Scholars Journal of Applied Medical Sciences
Abbreviated Key Title: Sch J App Med Sci
ISSN 2347-954X (Print) | ISSN 2320-6691 (Online)
Journal homepage: https://saspublishers.com

OPEN ACCESS

Anaesthesia

"Effectiveness of Topical Vs Retrobulbar Anesthesia in Cataract Surgery"

Dr. A.H.M Mostak Anwar[1*], Dr. Mahmud-Un-Nabi[1], Dr. Md. Sumsuzzaman[1], Dr. Taj Uddin Ahmed[1], Dr. Ismot Ara[2], Dr. Monowara Begum[3]

[1]Medical Officer, Department of Anaesthesia, Analgesia and Intensive Care Medicine, Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka, Bangladesh
[2]Medical Officer, Control Room, Directorate General of Health Services (DGHS), Dhaka, Bangladesh
[3]Consultant, Department of Gynaecological Oncology, Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka, Bangladesh

DOI: https://doi.org/10.36347/sjams.2024.v12i09.014 | **Received:** 15.08.2024 | **Accepted:** 18.09.2024 | **Published:** 22.09.2024

***Corresponding author:** Dr. A.H.M Mostak Anwar
Medical Officer, Department of Anaesthesia, Analgesia and Intensive Care Medicine, Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka, Bangladesh

Abstract **Original Research Article**

Introduction: Local anesthesia has become preferable to general anesthesia for cataract surgery due to improvements in techniques and instrumentation. The advantages of local anesthesia are well known and include more rapid ambulation, the ability to perform the procedure as an outpatient, avoidance of complications of general anesthesia, and quicker surgery. This study aimed to evaluate and compare the efficacy of topical and retrobulbar anesthesia for cataract surgeries. ***Methods:*** This was a retrospective observational study and was conducted in the Department of Anaesthesia, analgesia and Intensive Care Medicine, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh during the period from July, 2022 to August, 2023. In our study, we included 60 patients who were undergoing cataract surgery. Patients were divided into two groups – Group A (Patients who received topical anesthesia) and Group B (Patients who received retrobulbar anesthesia. ***Result:*** The mean age of study patients was 73.4 ± 8.9 and 74.2 ± 7.4 in Groups A and B respectively. The mean Pain score was 0.87 ± 1.41 and 0.74 ± 1.70 in Groups A and B respectively. The most common preoperative risk factor was exfoliation syndrome (40% in group A and 30% in group B). Twenty-eight patients (93%) in the topical anesthesia group and 60% in the retrobulbar anesthesia group reported no pain at all. ***Conclusion:*** In conclusion, topical anesthetic, as opposed to retrobulbar anesthesia, offers the surgeon good surgical conditions and comfortable operating circumstances for the patient, even in challenging instances with related ocular comorbidities.

Keywords: Effectiveness, Topical, Retrobulbar anesthesia, Cataract surgery.

INTRODUCTION

Cataract is a major cause of blindness worldwide, and the only effective treatment is surgery [1]. Although topical anaesthesia was described by Koller in 1884, [2] Fichman was the first to use topical anaesthesia in cataract surgery in 1992 [3].

Local anesthesia has become preferable to general anesthesia for cataract surgery due to improvements in techniques and instrumentation. The benefits of local anesthetic are well established, including faster ambulation, the opportunity to do the treatment as an outpatient, the avoidance of general anesthesia issues, and shorter surgical times [4].

Methods of local anesthesia for cataract extraction currently include retrobulbar, [5] peribulbar, [6-9] subconjunctival,[10] and sub-Tenon application of local anesthetic solution [11]. Retrobulbar anesthesia has been associated with several potentially serious complications, including inadvertent globe perforation, retrobulbar hemorrhage, orbital infection, central retinal artery occlusion, chronic mydriasis, contralateral amaurosis, damage to the optic nerve, intravascular or intrathecal injection, respiratory depression, apnea, and death [12-14]. Other more common complications include postoperative diplopia, ptosis, nausea, and systemic hypertension [15, 16]. Peri bulbar anesthesia eliminates the risk of optic nerve trauma and lessens the chance of retrobulbar hemorrhage. However, the risk of global perforation remains [17]. The peribulbar technique is time-consuming and requires a greater volume of anesthetic than the retrobulbar technique [18].

Retrobulbar injection of anesthetic agents has been used for more than a century in cataract surgery. Despite various modifications that have been devised over the decades to reduce the potential risks of injuring intraorbital structures, the "blind" insertion of a needle into the retrobulbar space has never been completely free of several sights- and life-threatening complications [19-23]. Topical anesthesia was proposed by Fichman as an attractive alternative to the traditional method of injecting local anesthetic agents, resulting in faster visual recovery and high patient satisfaction [24]. The benefits of topical anesthesia include ease of application, low to no discomfort during administration, rapid onset of unconsciousness, and, most crucially, the absence of potential hazards associated with retrobulbar injections [24-26]. In addition to all of these advantages, the technique is economical, avoids undesirable cosmetic adverse effects, and allows instant visual rehabilitation. However, topical anesthetic only blocks the trigeminal nerve terminals, producing "complete" analgesia of the eye. The patient's optic nerve and motor neurons are usually unaffected, resulting in normal ocular mobility. Although previous reports indicate that topical anesthesia is safe and effective in most uncomplicated cataract procedures, [23-26] various studies suggest that topical anesthesia should not be considered in eyes with severe concomitant ocular pathological features [27]. Therefore, in this study, we aimed to evaluate and compare the efficacy of topical and retrobulbar anesthesia for cataract surgeries.

METHODOLOGY & MATERIALS

This was a retrospective observational study and was conducted in the Department of anaesthesia, analgesia and Intensive Care Medicine, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh during the period from July, 2022 to August, 2023. In our study, we included 60 patients who were undergoing cataract surgery. Patients were divided into two groups – Group A (Patients who received topical anesthesia) and Group B (Patients who received retrobulbar anesthesia.

These are the following criteria to be eligible for enrollment as our study participants: a) Patients aged more than 40 years; b)Patients undergoing cataract surgery; c) Patients who were willing to participate were included in the study And a) Patients with known allergy/hypersensitivity to anesthetic drugs; e) Patients with hearing impairment, dementia, eye movement disorder, or excessive anxiety; f) Patients with any history of acute illness (e.g., renal or pancreatic diseases, ischemic heart disease, asthma, COPD etc.) were excluded from our study.

Anesthesia Administration: Patients in the retrobulbar anesthesia group received an oral sedation of 5.1 to 10.2 mg of midazolam hydrogenmaleat 30 minutes before a single injection of a solution of 0.5% bupivacaine hydrochloride, 2% lidocaine, and 0.5 mL of hyaluronidase (Wydase), 3.75 IU/mL, into the retrobulbar space. The volume of the block was 3.5 to 5.5 mL, depending on the weight of the patient. Ocular compression for 10 minutes was achieved using a modified Honan balloon.

Patients in the topical anesthesia group received a mini- mum total of 5 doses (approximately 40 µL per dose) of 2% topical lidocaine. Four doses were administered into the superior and inferior culs-de-sac at 10 minutes and 5 minutes before surgery, before draping, and immediately before the initial corneal incision. The final dose was administered before the commencement of phacoemulsification.

Surgical Technique: All patients underwent temporal clear corneal phacoemulsification and implantation of a foldable IOL. A temporal clear corneal incision was made using a 3-step incision while the globe was immobilized with a Thornton-Fine ring. This was followed by paracenteses of 2 side ports, each 90° from the temporal meridian, to allow for subsequent procedures. These included viscoelastic injection, continuous curvilinear capsulorhexis, hydrodissec- tion, hydrodelineation, endocapsular phacoemulsification, bi-manual aspiration of the remaining cortical lens material, and, finally, in-the-bag implantation of a foldable IOL. The wound was tested for leakage of fluid by gentle compression with a sponge, and none of the patients required a suture to close the wound. During postoperative recovery, each patient received topical corticosteroid drops and a combination of a corticosteroid and antibiotic ointment at night, the dosage being rapidly reduced depending on the degree of postoperative inflammation.

Statistical Analysis: All data were recorded systematically in preformed data collection form. Quantitative data was expressed as mean and standard deviation and qualitative data was expressed as frequency distribution and percentage. The differences between groups were analyzed by unpaired t-test, chi-square (X^2) test, etc. A p-value <0.05 was considered as significant. Statistical analysis was performed by using SPSS 23 (Statistical Package for Social Sciences) for Windows version 10. The study was approved by the Ethical Review Committee of Bangabandhu Sheikh Mujib Medical University.

RESULTS

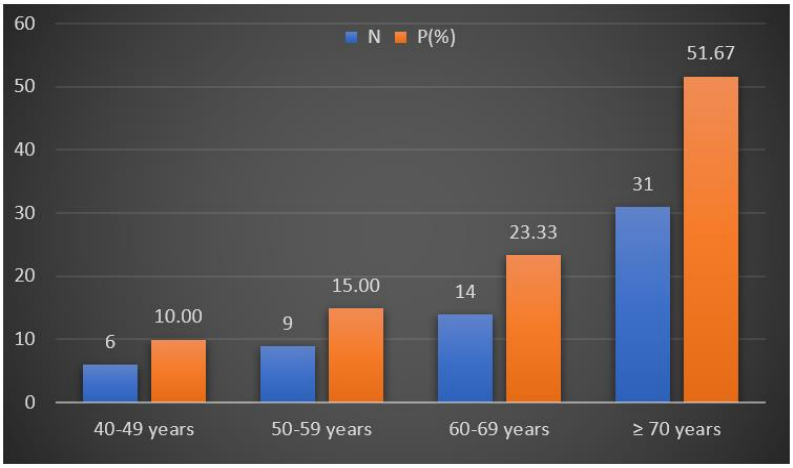

Figure 1: Age distribution of our study patients

Figure 1 shows that most of our patients (51.67%) were ≥70 years old, followed by 23.33% of patients aged 60-69, 15% were 50-59 years old, and only 10% of participants were 40-49 years old.

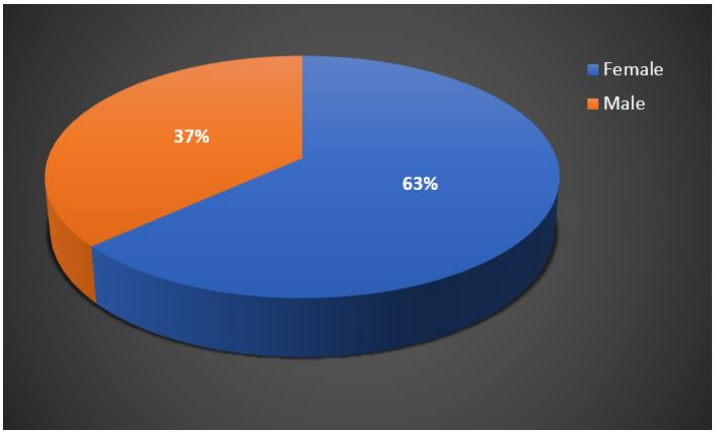

Figure 2: Gender distribution of study respondents

The pie chart shows that the majority (63%) of patients were female compared to male (37%). The male and female ratio was 1:1.7 in our study.

Table 1: Baseline characteristics of our study respondents

Baseline characteristics	Group A N (%)	Group B N (%)	P-value
Age (Years)			
Mean±SD	73.4 ± 8.9	74.2 ± 7.4	0.074
BMI (kg/m^2)	38.48± 14.89	39.48± 13.46	0.251
ASA			
I	3(10%)	2(6.67%)	
II	19(63.33%)	21(70%)	
III	8(26.67%)	7(23.33%)	
Pain score			
Mean ± SD	0.87 ± 1.41	0.74 ± 1.70	0.021
Co-morbidities			
HTN	4(13.33%)	3(10%)	
Hypotension	2(6.67%)	4(13.33%)	
DM	6(20%)	5(16.67%)	
Anemia	8(26.67%)	6(20%)	

Preoperative Risk Factor			
Exfoliation syndrome	12(40%)	9(30%)	
Uveitis	3(10%)	4(13.33%)	
Axial myopia (≥26 mm)	4(13.33%)	2(6.67%)	
Axial hyperopia (≤21 mm)	3(10%)	5(16.67%)	
Poor pupillary dilation (≥3 mm)	4(13.33%)	6(20%)	
Previous intraocular surgery	5(16.67%)	8(26.67%)	

Table 1 shows that the mean age of study patients was 73.4 ± 8.9 and 74.2 ± 7.4 in Groups A and B respectively. The majority of patients had ASA II in both groups. The mean Pain score was 0.87 ± 1.41 and 0.74 ± 1.70 in Groups A and B respectively. Diabetes mellitus was the most common comorbidity among study patients. The most common preoperative risk factor was exfoliation syndrome (40% in group A and 30% in group B), followed by previous intraocular surgery and the prevalence was 16.67% & 26.67% in groups A & B respectively.

Table 2: Distribution of our study patients by Intraoperative and within 24 Hours postoperative complications

Complications	**Group A**		**Group B**		**P-value**
	(n = 30)	**P (%)**	**(n = 30)**	**P (%)**	
Intraoperative					
Capsular tear	3	10.00	6	20.00	0.321
Vitreous loss	2	6.67	5	16.67	0.034
In-and-out placement	2	6.67	4	13.33	0.401
Anterior chamber IOL	0	0.00	2	6.67	0.115
Iris prolapse	4	13.33	1	3.33	0.172
Anesthesia-related					
Chemosis	0	0.00	5	16.67	0.010
Periorbital hematoma	0	0.00	2	6.67	0.172
Subconjunctival hemorrhage	0	0.00	4	13.33	0.042
Early postoperative					
Corneal edema	6	20.00	7	23.33	0.101
Wound leak	0	0.00	1	3.33	0.124
IOP ≥30 mm Hg	12	40.00	11	36.67	0.415
Retained lens materials	2	6.67	3	10.00	0.651
Fibrinous threads within the AC	7	23.33	7	23.33	0.714

In Table 2 complications were sub-grouped into anesthesia-related, intraoperative, and problems occurring within 24 hours of surgery. There were notable differences in anesthesia-related complications between the two groups. No patient needed a different kind of anesthetic for the cataract surgery to be finished. Only the retrobulbar anesthesia group experienced anesthesia-related chemotherapy, periorbital hematoma, and subconjunctival hemorrhage, and these complications never resulted in the intended surgical operation being completely canceled or significantly delayed.

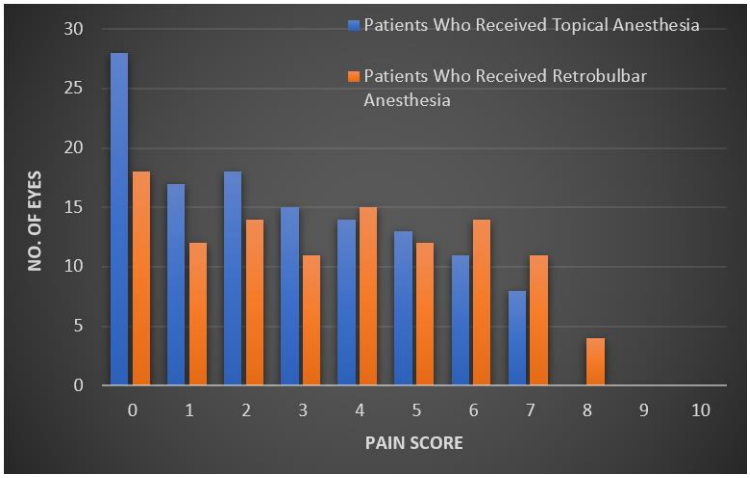

Figure 3: Pain scores of our study patients

Figure 3 reported the pain scores by the patients after surgery using a 10-point scale to rate the level of pain felt during the operation, including the pain felt after surgery. Twenty eight patients (93%) in the topical anesthesia group and 60% in the retrobulbar anesthesia group reported no pain at all (a score of 0). The mean±SD pain score in the topical anesthesia group was 0.86 ± 1.20 (range, 0-7), while in the retrobulbar anesthesia group, it was 0.71 ± 1.40 (range, 0-8). The difference between the mean pain scores was not statistically significant (*P* = 0.141).

Table 3: Distribution of participants by Anesthetic-Related Intraoperative Difficulties

Intraoperative difficulties	Group A		Group B		P-value
	(n = 30)	P (%)	(n = 30)	P (%)	
None	19	63.33	15	50.00	0.104
Slightly difficult	5	16.67	6	20.00	
Moderately difficult	4	13.33	5	16.67	
Extremely difficult	2	6.67	4	13.33	

Table 3 shows the intraoperative difficulties as judged by the surgeon. In most patients in both groups, the surgeon reported no difficulty (63.33% in group A and 50% in group B), followed by slight difficulty (16.67% & 20% in groups A & B respectively).

DISCUSSION

The first successful use of topical anesthesia for cataract extraction was reported by Knapp in 1884 [28]. He used frequent drops of 5% cocaine. Topical anesthesia has been used recently for strabismus surgery [29]. Shule reported the use of topical anesthesia without intravenous sedation for phacoemulsification cataract extraction with intraocular lens implantation in a patient with a history of retrobulbar hemorrhage [30]. He advocated the use of topical anesthesia in such patients with a high risk of complications associated with needle anesthesia. Kershner evaluated 100 patients undergoing cataract extraction under topical anesthesia and concluded that topical anesthesia was safe, decreased intraoperative and postoperative complications, and allowed rapid return of vision [31]. However, when Fukasaku and Marron compared topical anesthesia with retrobulbar anesthesia, they found more intraoperative pain with the topical technique. They discovered that a sub-Tenon method in the superior temporal region with local anesthetic provided better intraoperative pain control than topical anesthesia. Fukasaku and Marron didn't discuss preoperative patient counseling or intravenous sedation [32]. Stevens has advocated one quadrant sub-Tenon infiltration anesthesia in preference to retrobulbar or peri-bulbar anesthesia [33]. However, he noted more conjunctival chemosis than usually seen with peribulbar or retrobulbar anesthesia. Subconjunctival hemorrhage extending to more than one quadrant occurred in 32% of his patients, and 46% required an additional Van Lint facial block immediately before surgery [33]. Advantages of his technique include reduced likelihood of injury to the vortex vein in the inferior nasal quadrant where the vortex vein is more posteriorly situated than the inferior temporal quadrant, avoidance of damage to the superior conjunctiva, delivery of adequate anesthesia, and akinesia [33]. There is a risk of hemorrhage, especially in patients receiving anticoagulants. In addition, there is a theoretical risk of spread of infection via the conjunctival and sub-Tenon incision to the retrobulbar space [25].

Topical anesthetic virtually decreases the risk of major conjunctival chemosis, optic nerve injury, globe perforation, retrobulbar hemorrhage, and dural perforation. Hemorrhage beneath the conjunctiva is uncommon [25]. The topical technique appears to provide acceptable analgesia during surgery, wears off rapidly after surgery, and does not interfere with the patient's ability to blink, see, or move the eye. Patients can follow commands, and the ability to move the eyeball in the desired position was found to be useful. Movement of the eyeball is rarely a problem. Usually, no patch is required as the corneal sensation recovers rapidly and there is no ptosis. Patients are therefore able to see immediately after the surgery [25].

Our data showing 10% of capsular tears, and 6.67% vitreous loss is well within the range of levels of complications reported in other series of non-selected cases [34-36]. The incidences of intraoperative complications and early postoperative problems and their correlation to potential risk factors are broadly comparable with those found in other series.

Anesthesia-related complications prevailed, as expected, in the retrobulbar group. Chemosis, subconjunctival hemorrhage, and periorbital hematoma were exclusively observed in the retrobulbar anesthesia group. However, these adverse events were of no substantial clinical concern since in no patient was the planned surgical intervention prevented or delayed.

Between our study groups, however, we did not observe any statistically significant difference for supplemental para-ocular anesthetic injection. Likewise, the pain scores reported by patients immediately after completion of surgery did not differ significantly between the groups. This similarity between the mean pain scores of the 2 study groups was not observed in any previous studies [37,39].

Compared to retrobulbar anesthesia, topical anesthetic provides better surgical conditions for the surgeon and more comfortable operating settings for the patient, even in severe situations with ocular comorbidities. This study demonstrates that difficult cataract surgery can be conducted under topical anesthetic while maintaining procedural safety. While surgery-related complications under topical anesthesia were comparable to those found with retrobulbar injections, anesthesia-related difficulties were only observed in the retrobulbar-injected group. Although the findings of pain evaluation during anesthetic delivery preferred the topical approach, there was no statistical difference in patient pain assessments during and shortly after anesthesia between the topical and retrobulbar groups.

However, we believe that topical anesthesia is justified to improve the safety and comfort of the patient even in complicated cases of cataract surgery and is likely to become the preferred type of anesthesia in small-incision phacoemulsification and foldable IOL implantation, particularly for so-called high-volume surgeons.

Limitations of the study

Our study was a single-center study. We took a small sample size due to our short study period. After evaluating those patients, we did not follow up with them for the long term and do not know other possible interference that may happen in the long term with these patients.

CONCLUSION AND RECOMMENDATIONS

In conclusion, topical anesthetic, as opposed to retrobulbar anesthesia, offers the surgeon good surgical conditions and comfortable operating circumstances for the patient, even in challenging instances with related ocular comorbidities. According to this study, complex cataract surgery can be carried out under local anesthesia without posing a risk to patient safety. Although complications linked to surgery under topical anesthetic were comparable to those arising from retrobulbar injections, anesthesia-related complications were observed only in the group receiving retrobulbar injections. The topical technique was preferred in the pain evaluation findings during anesthetic delivery; however, there was no statistical difference in the pain assessments made by patients during and shortly after anesthesia between the retrobulbar and topical groups.

So further study with a prospective and longitudinal study design including a larger sample size needs to be done to validate the findings of our study.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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