

## Original research article

## A Comparison of Patient Pain and Visual Result Following Cataract Surgery Utilizing Topical Anaesthetic Versus Regional Anaesthesia: Comparative Study

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### Abstract

**Aim:** A comparison of patient pain and visual outcome using topical anesthesia versus regional anesthesia during cataract surgery.

**Methods:** This comparative study was done at the Department of Ophthalmology, Patna Medical College and Hospital, Patna, Bihar, India for 13 months and patients enrolled for the study were operated at Drishtikunj Netralaya, Patna and Phulwari Eye Hospital, Patna.

**Results:** 100 patients (mean age  $73.5 \pm 7.2$  years) received topical anesthesia, 100 patients (mean age  $70.5 \pm 9.4$  years) received sub-Tenon anesthesia, and 100 patients (mean age  $71.5 \pm 8.8$  years) received intracameral anesthesia. There was a significant difference in mean age between the topical group and sub-Tenon group ( $P=0.032$ ). The mean pain score on the visual pain scale in the sub-Tenon group was significantly lower than that in the topical group ( $P=0.0007$ ) and in the intracameral group ( $P=0.0051$ ). There were no statistical differences in mean pain score between the topical and intracameral groups ( $P=0.85$ ). In our study, 70 patients received bilateral cataract surgery and 115 patients received unilateral surgery. The mean pain score was 0.435 in 70 eyes of 70 patients who received bilateral surgery and 0.478 in 115 patients who received unilateral surgery. There was no significant difference in mean pain score between the two groups ( $P=0.44$ ). 50 patients showed high myopia ( $>-6D$ ). In 50 myopic eyes, there were no significant differences in age, duration of surgery, visual acuity, and mean percentage of corneal endothelial cell loss between the three groups (topical, sub-Tenon, and intracameral). The mean pain score in the sub-Tenon group was significantly lower than that in the topical and intracameral groups ( $P=0.0027$  and  $P=0.0022$ , respectively). However, in 250 eyes without high myopia ( $<-6D$ ), there were no significant differences in mean pain score between the sub-Tenon and intracameral groups ( $P=0.15$ ).

**Conclusion:** Intracameral lidocaine provides sufficient pain suppressive effects in eyes without high myopia, while sub-Tenon anesthesia is better for cataract surgery in eyes with high myopia.

**Keywords:** cataract, anesthesia, topical, intracameral, sub-Tenon

## Introduction

Cataract surgery is the most common eye surgery with excellent and exceptionally cost-effective outcomes, second only to vaccination.<sup>1</sup> It is also one of the commonest surgical procedure worldwide.<sup>2</sup> Phacoemulsification and Manual Small Incision Cataract Surgery (MSICS) are the two most popular and comparable methods of removal of cataract (combined with implantation of Intra Ocular Lens) which provide complete rehabilitation of these patients.<sup>3</sup> Both can be done under topical anesthesia,<sup>4</sup> which is the anesthesia of choice due to least complications and being patient friendly when compared to contemporary techniques like Peribulbar, Retrobulbar, Sub-tenon, and sub conjunctival anesthesia.<sup>5</sup> Cataract surgery under topical anesthesia is less painful with better patient comfort when augmented with intracameral anesthesia using Lignocaine 0.5–1% solution.<sup>6</sup>

However, Lignocaine is known to have dose related toxicity to corneal endothelium.<sup>7</sup> The studies have concluded that the Ropivacaine is safer than Lignocaine on tissue and a comparatively lower dose is effective and less toxic.<sup>8</sup> In comparison to Lignocaine a novel anesthetic agent, Ropivacaine is safer and equally effective local anesthetic agent when compared to Lignocaine for local anesthesia during intraocular surgery.<sup>8-10</sup> It has also been evaluated for toxicity to corneal endothelium, in vitro and animal studies.<sup>7,8,11,12</sup> It is also known that the intracameral injection of anesthetic agents can percolate into the vitreous cavity and cause toxicity to the retina,<sup>13</sup> thus the relative safety of Ropivacaine to retinal tissue<sup>9,14</sup> is also a relevant issue when being used as an intracameral anesthesia agent.

## Material and Methods

This comparative study was done the Department of Ophthalmology, Patna Medical College and Hospital, Patna, Bihar, India for 13 months and patients enrolled for the study were operated at Drishtikunj Netralaya, Patna and Phulwari Eye Hospital, Patna. Study was conducted after taking the approval of the institutional ethics committee.

Prior to the surgery, all patients underwent comprehensive ophthalmologic evaluations. This included standardized refraction and measurement of best-corrected visual acuity (BCVA) using a Landolt ring, slit-lamp biomicroscopy, and specular microscopy. Written informed consent was obtained from every patient participating in this study.

All the groups underwent identical preoperative preparation with 0.4% oxybuprocaine hydrochloride, 4% lidocaine, tropicamide, and phenylephrine hydrochloride 60 minutes prior to surgery. Six trained ophthalmologists performed all the surgical procedures, including the administration of local anesthesia. The topical group received drops of 4% lidocaine instilled at the start of surgery. The anesthetic agent used was 1 mL of 2% intravenous lidocaine for the sub-Tenon group, and a purpose-designed sub-Tenon's cannula was used to instill the agents. Patients in the intracameral group also received drops of 4% lidocaine instilled at the start of surgery. At the start of the surgery, an infusion of 0.1–0.2 cc of 1% preservative-free lidocaine was infused into the anterior chamber through the side port before the chamber was filled with viscoelastic materials. No general or preoperative sedation or other anesthesia was used in all groups.

All patients underwent surgery using the same technique. A 2.2 mm groove was made in the sclera or clear cornea. Continuous curvilinear capsulorhexis with capsule forceps was performed followed by hydro dissection of the lens with balanced salt resolution. All patients received a foldable acrylic lens. No wound sutures were required for any of the patients. Complicated surgeries, such as posterior capsule rupture or zonular dialysis, were excluded

from this study. In cases where patients claimed unbearable pain, an additional sub-Tenon injection of 2% lidocaine was administered.

The patients were asked within 5 minutes after the surgery to grade the pain experienced during surgery on an analog scale. Pain was graded on a linear scale from 0 to 2 (grade 0= no pain, grade 1=mild pain, and grade 2= severe pain). Independent nurses asked the patients to provide a pain score in a separate room. The patients were followed up for at least 3–4 weeks after the surgery, and corneal endothelial damage and BCVA were evaluated. The statistical differences in pain score, visual outcome, and corneal endothelial damage between the three groups were evaluated.

Data are expressed as mean±standard deviation. All BCVA measurements were converted to logarithm of the minimum angle of resolution equivalents for statistical analyses. Analysis of variance and Tukey–Kramer method were used to compare ophthalmic data between the three groups (topical, sub-Tenon, and intracameral anesthesia). Significance was defined as  $P < 0.05$ , and all statistical analyses were performed using R software (Version 3.1.3; R Foundation, Vienna, Austria).

## Results

300 eyes were included in this study. 100 patients (mean age  $73.5 \pm 7.2$  years) received topical anesthesia, 100 patients (mean age  $70.5 \pm 9.4$  years) received sub-Tenon anesthesia, and 100 patients (mean age  $71.5 \pm 8.8$  years) received intracameral anesthesia. None of the patients required additional anesthesia during the surgery. There was a significant difference in mean age between the topical group and sub-Tenon group ( $P = 0.032$ ; Table 1).

Additionally, the baseline BCVA in the topical group was significantly better than that in the sub-Tenon group ( $P = 0.027$ ). However, there were no significant differences in visual outcome after the surgery between the three groups. Table 1 shows the mean corneal endothelial cell count. The reduction in endothelial cell count was 7.8% in the topical anesthesia group, 7.8% in the sub-Tenon group, and 8.7% in the intracameral anesthesia group. The change in endothelial cell density was not significantly different between the three groups. The mean pain score on the visual pain scale in the sub-Tenon group was significantly lower than that in the topical group ( $P = 0.0007$ ) and in the intracameral group ( $P = 0.0051$ ). There were no statistical differences in mean pain score between the topical and intracameral groups ( $P = 0.85$ ).

In our study, 70 patients received bilateral cataract surgery and 115 patients received unilateral surgery. The mean pain score was 0.435 in 70 eyes of 70 patients who received bilateral surgery and 0.478 in 115 patients who received unilateral surgery. There was no significant difference in mean pain score between the two groups ( $P = 0.44$ ).

Table 2 shows the characteristics and pain score of 130 first eyes that underwent cataract surgery. A subgroup analysis showed that the mean pain score in the sub-Tenon group was significantly lower than that in the topical group ( $P = 0.016$ ). The intracameral anesthesia group showed no statistically significant difference compared with sub-Tenon and topical anesthesia groups ( $P = 0.062$  and  $P = 0.79$ , respectively). In 115 first eyes of 115 patients who received unilateral surgery, the mean pain score was 0.435 (Table 3). There was no significant difference in mean pain score between the bilateral and unilateral groups ( $P = 0.44$ ).

the average of pain scores in patients with and without high myopia. 50 patients showed high myopia ( $> -6D$ ). In 50 myopic eyes, there were no significant differences in age, duration of

surgery, visual acuity, and mean percentage of corneal endothelial cell loss between the three groups (topical, sub-Tenon, and intracameral). The mean pain score in the sub-Tenon group was significantly lower than that in the topical and intracameral groups ( $P=0.0027$  and  $P=0.0022$ , respectively). However, in 250 eyes without high myopia ( $<-6D$ ), there were no significant differences in mean pain score between the sub-Tenon and intracameral groups ( $P=0.15$ ). There were no significant differences in baseline characteristics and visual outcome between the three groups.

**Table 1: Baseline demographics and ophthalmic examination data of patients who underwent cataract surgery**

	Topical	Sub-Tenon	Intracameral	P-value
Eyes, n	100	100	100	–
Male/female, n	40/60	50/50	45/55	–
Age (years), mean $\pm$ SD	73.5 $\pm$ 7.2	70.5 $\pm$ 9.4	71.5 $\pm$ 8.8	0.032
BCVA before surgery (LogMAR), mean $\pm$ SD	0.242 $\pm$ 0.215	0.373 $\pm$ 0.473	0.282 $\pm$ 0.321	0.027
BCVA after surgery (LogMAR), mean $\pm$ SD	0.025 $\pm$ 0.142	0.047 $\pm$ 0.354	0.007 $\pm$ 0.231	0.16
Mean operative time (min)	8.6	9.9	9.3	0.015
Pain score, n				
Grade 0	45	70	50	–
Grade 1	50	28	48	–
Grade 2	5	2	2	–
Mean pain score	0.511	0.222	0.536	0.0003
Mean endothelial cell count (cells/mm <sup>2</sup> )				
Preoperative	2616	2521	2611	0.48
Postoperative	2425	2352	2369	0.83
Mean cell loss (%)	7.8	7.8	8.7	0.95

**Abbreviations:** SD, standard deviation; BCVA, best-corrected visual acuity; LogMAR, logarithm of the minimum angle of resolution; min, minutes.

**Table 2: Ophthalmic examination data of first eyes of patients who underwent cataract surgery**

	Topical	Sub-Tenon	Intracameral	P-value
Eyes, n	63	53	44	–
Age (years), mean $\pm$ SD	73.5 $\pm$ 7.2	70.2 $\pm$ 9.5	71.3 $\pm$ 9.5	0.042
BCVA before surgery (LogMAR), mean $\pm$ SD	0.250 $\pm$ 0.222	0.413 $\pm$ 0.487	0.358 $\pm$ 0.353	0.086
BCVA after surgery (LogMAR), mean $\pm$ SD	0.017 $\pm$ 0.158	0.007 $\pm$ 0.258	0.035 $\pm$ 0.254	0.50
Pain score, n				
Grade 0	30	38	25	–
Grade 1	29	15	18	–
Grade 2	4	0	1	–
Mean pain score	0.524	0.268	0.520	0.012

**Abbreviations:** SD, standard deviation; BCVA, best-corrected visual acuity; LogMAR, logarithm of the minimum angle of resolution

**Table 3: Detailed characteristics of 160 first eyes of patients**

	<b>Bilateral</b>	<b>Unilateral</b>	<b>P-value</b>
Eyes, n	70	115	–
Age (years), mean±SD	71.3±9.5	72.0±8.4	0.54
BCVA before surgery (LogMAR), mean±SD	0.258±0.316	0.374±0.410	0.034
BCVA after surgery (LogMAR), mean±SD	0.031±0.188	0.034±0.231	0.041
Anesthesia, n			
Topical	25	60	–
Sub-Tenon	32	29	–
Intracameral	13	26	–
Mean pain score	0.435	0.478	0.44

## Discussion

To the best of our knowledge, this is the first study to compare the efficacy of three types of anesthesia (topical, sub-Tenon, and intracameral) during cataract surgery. In the present study, all types of anesthesia provided good patient comfort, as none of the patients required additional anesthesia during surgery. Additionally, no complications caused by anesthesia were noted in any of the patients. There were no differences in visual outcome and corneal endothelial cell loss between the groups. The mean percentage of corneal endothelial loss in all patients was 8.2%, and this result is almost similar to previous studies.<sup>15,16</sup> The duration of surgery was shortest in the topical group; this may be because the anesthetic procedure is simpler and easier than sub-Tenon and intracameral anesthesia.

Several studies have reported almost no differences in mean pain scores between intracameral lidocaine and placebo in patients undergoing cataract surgery under topical anesthesia.<sup>17-19</sup> Most statistical analyses did not yield strong data supporting the efficacy of additional intracameral anesthesia during phacoemulsification under topical anesthesia. However, Ezra et al.<sup>20</sup> reported a statistically significant benefit from the use of this technique. In our study, there were no statistically significant differences in pain scores during surgery between the topical and intracameral lidocaine groups (mean pain score 0.524 and 0.520, respectively). Pain scores using both anesthesia techniques were consistently low; 90% of patients scored pain as grade 1 or 0. It is possible that topical anesthesia alone is sufficiently effective and the additional benefit with intracameral anesthesia is minimal.

Our findings indicate that sub-Tenon anesthesia in cataract surgery can suppress patient pain better than topical and intracameral anesthesia. The patients in the sub-Tenon group showed remarkable results in terms of the apparent painlessness of the surgery. Almost no pain was reported in 70 out of 100 eyes (70%) during surgery. In particular, in eyes with high myopia, sub-Tenon anesthesia provided reasonable suppression of intraoperative pain compared with topical and intracameral anesthesia. This result suggests that intracameral lidocaine does not provide sufficient pain suppression in eyes with high myopia because of the thinly stretched Zinn's zonules and the underdeveloped ciliary body. However, in eyes without high myopia, there were no significant differences in mean pain score between sub-Tenon and intracameral anesthesia. Intracameral lidocaine combined with topical anesthesia was not inferior to sub-Tenon anesthesia in regular refraction eyes.

In the present study, 115 patients received bilateral cataract surgery and 70 patients received unilateral surgery. Roxana et al.<sup>21</sup> reported that there was a subtle increase in pain during cataract surgery in the second eye relative to the first. The result of our subgroup analysis restricted to first 185 eyes also showed no significant differences in mean pain score between

sub-Tenon and intracameral anesthesia. Additionally, there was no significant difference in mean pain score between the two groups who received bilateral or unilateral surgery. We evaluated pain only during surgery; the pain during instillation of anesthesia and anxiety from visual light should be evaluated separately. It is possible that patients included the pain on injection of anesthetic agents in the pain score. In previous studies,<sup>22</sup> balanced salt solution was used to compare local and topical anesthesia. Using a placebo may be preferable in order to obtain an accurate comparison of anesthetic effect.

### Conclusion

Intracameral lidocaine provides sufficient pain suppressive effects in eyes without high myopia, while sub-Tenon anesthesia is better for cataract surgery in eyes with high myopia.

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