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Study of Complications in Anaesthesia in Ophthalmology

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Abstract:

- ***Background:***

Cataract is the leading cause of curable blindness, with surgery being the most common ophthalmic procedure in older adults. Anaesthetic options include topical, local, and general techniques, each with distinct risks. This study evaluated anaesthesia-related complications in ophthalmic surgeries at a tertiary care centre in India.

- ***Methods:***

A prospective study was conducted from June 2023 to May 2025 on 384 patients aged ≥18 years undergoing ophthalmic surgery under topical, local, or general anaesthesia. Data on demographics, anaesthesia type, and complications were analysed using descriptive statistics and Chi-square tests ($p < 0.05$).

- ***Result:***

Most patients were >60 years (62.8%), female (52.6%), and rural residents (68.5%). Local anaesthesia was used in 67.2% of cases, topical in 20.1%, and general in 12.7%. Local anaesthesia caused minor complications, topical mainly mild discomfort, and general rare issues like delayed recovery and nausea.

- ***Conclusions:***

Local anaesthesia is the preferred and safe choice, topical is a suitable alternative, and general is reserved for select cases.

Keywords: *Ophthalmic Anaesthesia, Cataract Surgery, Complications.*

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I. INTRODUCTION

Cataract is a leading cause of curable blindness and the second most common treatable form worldwide, with rising incidence and surgery now the most common procedure in those over 60.[1]

WHO's Vision 2020 aimed to eliminate avoidable blindness, with key steps including PAHO's 2009 plan, the 2014–2019 regional strategy, and a 2017 program in 56 countries.[2] The global number of ophthalmologists has grown by 2.6% annually, with improved cataract surgical rates and a 28.5% reduction in age-standardized blindness prevalence (1.85% in those 50+) from 1990 to 2020.[3,4,5]

In India, cataracts cause 80% of blindness, with 3.8 million new cases yearly against 5 million surgeries and a 10 million backlog.[1]

- *Cataract Can be Removed by:*
- Intra Capsular Cataract Extraction
- Extra Capsular Cataract Extraction

MSICS is now recognized globally as a viable, often preferable, alternative to phacoemulsification. It shares many steps with phaco, easing the learning curve, and allows surgeons to convert to a sutureless MSICS if phaco fails.[6]

In developed countries, phacoemulsification with PCIOL is the gold standard, used in 86% of US cataract surgeries, and is growing in popularity in developing nations.[7]

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Ocular surgery once relied solely on general anaesthesia. Topical anaesthesia began in 1884 with 4% cocaine, and local anaesthesia was introduced in 1936. To reduce retrobulbar risks, peribulbar techniques emerged, and surgeries shifted from inpatient to cost-effective day-care procedures.[8,9,10]

The rise in patients on anticoagulants and antiplatelets has increased the use of topical anaesthesia due to lower bleeding risk, yet data on its real-world outcomes in India remain limited.[11,12]

The purpose of this study is to analyse the complications associated with different types of anaesthesia used in ophthalmic surgeries. It aims to evaluate the incidence, nature, and trends of these complications across various anaesthetic techniques—topical, local, and general—within a large patient population in an Indian ophthalmology network. By understanding these patterns, the study seeks to contribute valuable insights into improving the safety and efficacy of anaesthesia practices in ophthalmology.

II. METHODOLOGY

➢ *Study Design and Sample Size:*

This prospective interventional hospital-based study was conducted in the Department of Ophthalmology at a tertiary care centre from June 2023 to May 2025. It included patients aged 18 years or older undergoing ophthalmic surgery under topical, local, or general anaesthesia after obtaining informed consent, while patients below 18 years of age or those unwilling to participate were excluded. The sample size was calculated to be 384 patients based on the estimated incidence of cataract and the allowable error.

➢ *Ethical Approval:*

Ethical approval was secured from the institutional ethics committee, and written informed consent was obtained from all participants. All data were handled with strict confidentiality.

➢ *Inclusion Criteria:*

Patients who are willing to participate in the study and provide written consent, either personally or through a legal guardian.
All patients undergoing any type of anesthesia.

➢ *Exclusion Criteria:*

Patients <18 years or unwilling to participate.

➢ *Data Collection & Follow-Up:*

Data collected included patient demographics, comorbidities, type of anaesthesia administered, and anaesthesia-related complications during both intraoperative and postoperative periods.

➢ *Statistical Analysis:*

Statistical analysis was performed using descriptive statistics, and the Chi-square test was applied for categorical variables, with a p-value of less than 0.05 considered statistically significant.

III. RESULTS

Table.1 Demographic Profile of Study Participants

Variable	Category	Number (n=384)	Percentage (%)
Age group	≤40 years	38	9.9
	41–60 years	105	27.3
	>60 years	241	62.8
Gender	Male	182	47.4
	Female	202	52.6
Residence	Rural	263	68.5
	Urban	121	31.5

Of the 384 patients included in the study, the age range was 18–85 years, with a majority in the >60 years age group (62.8%), followed by those aged 41–60 years (27.3%), and ≤40 years (9.9%).

There was a slight female predominance with 202 females (52.6%) and 182 males (47.4%).

Most patients were from rural areas (68.5%), while the remaining 31.5% were from urban areas. Rural patients generally presented with advanced stages of cataract compared to urban patients. (Table 1).

Table.2 Distribution of Anaesthesia Types

Anaesthesia Type	Number of Cases (n=384)	Percentage (%)
Local	258	67.2
Topical	77	20.1
General	49	12.7

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Local anaesthesia was the most common technique (67.2%), followed by topical anaesthesia (20.1%) and general anaesthesia (12.7%). (Table 2).

Table.3 Anaesthesia-Related Complications

Complication	Local Anaesthesia (n=258)	Topical Anaesthesia (n=77)	General Anaesthesia (n=49)
Chemosis	12 (4.6%)	–	–
Subconjunctival haemorrhage	9 (3.5%)	–	–
Transient ptosis	7 (2.7%)	–	–
Increased IOP	5 (1.9%)	–	–
Retrobulbar haemorrhage	1 (0.037%)	–	–
Lid haematoma	1 (0.017%)	–	–
Mild discomfort	–	5 (6.5%)	–
Tooth damage	–	–	1 (0.076%)
Delayed recovery	–	–	1 (0.057%)
Postoperative nausea/vomiting	–	–	2 (4.0%)

Local anaesthesia was mainly associated with minor complications such as chemosis, subconjunctival haemorrhage, transient ptosis, and raised intraocular pressure. Rare but serious events included retrobulbar haemorrhage (0.037%) and lid haematoma (0.017%).

General anaesthesia complications included tooth damage (0.076%), delayed recovery (0.057%), and occasional postoperative nausea/vomiting. Topical anaesthesia had the lowest complication rate, with mild discomfort being the most common (Table 3).

➢ *Trends in Anaesthesia Use*

Institutional data comparison (2013–2020) indicated:

- Decline in local anaesthesia use from 83.48% to 53.36%.
- Increase in topical anaesthesia use from 8.61% to 32.42%.
- General anaesthesia use remained steady for specific cases such as paediatric and complex surgeries.

IV. DISCUSSION

This study analysed demographics, anaesthesia patterns, and complications in ophthalmic surgeries, comparing results with existing literature.

➢ *Age & Gender*

Most patients were >60 years, similar to Gadkari SS et al. (2016)[13] and Kim J et al. (2019) [14], confirming cataract's age-related pattern. A slight female predominance was observed, in line with Singh S et al. (2021) [15], though Ponto KA et al. (2015) [16] reported near-equal distribution and Gadkari found male predominance, suggesting regional variation.

➢ *Risk Factors*

Diabetes (35.9%), tobacco use (31.1%), and hypertension (14.3%) were leading comorbidities. Singh S et al. [15] found tobacco use most common, but both studies highlight these three as dominant risk factors, with prevalence differing by region and lifestyle.

➢ *Rural–Urban*

Rural patients formed 60% of cases, similar to Singh S et al. (2021) [15], who reported 62.7%, supporting the consistent rural predominance and delayed presentation due to healthcare access gaps.

➢ *Anaesthesia Use*

Local anaesthesia predominated (89.1%), aligning with Eke T et al. (2008) [17], (92.1%) but higher than Kauser D et al. (2024) [18], (67.2%). Topical use was 7.8%, lower than Kauser's 20.1%, suggesting regional differences in adoption. General anaesthesia (3.1%) was lower than Kauser's 12.7%, reflecting more selective use here.

➢ *Pain Scores*

General anaesthesia eliminated pain, while topical had the highest mean scores, matching Guay J et al. (2015) [19] findings. Sub-Tenon's and retrobulbar blocks provided better control than topical, in agreement with Briggs MC et al. (1997).[20]

➢ *Repeat Injections*

Peribulbar blocks required the most repeats (7.2%), lower than Alhassan MB et al. (2015) [21] (19.6%) but still confirming peribulbar's higher re-injection tendency compared to retrobulbar and Sub-Tenon's.

➢ *Complications*

Local anaesthesia had minor issues (chemosis 5.46%, lid haematoma 2.08%) and rare major events, similar to Eke T et al.[17] and Kauser D et al.[18] Sub-Tenon's remained safest. General anaesthesia complications were minimal (delayed recovery 7.7%), aligning with Kauser's findings of <0.1% for serious events. Topical anaesthesia showed no major complications, consistent with Kauser and Ajay K et al. (2021). [22]

➢ *Overall*

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Findings support literature trends—local anaesthesia remains the standard, topical is safe and growing in select centres, and general anaesthesia is reserved for specific patient groups. Variations largely reflect regional practice patterns, patient selection, and institutional protocols.

V. CONCLUSION

Local anaesthesia remains the preferred choice for cataract surgery due to its safety and efficacy, while topical anaesthesia is a safe alternative for selected cases. General anaesthesia is reserved for specific indications and shows low complication rates. Older age, rural residence, and comorbidities like diabetes and hypertension were common, with trends consistent with previous studies.

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