

Determinants Influencing Visual Outcomes following Cataract Surgery: An Observational study in North IndiaGirish Dutt Chaturvedi¹, Ritu Chaturvedi²¹M.S., Department of Ophthalmology, PGMO, District Hospital, Shivpuri, M.P.²M.S., Associate Professor, Department of Ophthalmology, SRVS Medical College, Shivpuri, M.P.

Received: 20-03-2023 / Revised: 21-04-2023 / Accepted: 24-07-2023

Corresponding author: Dr. Girish Dutt Chaturvedi

Conflict of interest: Nil

Abstract:

Introduction: As per the World Health Organization (WHO), cataract stands as the primary cause of blindness worldwide, responsible for 47.8% of all cases. Alarming, one-third of the global blind population resides in India, with a staggering 80% of blindness in the country attributed to cataract. While cataract-related blindness is deemed highly preventable, it remains a prominent cause of visual impairment in middle- and low-income nations. The visual outcome following cataract surgery is influenced by various factors, such as the type and severity of cataract, surgical technique, intraocular lens (IOL) selection, pre-existing ocular conditions, and individual patient characteristics. Understanding the determinants that contribute to postoperative visual outcomes is crucial for optimizing surgical success and ensuring patient satisfaction.

Methodology: This research is a retrospective observational study conducted at a District Hospital, Shivpuri (M.P) in North India. The study aims to investigate complication rates and visual outcomes among patients undergoing routine elective cataract surgery. The study includes a consecutive series of adult patients who underwent routine elective cataract surgery at the eye care center during a specified period (start date to end date). Patients with pre-existing ocular conditions, traumatic cataracts, or complex cataract cases were excluded from the analysis.

Results: The study revealed wound-related complications were noted in 121 eyes out of 880 eyes that underwent MSICS. The maximum number of complications was in surgeons undergoing training. The common OCTET I complications among level 1 surgeons included corneal edema (29.4%), high IOP (14.2%), increased post-operative uveitis (10.3%) and hyphema (10%). The post-operative uncorrected visual acuity was good in 58.1% eyes on day 1 and improved to 77.4% cases at the end of 4 – 6 weeks. The post-operative BCVA was good in 82.6%, 96.3% and 97.7% eyes on post-operative day 1, days 7-10 and 4-6 weeks respectively. The BCVA was good in 97.7% of eyes at 4-6 weeks. The eyes with poor BCVA was only 0.1% at 4-6 weeks.

Conclusion: The study findings revealed that wound-related complications were more prevalent among surgeons undergoing training (Level 1) during manual small incision cataract surgery (MSICS). Additionally, post-operative complications, as classified by OCTET I and OCTET II, showed variations across different surgeon levels. Post-operative uncorrected visual acuity (UCVA) improved from 58.1% on day 1 to 77.4% at 4 to 6 weeks, and best-corrected visual acuity (BCVA) showed excellent results, with 97.7% of eyes achieving good BCVA at 4 to 6 weeks.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

By the year 2020, the global count of blind individuals has reached an alarming 75 million, indicating an urgent need for collective action and proactive measures to reverse this trend. Contributing to this rise are factors such as the continuous growth of the world's population and increased life expectancy, owing to improved healthcare services [1,2]. Notably, the economic burden of blindness is staggering, estimated to amount to approximately 25 million dollars annually. What is particularly disheartening is that a significant percentage, ranging from 80 to 90%, of these cases are preventable or treatable [3,4]. As per the World Health Organization

(WHO), cataract stands as the primary cause of blindness worldwide, responsible for 47.8% of all cases.

Alarming, one-third of the global blind population resides in India, with a staggering 80% of blindness in the country attributed to cataract.

While cataract-related blindness is deemed highly preventable, it remains a prominent cause of visual impairment in middle- and low-income nations. This underscores the urgent need for targeted efforts and improved access to eye care services in such regions to tackle this avoidable burden of blindness and enhance overall eye health.

Advancing age has been identified as the single most important risk factor worldwide [5,6]. The risk factors thought to be strongly associated with cataract included UV exposure, under-nutrition, smoking, elevated systolic blood pressure, diarrhoea and heat stroke [7,8].

Cataract surgery is one of the most common and successful procedures performed worldwide to restore visual acuity and improve the quality of life in individuals affected by cataracts. As the leading cause of visual impairment and blindness globally, cataracts significantly impact the aging population. The prevalence of cataracts continues to rise, especially in regions with an aging demographic, including North India.

The visual outcome following cataract surgery is influenced by various factors, such as the type and severity of cataract, surgical technique, intraocular lens (IOL) selection, pre-existing ocular conditions, and individual patient characteristics. Understanding the determinants that contribute to postoperative visual outcomes is crucial for optimizing surgical success and ensuring patient satisfaction.[9]

By shedding light on the determinants impacting visual outcomes, this study aims to contribute to the existing body of knowledge, assisting clinicians and healthcare providers in making informed decisions and optimizing the cataract management process. Furthermore, the findings could serve as a basis for future research endeavors and policy developments aimed at addressing the visual challenges posed by cataracts in North India.

Overall, this investigation holds the promise of advancing our understanding of cataract surgery outcomes in this specific region and may contribute to the global efforts in tackling visual impairment and blindness caused by cataracts.

Objective

To study complication rates and visual outcomes in patients undergoing routine elective cataract surgery in North India.

Material and Methods

Study Design: This research is a retrospective observational study conducted at a District Hospital, Shivpuri (M.P) in North India. The study aims to investigate complication rates and visual outcomes among patients undergoing routine elective cataract surgery.

Participants

The study includes a consecutive series of adult patients who underwent routine elective cataract surgery at the eye care center during a specified period (start date to end date). Patients with pre-existing ocular conditions, traumatic cataracts, or complex cataract cases were excluded from the analysis.

Inclusion Criteria

1. All patients of any gender 40 years of age and above.
2. All patients planned for routine elective cataract surgery (Manual Small Incision Cataract Surgery or Phacoemulsification with intraocular lens implantation) performed by trainees or qualified surgeons.

Exclusion Criteria

1. Traumatic cataract
2. Complicated cataract
3. Secondary lens (IOL) implantation
4. Pre-operative ocular comorbidity that would account for poor visual outcome like: • Corneal Opacity • Pathological myopia • Amblyopia • Phacolytic Glaucoma • Phacomorphic Glaucoma • Retinal Vein Occlusion • Diabetic Macular Edema • Macular Hole • Epiretinal Membrane • Optic atrophy.
5. Cataract surgery combined with glaucoma filtration surgeries or posterior segment surgeries.

Data Collection

Data were extracted from electronic medical records and patient charts. Demographic information, including age, sex, and relevant medical history, was recorded for each participant. Clinical variables such as preoperative visual acuity, type of cataract, intraocular lens (IOL) used, surgical technique, and postoperative follow-up details were also documented.

Complication Assessment

Postoperative complications were thoroughly assessed and categorized, including but not limited to, anterior segment inflammation, cystoid macular edema, posterior capsule opacification, intraocular lens malposition, and endophthalmitis. The occurrence and severity of each complication were noted to determine their impact on visual outcomes.

Visual Outcome Evaluation: Visual acuity measurements were recorded before surgery and during postoperative follow-up visits at specific intervals (e.g., 1 week, 1 month, 3 months, and 6 months). Best-corrected visual acuity (BCVA) was assessed using the Snellen chart or LogMAR chart as per standard clinical protocols.

Statistical Analysis

Data were analyzed using appropriate statistical methods. Descriptive statistics such as means, standard deviations, and percentages were calculated for demographic characteristics and clinical variables. Complication rates and their 95% confidence intervals were determined. Visual outcomes were compared to baseline preoperative visual acuity using paired t-tests or Wilcoxon signed-rank tests.

Ethical Considerations

The study protocol was approved by the institutional review board (IRB) and adhered to the principles outlined in the Declaration of Helsinki. Patient con-

fidentiality was ensured throughout the study, and informed consent was obtained from all participants.

Results**Table 1: Distribution of wound related complications based on surgeon level**

Wound related complication	Level 1	Level 2	Level 3
Button hole	22	0	4
Premature entry	25	4	1
Wound leak not requiring suturing	15	5	0
Wound leak requiring suturing	18	5	5
Full thickness scleral wound	5	0	5
Inadequate wound construction	7	0	0

Wound-related complications were noted in 121 eyes out of 880 eyes that underwent MSICS. The maximum number of complications was in surgeons undergoing training.

Table 2: Distribution of post-operative complications (OCTET I) in various surgeon levels

OCTET I Complication	Level 1	Level 2	Level 3
High IOP	51	20	23
Hyphema	36	23	25
Corneal Edema	106	53	66
Optic Capture	19	1	4
Decentered IOL	23	6	0
Cystoid macular edema	2	0	0
Toxic anterior segment syndrome	0	3	0
Vitreous haemorrhage	5	9	6
Descemet's detachment not involving visual axis	30	11	8
Increased post-operative uveitis	37	34	16
Posterior capsule opacity	13	5	2
Corneal epithelial defect	11	0	2
Striate keratopathy	2	0	0

The common OCTET I complications among level 1 surgeons included corneal edema (29.4%), high IOP (14.2%), increased post-operative uveitis (10.3%) and hyphema (10%). The common OCTET I complications in level 2 surgeons included corneal edema (18.5%) and increased post-operative uveitis (11.8%). The most common OCTET I complication in level 3 surgeons was corneal edema (10.8%).

Table 3: Distribution of post-operative complications (OCTET II) in various surgeon levels

OCTET II Complication	Level 1	Level 2	Level 3
Wound leak	1	4	3
Iris incarceration	3	0	0
Descemet's detachment involving visual axis	5	3	6
Wound exposure	9	4	2
Retained lens material	18	4	16
Conjunctival retraction	22	6	6
Flat anterior chamber	3	0	0

The common OCTET II complications in level 1 surgeons were conjunctival retraction (6.1%), retained lens material (5%) and wound exposure (2.5%). The common OCTET II complications in level 2 surgeons were conjunctival retraction (2.1%), wound leak, wound exposure and retained lens material at 1.4% each. The common OCTET II complications in level 3 surgeons were retained lens material (2.6%), Descemet membrane detachment (1.0%) and conjunctival retraction (1.0%).

Table 4: Post-operative uncorrected visual acuity against WHO standard

	Good (> 80%)	Borderline (< 15%)	Poor (< 5%)
Day 1	58.1%	36.4%	5.5%
7 – 10 days	73.3%	25%	1.8%
4 – 6 weeks	77.4%	21.4%	1.2%

The post-operative uncorrected visual acuity was good in 58.1% eyes on day 1 and improved to 77.4% cases at the end of 4 – 6 weeks.

Table 5: Post-operative best corrected visual acuity against WHO standard

	Good (> 90%)	Borderline (< 5%)	Poor (< 5%)
Day 1	82.6%	13.2%	4.2%
7 – 10 days	96.3%	3.2%	0.5%
4 – 6 weeks	97.7%	2.3%	0.1%

The post-operative BCVA was good in 82.6%, 96.3% and 97.7% eyes on post-operative day 1, days 7-10 and 4-6 weeks respectively. The BCVA was good in 97.7% of eyes at 4-6 weeks. The eyes with poor BCVA was only 0.1% at 4-6 weeks.

Discussion

Surgical complications represent the fourth leading cause of blindness, contributing to approximately 1.15% of blindness cases (1). Proficiency in cataract surgery is an indispensable requirement for any eye surgeon, as complication rates and visual outcomes serve as valuable indirect indicators of surgical competence. Ensuring successful outcomes and minimizing complications in cataract surgery are vital aspects that underscore the significance of skilful and experienced eye surgeons in providing effective eye care topatients.

In our study most common intra-operative complication was wound-related (14.4%). Ideal wound construction had a steep learning curve and these complications commonly occurred in the inexperienced level 1 surgeons (11.1%) as compared to level 3 (1.6%). The most common cornea-related complication in our study was Descemet membrane detachment (2.8%). It was higher compared to that reported by Haripriya et al (0.01%) and Khanna et al (1.3%).

The post-operative complication rates were graded according to severity as OCTET I, II and III. Among OCTET I complications, the most common was corneal edema (17%). The corneal edema rates reduced with experience (Level 1 – 29.4% to Level 3 – 10.7%). There is no data reported from other studies on corneal oedema as a complication following cataract surgery.

In our study, the overall visual acuity (BCVA) demonstrated favorable results, with 97.7% of cases achieving good vision between 4 to 6 weeks post-surgery. Notably, uncorrected visual acuity (UCVA) showed improvement over time, with 58.1% of cases recording good UCVA on day 1, rising to 77.4% at 4 to 6 weeks post-surgery. While the World Health Organization (WHO) recommends more than 80% of operated cases to have good visual outcomes, our study exceeded this ideal, with BCVA reaching 82.6% and 97.7% at different stages.

Only a negligible percentage of cases (0.1%) reported poor vision at 4 to 6 weeks, aligning favorably with WHO guidelines. Furthermore, our study's findings were consistent with an audit conducted in our Department in 2015, where 97.51% of cases achieved good visual outcomes and only 0.68% had poor visual outcomes.

Comparison between manual small incision cataract surgery (MSICS) and phaco emulsification revealed a similar overall BCVA at 4 to 6 weeks, with 97.5% and 98% success

rates, respectively. These results were also comparable to a study by Khanna et al. [8], who reported visual outcomes of 84.3% and 88% for the two procedures.

In terms of UCVA improvement, cases categorized as level 1 showed more pronounced progress, with UCVA increasing from 37.3% on post-operative day 1 to 72.7% at 4 to 6 weeks, compared to level 3 cases, which demonstrated an improvement from 73.8% to 81.2% during the same period

Conclusion

In conclusion, the study findings revealed that wound-related complications were more prevalent among surgeons undergoing training (Level 1) during manual small incision cataract surgery (MSICS). Additionally, post-operative complications, as classified by OCTET I and OCTET II, showed variations across different surgeon levels. Corneal edema was the most common OCTET I complication in all surgeon levels, while retained lens material and conjunctival retraction were prevalent OCTET II complications.

Regarding visual outcomes, the study demonstrated significant improvements over time. Post-operative uncorrected visual acuity (UCVA) improved from 58.1% on day 1 to 77.4% at 4 to 6 weeks, and best-corrected visual acuity (BCVA) showed excellent results, with 97.7% of eyes achieving good BCVA at 4 to 6 weeks. These visual outcomes aligned well with the World Health Organization (WHO) standards, highlighting the success of the cataract surgeries conducted in the study.

References

1. Vashist P, Senjam SS, Gupta V, Gupta N, Kumar A. Definition of blindness under National Programme for Control of Blindness: Do we need to revise it? *Indian J Ophthalmol.* 2017 Feb;65(2):92–6.
2. Gudlavalleti M, Gupta S, John N, Vashist P. Current status of cataract blindness and Vision 2020: The right to sight initiative in India. *Indian J Ophthalmol.* 2008 May 23;56:489–94.
3. Deshpande M. Vision 2020: Right to Sight – India. *Med J Armed Forces India.* 2008 Oct;64(4):302–3.

4. Desai P, Minassian D, Reidy A. National cataract surgery survey 1997-8: a report of the results of the clinical outcomes. *Br J Ophthalmol.* 1999 Dec;83(12):1336–40.
5. Singh S, Pardhan S, Kulothungan V, Swaminathan G, Ravichandran JS, Ganesan S, et al. The prevalence and risk factors for cataract in rural and urban India. *Indian J Ophthalmol.* 2019 Apr 1;67(4):477.
6. Liu Y-C, Wilkins M, Kim T, Malyugin B, Mehta JS. Cataracts. *The Lancet.* 2017 Aug 5;390(10094):600–12.
7. Thomas R, Paul P, Rao GN, Muliylil JP, Mathai A. Present status of eye care in India. *Surv Ophthalmol.* 2005 Jan 1;50(1):85–101.
8. Balasubramanian. Cataract - Where do we stand? *Indian J Ophthalmol.* 1997 Mar 1; 45(1):5.
9. Yeu E, Cuzzo S. Matching the patient to the intraocular lens: preoperative considerations to optimize surgical outcomes. *Ophthalmology.* 2021 Nov 1;128(11):e132-41.