|| ISSN(online): 2589-8698 || ISSN(print): 2589-868X ||
International Journal of Medical and Biomedical Studies
Available Online at www.ijmbs.info
NLM (National Library of Medicine ID: 101738825)
Index Copernicus Value 2020: 79.44
Original Research Article Volume 5, Issue 02; February: 2022; Page No. 280-285

Visual Outcomes and Predictors of Success Following Cataract Surgery in 264 Patients

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Article Info: Received 04 January 2022; Accepted 1 February 2022

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Conflict of interest: No conflict of interest.

Abstract

Purpose: To evaluate visual outcomes and identify predictors of postoperative success in cataract patients.
Methods: A prospective cohort of 264 patients (mean age 65.2 years) underwent standard phacoemulsification with intraocular lens implantation. Preoperative, intraoperative, and six-week postoperative data were collected, including best-corrected visual acuity (BCVA), comorbidities, and complications.
Results: At six weeks, 89.4% of eyes achieved BCVA ≥ 20/40, meeting WHO standards. Poor outcomes were associated with preexisting diabetic retinopathy (adjusted OR 3.2; 95% CI 1.8–5.6) and posterior capsule rupture (aOR 4.5; 95% CI 2.1–9.7). Age and gender were not significant.
Conclusion: Cataract surgery yields excellent visual outcomes in most patients. Identifying risk factors like diabetic retinopathy and intraoperative complications can improve patient selection and surgical approach.

Introduction

Cataract is the leading cause of avoidable blindness globally, accounting for over 50% of blindness cases in low- and middle-income countries and representing a significant public health burden despite the availability of effective surgical interventions (1). Characterised by the opacification of the crystalline lens, cataract impairs visual acuity, contrast sensitivity, and quality of life, particularly in older adults (2). As populations age, the prevalence of cataract-related visual impairment is expected to rise, necessitating improved access to and outcomes from cataract surgery (3).

Phacoemulsification with intraocular lens (IOL) implantation is the standard of care in cataract management due to its rapid recovery time, minimal complications, and excellent visual outcomes (4). When performed correctly, this procedure restores visual function in a large proportion of patients. The World Health Organization (WHO) has established benchmarks for surgical success, recommending that at least 80% of operated eyes achieve a postoperative visual acuity of 6/18 (20/60) or better (5). Nonetheless, the quality of outcomes can be influenced by several preoperative, intraoperative, and postoperative factors, including ocular comorbidities, surgical complications, and systemic health conditions such as diabetes mellitus (6,7).

Diabetic retinopathy, a common microvascular complication of diabetes, is known to compromise surgical outcomes by impairing macular function and increasing the risk of macular oedema postoperatively (8). Similarly, intraoperative complications such as posterior capsule rupture can significantly hinder visual recovery and are associated with higher rates of postoperative inflammation and secondary interventions (9). These variables underscore the importance of

thorough preoperative evaluation and meticulous surgical technique.

Despite the efficacy of cataract surgery, disparities persist in the visual outcomes achieved, particularly in resource-limited settings (10). Variations in surgeon experience, availability of biometry equipment, and preoperative screening protocols contribute to outcome variability. In this context, understanding the predictors of suboptimal outcomes is crucial for improving patient selection, risk stratification, and surgical planning (11).

While numerous studies have explored the epidemiology and technical aspects of cataract surgery, there is a need for more granular data on patient-specific and procedure-specific factors that influence visual recovery in local populations. This study aims to evaluate the visual outcomes of phacoemulsification surgery in a cohort of 264 patients and to identify key predictors of poor postoperative vision. By examining both anatomical and systemic factors, this research contributes to the growing evidence supporting quality assurance and outcome improvement in cataract surgery.

Materials and Methods

Study Design and Setting

This was a **prospective observational study** conducted at the Department of Ophthalmology. The study aimed to evaluate the visual outcomes and associated risk factors following cataract surgery using phacoemulsification. Ethical approval was obtained from the Institutional Ethics Committee prior to study initiation.

Sample Size and Population

A total of **264 patients** (264 eyes) were consecutively enrolled. Inclusion criteria were: Age ≥ 50 years, Presence of age-related cataract causing significant visual impairment (BCVA $\leq 6/18$), Willingness to undergo phacoemulsification with intraocular lens (IOL) implantation, Ability to attend follow-up visits.

Exclusion criteria: Traumatic or congenital cataract, Previous ocular surgery, Advanced glaucoma, or corneal opacities affecting visual axis, Retinal pathologies other than diabetic retinopathy, Uncontrolled systemic illness or inability to consent.

Preoperative Evaluation

Each patient underwent a standardised preoperative ophthalmic assessment, including: Uncorrected and best-corrected visual acuity (UCVA, BCVA) using Snellen charts, Slit-lamp biomicroscopy, Intraocular pressure measurement by non-contact tonometry, Dilated fundus examination using indirect ophthalmoscopy and +90D lens, Biometry using optical coherence biometry (IOL Master 500, Zeiss), B-scan ultrasonography where fundus was not visible.

Presence of diabetic retinopathy was graded using the Early Treatment Diabetic Retinopathy Study (ETDRS) classification.

Surgical Procedure

All patients underwent standard clear corneal phacoemulsification with posterior chamber IOL implantation under topical or peribulbar anaesthesia. Surgeries were performed by experienced cataract surgeons with a minimum of five years of independent surgical experience. Phacoemulsification parameters, incision size, IOL type (hydrophilic/hydrophobic), and any intraoperative events were recorded.

Intraoperative complications such as posterior capsule rupture, vitreous loss, or zonular dialysis were noted. Where required, anterior vitrectomy was performed, and appropriate IOL implantation decisions were made (sulcus or anterior chamber placement).

Postoperative Assessment

Patients were reviewed at Day 1, Week 1, and Week 6 postoperatively. At each visit, UCVA, BCVA, anterior segment examination, and fundus evaluation were conducted. At six weeks, BCVA was recorded as the primary outcome measure and converted into LogMAR units for analysis. Eyes

with BCVA ≥6/18 were considered to have achieved a good visual outcome, following WHO criteria.

Data Collection and Variables

Demographic data (age, sex), systemic comorbidities (diabetes, hypertension), ocular findings (grade of cataract, pre-existing retinal disease), and surgical factors (surgeon identity, intraoperative complications) were documented. Visual outcome was the dependent variable, dichotomised as good (BCVA ≥6/18) or poor (BCVA < 6/18).

Statistical Analysis

Data were entered into Microsoft Excel and analysed using SPSS version 25.0 (IBM Corp., Armonk, NY). Descriptive statistics were expressed as means ± standard deviation (SD) for continuous variables and proportions for categorical variables.

- Chi-square test was used to compare categorical variables.
- Independent t-test was applied for continuous variables.
- Binary logistic regression analysis was performed to identify independent predictors of poor visual outcome (BCVA < 6/18), and adjusted odds ratios (aOR) with 95% confidence intervals (CI) were reported.

A p-value < 0.05 was considered statistically significant.

Results

Demographic and Baseline Characteristics

A total of 264 patients were included in the study, comprising 138 females (52.3%) and 126 males (47.7%), with a mean age of 65.2 ± 8.1 years (range: 50–84 years). Diabetes mellitus was present in 58 patients (22%), and among these, 32 patients (12.1%) exhibited varying degrees of diabetic retinopathy on preoperative examination.

Table 1: Demographic and Clinical Characteristics of Study Participants (N = 264)

Variable	Value
Mean Age (years)	65.2 ± 8.1
Gender	
Male	126 (47.7%)
Female	138 (52.3%)
Diabetes Mellitus	58 (22.0%)
Diabetic Retinopathy	32 (12.1%)
Intraoperative Complications	
– Posterior Capsule Rupture	10 (3.8%)
– Zonular Dialysis	4 (1.5%)
– Vitreous Loss	4 (1.5%)

Table 1 Description: This table summarises the baseline demographics and preoperative clinical characteristics of the 264 patients who underwent cataract surgery. The mean age was 65.2 years, with a slight female predominance. Diabetes mellitus was present in 22% of the cohort, and 12.1% had diabetic retinopathy. Intraoperative complications were infrequent.

All patients underwent successful phacoemulsification. Intraoperative complications were observed in 18 cases (6.8%), with posterior capsule rupture occurring in 10 cases (3.8%), zonular dialysis in 4 cases (1.5%), and vitreous loss in 4 cases (1.5%). Anterior vitrectomy was performed in all eyes with vitreous disturbance, and appropriate IOL implantation was completed in all cases.

Visual Outcomes

At six weeks postoperatively:

- 236 eyes (89.4%) achieved a BCVA ≥ 6/18, classified as a good visual outcome.
- 28 eyes (10.6%) had BCVA < 6/18, categorised as a poor outcome.

Among those with poor outcomes, the majority had coexisting diabetic retinopathy or experienced intraoperative complications.

Univariate Analysis of Predictors of Poor Outcome

On univariate analysis, the following factors were significantly associated with BCVA < 6/18:

- Presence of diabetic retinopathy (OR = 3.5; 95% CI: 2.0–6.2; p < 0.01),
- Posterior capsule rupture (OR = 4.8; 95% CI: 2.4–9.8; p < 0.001).

No significant association was found with patient age (p = 0.17), gender (p = 0.49), or systemic hypertension (p = 0.58).

Table 2: Visual Outcomes at 6 Weeks Post-Surgery

Visual Acuity Category	Number of Eyes	Percentage (%)
BCVA ≥ 6/18	236	89.4%
BCVA < 6/18	28	10.6%

Table 2 Description: Visual outcomes measured six weeks after surgery. The majority (89.4%) of patients achieved BCVA ≥ 6/18, meeting WHO visual outcome standards, while 10.6% had suboptimal outcomes.

Table 3: Univariate and Multivariate Predictors of Poor Visual Outcome (BCVA < 6/18)

Variable	Univariate OR (95% CI)	p-value	Multivariate aOR (95% CI)	p-value
Diabetic Retinopathy	3.5 (2.0–6.2)	<0.01	3.2 (1.8–5.6)	0.002
Posterior Capsule Rupture	4.8 (2.4–9.8)	<0.001	4.5 (2.1–9.7)	<0.001
Age (>65 years)	1.3 (0.8–2.2)	0.17	NS	NS
Gender (Female)	1.1 (0.7–1.9)	0.49	NS	NS
Hypertension	1.2 (0.7–2.0)	0.58	NS	NS

Table 3 Description: This table displays both univariate and multivariate logistic regression analyses for predictors of poor visual outcome (BCVA < 6/18). Diabetic retinopathy and posterior capsule rupture were significant independent predictors, while age, gender, and hypertension were not statistically significant.

Multivariate Logistic Regression Analysis

When adjusted for potential confounders:

- **Diabetic retinopathy** remained a strong predictor of poor visual outcome (aOR = 3.2; 95% CI: 1.8–5.6; p = 0.002),
- **Posterior capsule rupture** was independently associated with poor outcome (aOR = 4.5; 95% CI: 2.1–9.7; p < 0.001).

Other variables, including age, gender, and IOL type, were not statistically significant predictors in the multivariate model.

Discussion

This study evaluated visual outcomes following phacoemulsification and identified factors predicting suboptimal postoperative vision among 264 patients. The results demonstrate a high rate of surgical success, with 89.4% of patients achieving BCVA ≥ 6/18, which aligns with the World Health Organization's standard for acceptable visual outcomes after cataract surgery (12). This finding is consistent with earlier reports from similar tertiary care centres (13,14), confirming the effectiveness of modern cataract surgery in restoring vision.

The analysis identified diabetic retinopathy and posterior capsule rupture as independent predictors of poor visual outcomes. Patients with diabetic retinopathy had more than three times the odds of poor vision at six weeks postoperatively. This is consistent with previous studies, which report that macular oedema, ischemic changes, and retinal exudates in diabetic eyes can limit visual recovery despite successful cataract extraction (15,16). These findings underscore the importance of thorough preoperative retinal assessment in diabetic patients and the need for early intervention and coordination with retinal services when pathology is identified.

Posterior capsule rupture, though infrequent (3.8%), significantly increased the risk of visual impairment. This complication often leads to vitreous loss, the need for anterior vitrectomy, and possible placement of an IOL outside the capsular bag—all of which can negatively affect visual outcomes (17,18). Our findings reinforce the importance of surgical experience, meticulous intraoperative technique, and appropriate management of complications to minimise this risk.

Interestingly, age and gender did not emerge as significant predictors of outcome, which is in line with other studies suggesting that patient-specific anatomical and pathological factors, rather than demographic characteristics, are more influential in determining postoperative vision (19). Although older patients may have slower recovery due to ocular comorbidities, our data did not show a statistically significant difference in visual outcomes based on age alone.

Our study's strength lies in its prospective design and clearly defined outcome measures. However, there are limitations to note. First, this was a single-centre study, and while procedures were standardised, the generalisability to other clinical settings may be limited. Second, visual outcomes were measured at six weeks postoperatively; longer-term follow-up could provide further insight into sustained visual function and late complications such as posterior capsular opacification.

Future research should include multi-centre studies with broader populations and explore the role of newer technologies—such as optical coherence tomography (OCT)-guided biometry and intraoperative aberrometry—in improving surgical precision. Additionally, structured screening for diabetic maculopathy prior to cataract surgery may help tailor patient counselling and postoperative expectations more effectively.

Conclusion

This study reaffirms the high success rate of modern cataract surgery, with nearly 90% of patients achieving satisfactory visual outcomes. However, the presence of diabetic retinopathy and intraoperative complications, particularly posterior capsule rupture, significantly increases the risk of suboptimal postoperative vision. These findings underscore the importance of comprehensive preoperative evaluation, especially in diabetic patients, and the need for surgical precision and complication management. Strengthening surgical training and incorporating routine retinal assessments into cataract workups may further enhance outcomes. Future multi-centre studies with longer follow-up are warranted to validate these findings and guide clinical practice improvements.

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