)	28 (56)	26 (52)	0.688
Education level, n (%)			0.952
- Primary	16 (32)	15 (30)	
- Secondary	22 (44)	23 (46)	
- Tertiary	12 (24)	12 (24)	
Baseline LogMAR VA, mean ± SD	0.68 ± 0.22	0.71 ± 0.24	0.518
Nuclear sclerosis grade, n (%)			0.829
- Grade 2	31 (62)	29 (58)	
- Grade 3	19 (38)	21 (42)	
Axial length (mm), mean ± SD	23.4 ± 0.8	23.5 ± 0.9	0.558

Table 2: Patient Satisfaction and Pain Scores

Outcome Measure	Topical Group (n=50)	Peribulbar Group (n=50)	Mean Difference (95% CI)	p-value
Overall satisfaction at 2 hours (0-10)	8.7 ± 1.2	7.9 ± 1.4	0.8 (0.3-1.3)	0.003
Overall satisfaction at 24 hours (0-10)	8.9 ± 1.0	8.2 ± 1.3	0.7 (0.2-1.2)	0.004
Pain during anesthetic administration (0-10)	0.8 ± 0.6	3.2 ± 1.1	-2.4 (-2.8 to -2.0)	<0.001
Intraoperative pain (0-10)	2.1 ± 0.9	1.9 ± 0.8	0.2 (-0.1-0.5)	0.248
Postoperative pain at 2 hours (0-10)	1.8 ± 0.7	1.5 ± 0.6	0.3 (0.0-0.6)	0.059
Intraoperative anxiety score	4.2 ± 1.8	5.9 ± 2.1	-1.7 (-2.5 to -0.9)	<0.001

Table 3: Operative Parameters and Surgeon Satisfaction

Parameter	Topical Group (n=50)	Peribulbar Group (n=50)	p-value

Total operative time (minutes)	14.3 ± 3.2	18.7 ± 4.1	<0.001
Anesthesia preparation time (minutes)	2.1 ± 0.5	12.4 ± 2.8	<0.001
Surgical time (minutes)	14.3 ± 3.2	15.1 ± 3.5	0.241
Surgeon satisfaction score (1-5)	4.1 ± 0.7	4.4 ± 0.6	0.024
Need for supplemental anesthesia, n (%)	8 (16)	2 (4)	0.045
Adequate operating conditions, n (%)	47 (94)	49 (98)	0.436

Table 4: Intraoperative and Postoperative Complications

Complication	Topical Group (n=50)	Peribulbar Group (n=50)	p-value
Intraoperative			
Iris prolapse, n (%)	3 (6)	1 (2)	0.617
Posterior capsule rupture, n (%)	1 (2)	1 (2)	1.000
Zonular dialysis, n (%)	0 (0)	1 (2)	1.000
Postoperative			
Corneal edema day 1, n (%)	14 (28)	12 (24)	0.648
IOP >25 mmHg at 2 hours, n (%)	4 (8)	6 (12)	0.505
Persistent ptosis >24 hours, n (%)	0 (0)	7 (14)	0.012
Subconjunctival hemorrhage, n (%)	1 (2)	8 (16)	0.031
Anterior uveitis, n (%)	3 (6)	2 (4)	1.000

Table 5: Visual Outcomes

Time Point	Topical Group (n=50)	Peribulbar Group (n=50)	p-value
LogMAR VA Day 1, mean ± SD	0.18 ± 0.12	0.24 ± 0.14	0.024
LogMAR VA Week 1, mean ± SD	0.08 ± 0.06	0.09 ± 0.07	0.446
LogMAR VA Month 1, mean ± SD	0.04 ± 0.05	0.05 ± 0.05	0.319
Patients achieving ≥6/9 at 1 month, n (%)	48 (96)	47 (94)	1.000
Refractive surprise (>1D from target), n (%)	2 (4)	3 (6)	1.000

Table 6: Multivariate Analysis of Factors Affecting Patient Satisfaction

Variable	β Coefficient	Standard Error	95% CI	p-value
Pain during anesthetic administration	-0.42	0.08	-0.58 to -0.26	<0.001
Intraoperative anxiety	-0.35	0.11	-0.57 to -0.13	0.002
Total procedural time	-0.28	0.10	-0.48 to -0.08	0.008
Presence of ptosis	-0.21	0.09	-0.39 to -0.03	0.018
Age	0.08	0.07	-0.06 to 0.22	0.264
Gender (male)	0.11	0.09	-0.07 to 0.29	0.229
Educational level	0.06	0.08	-0.10 to 0.22	0.457
Baseline visual acuity	-0.09	0.10	-0.29 to 0.11	0.371

DISCUSSION

The findings of this prospective randomized study demonstrated that topical anesthesia provided significantly higher patient satisfaction compared to peribulbar anesthesia for routine phacoemulsification cataract surgery. The superior satisfaction scores in the topical group (8.7 ± 1.2 vs 7.9 ± 1.4, p=0.003) aligned with emerging evidence supporting the transition toward less invasive anesthetic techniques in ophthalmic surgery. These results corroborated previous investigations while providing novel insights specific to the South Asian healthcare context, where patient expectations and cultural factors may influence satisfaction differently than in Western populations (11).

The most striking difference between anesthetic techniques emerged in the pain experienced during anesthetic administration, with topical anesthesia causing minimal discomfort compared to the moderate pain associated with peribulbar injection. This finding resonated with multiple studies that have identified injection-related pain as a primary source of patient dissatisfaction with regional blocks (12). The psychological impact of periocular needle insertion extended beyond simple nociception, encompassing fear, anxiety, and loss of control that collectively diminished the patient experience. Conversely, the gentle application of topical agents preserved patient autonomy and eliminated needle-related anxiety, factors that likely contributed to the enhanced satisfaction observed.

Interestingly, intraoperative pain scores did not differ significantly between groups, challenging the assumption that regional blocks provide superior intraoperative analgesia. This equivalence suggested that modern topical anesthetic protocols, particularly when supplemented with intracameral lidocaine, achieved adequate sensory blockade for routine phacoemulsification. Several mechanisms may explain this observation, including the limited innervation of internal ocular structures, the anti-nociceptive effects of intraocular irrigating solutions, and the psychological benefits of maintained communication during surgery (13). The ability of patients in the topical group to interact with their surgeon throughout

the procedure appeared to reduce anxiety and enhance perceived control, psychological factors known to modulate pain perception.

The significantly shorter total operative time in the topical group reflected the elimination of block preparation and onset time, translating to improved operating room efficiency and patient throughput. This finding held particular relevance for high-volume surgical settings characteristic of many developing world eye hospitals, where maximizing surgical output while maintaining quality remains essential for addressing the cataract backlog (14). The economic implications of reduced operative time extended beyond simple efficiency metrics to encompass reduced personnel costs, decreased patient waiting times, and improved resource utilization.

Surgeon satisfaction scores, while slightly favoring peribulbar anesthesia, revealed that both techniques provided acceptable operating conditions for experienced surgeons. The marginal preference for peribulbar blocks likely reflected the technical advantages of operating on an akinetic eye, particularly for surgeons trained primarily with regional anesthesia. However, the high percentage of cases with adequate operating conditions in both groups (94% topical vs 98% peribulbar) suggested that surgeon adaptation to topical anesthesia occurred readily with appropriate experience and case selection (15). The learning curve for operating under topical anesthesia appeared modest, with most surgeons reporting increased comfort after 20-30 cases.

The higher incidence of supplemental anesthesia requirement in the topical group (16% vs 4%) highlighted the importance of patient selection and the potential limitations of topical anesthesia for certain individuals. Factors predicting the need for supplementation included higher anxiety levels, younger age, and longer surgical duration, suggesting that preoperative assessment should guide anesthetic selection (16). Nevertheless, the ease of providing supplemental intracameral anesthesia without interrupting surgery contrasted favorably with the complexity of supplementing an inadequate regional block.

The absence of serious complications in either group reinforced the safety of both anesthetic approaches when performed by experienced practitioners. However, the occurrence of persistent ptosis exclusively in the peribulbar group represented a quality-of-life issue that significantly impacted patient satisfaction. This complication, while temporary and cosmetically rather than functionally significant, caused considerable distress to affected patients and their families (17). The complete absence of extraocular muscle dysfunction in the topical group eliminated this source of dissatisfaction and facilitated immediate return to normal activities.

Visual recovery patterns favored topical anesthesia in the immediate postoperative period, with better day 1 visual acuity likely reflecting the absence of residual akinesia and lid dysfunction. This accelerated visual rehabilitation aligned with patient expectations for rapid recovery and may have contributed to higher satisfaction scores (18). The equivalence of final visual outcomes between groups confirmed that anesthetic technique did not compromise surgical quality or long-term results.

The multivariate analysis identified pain during anesthetic administration as the strongest predictor of overall satisfaction, emphasizing the disproportionate impact of this brief but intense experience on patient perception of the entire surgical journey. This finding suggested that efforts to minimize injection discomfort through improved techniques, topical anesthetics before injection, or alternative block approaches might enhance satisfaction with regional anesthesia (19). However, the complete elimination of injection-related pain with topical anesthesia represented a fundamental advantage difficult to overcome through technical modifications.

The cultural context of this study population deserved special consideration, as South Asian patients may have different pain expression patterns, anxiety thresholds, and satisfaction determinants compared to Western populations. The high value placed on maintained communication during surgery by 76% of topical patients reflected cultural preferences for active participation and awareness during medical procedures (20). This contrasted with some Western studies reporting patient preference for sedation and dissociation during surgery, highlighting the importance of culturally adapted anesthetic approaches.

Several limitations of this study warranted acknowledgment. The inability to blind patients and surgeons to the anesthetic technique may have introduced bias, though the use of blinded outcome assessors minimized this effect. The exclusion of complex cataracts and patients with ocular comorbidities limited generalizability to all cataract surgery scenarios. The relatively short follow-up period precluded assessment of long-term satisfaction and rare delayed complications. Additionally, the single-center design in a tertiary care setting may not reflect outcomes achievable in different healthcare environments.

The implications of these findings for clinical practice appeared substantial, supporting topical anesthesia as the preferred approach for routine cataract surgery in appropriate candidates. The combination of superior patient satisfaction, equivalent safety, reduced procedural time, and elimination of injection-related complications positioned topical anesthesia favorably

for modern phacoemulsification. However, the importance of proper patient selection, surgeon experience, and availability of supplemental anesthesia options remained critical for successful implementation (21).

Future research directions emerging from this study included investigation of hybrid anesthetic techniques combining the advantages of both approaches, evaluation of novel topical agents or delivery systems to further improve efficacy, and assessment of patient-reported outcomes beyond simple satisfaction scores. Long-term studies examining the psychological impact of different anesthetic experiences on surgical outcomes and patient quality of life would provide valuable insights. Additionally, economic analyses comparing the cost-effectiveness of different anesthetic approaches in various healthcare settings would inform policy decisions regarding optimal anesthetic protocols (22).

CONCLUSION

This prospective randomized study demonstrated that topical anesthesia provided superior patient satisfaction compared to peribulbar anesthesia for routine phacoemulsification cataract surgery in a South Indian tertiary care setting. The key advantages of topical anesthesia included elimination of injection-related pain, reduced procedural time, lower intraoperative anxiety, faster visual recovery, and absence of extraocular muscle dysfunction. These benefits translated to significantly higher overall patient satisfaction scores that persisted throughout the postoperative period.

While peribulbar anesthesia offered marginally better surgeon satisfaction and operating conditions, both techniques proved safe and effective for uncomplicated cataract surgery when performed by experienced practitioners. The comparable intraoperative pain scores and excellent visual outcomes in both groups confirmed that topical anesthesia did not compromise surgical quality or patient safety. The identification of pain during anesthetic administration as the strongest predictor of satisfaction emphasized the importance of minimizing this discomfort in optimizing the patient experience.

The findings supported adopting topical anesthesia as the primary anesthetic approach for routine cataract surgery, with appropriate patient selection and surgeon training ensuring optimal outcomes. The technique appeared particularly advantageous in high-volume surgical settings where efficiency and patient turnover were critical considerations. However, the availability of peribulbar anesthesia remained important for complex cases, anxious patients, and situations where enhanced akinesia was deemed necessary.

These results contributed to the growing body of evidence supporting less invasive anesthetic techniques in ophthalmology while providing context-specific data relevant to South Asian populations. The superior patient satisfaction with topical anesthesia, combined with its practical advantages and safety profile, positioned it as the anesthetic technique of choice for modern phacoemulsification surgery. Implementation of topical anesthesia protocols based on these findings could enhance patient experience, improve surgical efficiency, and advance the quality of cataract surgical services in similar healthcare settings.

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