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Predictors of time to recovery from cataract surgery among cataract patients at Menelik II Comprehensive Specialized Hospital: a retrospective follow up study

Gininu Wendmeneh Tsegaw[1,2*], Yilma Chisha Dea[1*] and Melkamu Merid Mengesha[1,3]

Abstract

Background Cataracts are the leading cause of reversible blindness globally, disproportionately affecting populations in low- and middle-income countries. In Ethiopia, cataracts remain a significant public health concern. Despite the effectiveness of cataract surgery in restoring vision, information on recovery time and its predictors remain limited. The aim of this study was to assess time to recovery and its predictors among patients undergoing cataract.

Methods A retrospective cohort study was conducted on 459 cataract patients who underwent surgery between January 1 and December 31, 2023. Data were randomly extracted from their medical records between June 1 and August 15, 2024. The Kaplan-Meier method was used to estimate the survival probabilities and compare groups, with significant differences tested using the log-rank test. The Weibull regression with the inverse Gaussian frailty was applied following a goodness-of-fit test to identify predictors of time to recovery. Results are presented as adjusted hazard ratios (AHRs) with 95% confidence intervals (CIs). All statistical tests were declared significant at *P*-value < 0.05.

Results we reviewed 459 patient cards, and 368 (80.17%, 95% CI: 76.26–83.58%) had recovered from a cataract surgery over 7,919.28 person-weeks. The overall incidence rate of recovery was at 46.47 per 1,000 persons per week (95% CI: 41.95–51.47). The median recovery time was at 18.14 weeks (IQR: 12.29–24, 95% CI: 17.14–18.86). Age over 60 years (AHR = 0.25, 95% CI: 0.07–0.96), urban residence (AHR = 1.77, 95% CI: 1.15–2.70), preoperative visual acuity (medium: AHR = 1.98, 95% CI: 1.23–3.18; high: AHR = 5.83, 95% CI: 1.72–19.77), comorbidities (ocular: AHR = 0.30, 95% CI: 0.15–0.61; systemic: AHR = 0.41, 95% CI: 0.22–0.75), type of surgery (phacoemulsification: AHR = 1.98, 95% CI: 1.06–3.67; intracapsular cataract extraction: AHR = 0.14, 95% CI: 0.03–0.89), and complications (intraoperative: AHR = 0.29, 95% CI: 0.12–0.71; postoperative: AHR = 0.17, 95% CI: 0.06–0.47), and surgeries performed by an ophthalmologist (AHR = 3.44, 95% CI: 1.80–6.55) were statistically significant predictors of time to recovery from cataract surgery.

*Correspondence:
Gininu Wendmeneh Tsegaw
gininu22wendmeneh@gmail.com
Yilma Chisha Dea
cyilma1997@gmail.com

Full list of author information is available at the end of the article

Conclusion The median recovery time was shorter than in previous local studies but longer than in developed countries. Improved preoperative assessment, better comorbidity management, and minimizing complications may contribute to better recovery outcomes. The use of phacoemulsification and procedures performed by experienced ophthalmologists were associated with shorter recovery times, but further prospective studies are needed to confirm these findings. Personalized care approaches are recommended to optimize postoperative recovery.

Keywords Cataract surgery, Time to recovery from cataract surgery, Predictors of, Ethiopia

Introduction

Cataracts are a leading cause of visual impairment and blindness worldwide, disproportionately affecting low- and middle-income countries, including Ethiopia [1–3]. Globally, approximately 94 million people suffer from distance vision impairment or blindness due to cataracts [1]. Nearly 90% of global blindness cases occur in low-income countries, with cataracts accounting for 50% of these cases, making it a significant yet avoidable cause of blindness [1, 3]. Despite global efforts to reduce cataract-related blindness, disparities in access to timely treatment persist in many low-resource settings [4, 5]. In Ethiopia, cataracts contribute to 42.3% of low vision cases and 49.9% of blindness cases, adding to the national blindness rate of 1.6% and impaired vision prevalence of 3.7%. More than 80% of these cases are potentially preventable or treatable [3].

Beyond visual impairment, untreated cataracts impose a significant socioeconomic burden. They increase the risk of dementia [6], falls, and road accidents in older adults [7, 8], reduce quality of life, and contribute to increased mortality [9, 10]. Cataracts also impact productivity and independence, leading to broader economic consequences for individuals, families and communities [11]. Globally, an estimated 30% of disability-adjusted life years (DALYs) lost due to blindness and vision problems is attributed to cataracts [12].

Currently, there are no approved medications to prevent or reverse cataracts; making surgery is the only effective treatment [13–16]. Each year, approximately 9.5 million cataract surgeries are performed worldwide, significantly reducing the burden of vision impairment [15]. However, access to cataract surgery remains a major challenge in many low- and middle-income countries due to shortages of ophthalmologists, high surgical costs, and an unequal distribution of eye care services [5, 17, 18]. In Ethiopia, these barriers contribute to delays in treatment, prolonged recovery times, and an increased risk of complications [19]. Efforts are underway to address these challenges by increasing the number of trained ophthalmologists and expanding eye care facilities to underserved areas [17].

Despite the effectiveness of cataract surgery in restoring vision, there is limited evidence regarding the time required for full recovery and the factors influencing postoperative healing in resource-limited settings [20]. Recovery time after cataract surgery varies widely across different healthcare settings. Studies from high-income countries report recovery times of 4–12 weeks [21, 22], with most patients regaining functional vision within a month due to advanced surgical techniques, better postoperative care, and early rehabilitation programs [23–26].

In contrast, data on recovery times in low-income countries, particularly in Sub-Saharan Africa and South Asia, remain scarce [20]. However, recovery periods in these regions are likely prolonged due to limited access to advanced surgical techniques, inadequate postoperative care, and a higher prevalence of comorbidities [5, 17, 18]. In Ethiopia, for instance, a study from the north reported a median recovery time of 23 weeks (IQR: 16–35 weeks) [27], highlighting the stark contrast with high-income settings. Similar challenges may exist in other low-resource settings, though specific recovery time estimates are limited. Additionally, the full range of factors influencing recovery time remains unclear, including marital status, intraocular lens (IOL) site, operated eye type, ocular comorbidities, intraoperative and postoperative complications, and surgeon expertise.

This gap in knowledge presents challenges for both patients and healthcare providers. Patients often face uncertainty and unrealistic expectations, complicating their postoperative journey and resulting in increased anxiety, disappointment, and frustration [28, 29]. Healthcare providers struggle with unclear recovery timelines, making it difficult to optimize postoperative care, follow-up scheduling, and patient assessment [30, 31]. Without robust local data, policymakers and clinicians in Ethiopia lack clear benchmarks for recovery expectations, leading to suboptimal patient management and resource allocation.

Understanding the predictors of recovery time is crucial for improving surgical outcomes, patient counseling, and follow-up care in Ethiopia and other resource-limited settings. Identifying modifiable predictors such as surgical technique, complication management, surgeon expertise, and comorbidity management helps guide targeted interventions to enhance recovery outcomes. Additionally, this study provides evidence that informs policy decisions aimed at improving cataract surgery practices and healthcare resource allocation in Ethiopia.

By addressing these critical gaps, this study quantifies recovery time and identifies key predictors influencing postoperative healing among cataract patients at Menelik II Comprehensive Specialized Hospital. The findings support patients in setting realistic recovery expectations, assist clinicians in tailoring patient management strategies, and contribute to refining national eye health programs. Ultimately, this research offers actionable insights to enhance surgical outcomes and follow-up care in resource-limited settings.

Materials and methods

Study area

The study was conducted at Menelik II Comprehensive Specialized Hospital, a public tertiary health facility located in Addis Ababa, the capital of Ethiopia. Established in 1910, the hospital is the country's first and largest ophthalmology center. Managed by the Addis Ababa Health Bureau, it provides specialized eye care services to critically ill patients referred from across Ethiopia. The ophthalmology department is staffed by 22 specialists and 6 subspecialists and is equipped with 60 beds, 45 examination rooms, 4 operating theaters, and dedicated teaching facilities. The hospital offers a range of cataract treatments, including both standard and complex surgeries, and performs between 2,000 and 2,500 cataract surgeries annually on average.

Study design and period

A one-year facility-based retrospective cohort study was conducted at Menelik II Comprehensive Specialized Hospital. Secondary data were obtained from the electronic medical records system and medical charts of cataract patients treated with cataract surgery between January 1, 2023, and December 31, 2023, which served as the study period. Data were extracted from June 1, 2024, to August 15, 2024.

Population

Source population

All cataract patients were treated with cataract surgery at Menelik II Comprehensive Specialized Hospital.

Study population

All cataract patients were treated with cataract surgery at Menelik II Comprehensive Specialized Hospital from January 1, 2023, to December 31, 2023.

Inclusion and exclusion criteria

Inclusion criteria

The medical records of cataract patients treated with different types of cataract surgery at Menelik II Comprehensive Specialized Hospital between January 1, 2023, and December 31, 2023, were included in the study.

Exclusion criteria

Cataract patients who had undergone cataract surgery but whose medical records were incomplete were excluded from the study. Incomplete records were defined as missing data on surgery date, patient baseline data, or other important predictors or if the medical charts themselves were unavailable.

Sample size and sampling procedure

Sample size determination

To ensure adequate statistical power for analyzing recovery time from cataract surgery and its predictors, the sample size was calculated using the stpower log-rank test in Stata version 17. The estimation was based on significant predictors of recovery time identified in a previous study conducted in northern Ethiopia, including place of residence (AHR = 1.59), visual acuity (medium: AHR = 4.14; high: AHR = 5.23), type of cataract (traumatic: AHR = 1.75; secondary: AHR = 2.59), and type of surgical procedure (AHR = 1.43) [27]. Adjusted hazard ratios (AHR) were used instead of crude hazard ratios (CHR) to account for potential confounders and provide a more accurate effect estimate. Assumptions of 80% power, a 5% α error, and a 10% allowance for incomplete data were incorporated into the calculation. The sample sizes estimated for each predictor were compared, and the largest one was selected as the final minimum sample size. This was determined to be 494. Details of these calculations are summarized in Table 1.

Table 1 Sample size calculation for predictors of time to recovery from cataract surgery among cataract patients at menelik II comprehensive specialized hospital, 2024

Variables	Adjusted hazard ratio (AHR)	Probability of withdrawal	Event	Sample size	Reference
Resident(Urban)	1.59	0.1	152	288	[27]
Medium Visual Acuity	4.14	0.1	22	34	
High Visual Acuity	5.23	0.1	18	26	
Type of cataract(traumatic)	1.75	0.1	106	196	
Type of cataract (Secondary Cataract)	2.59	0.1	42	68	
Type of surgery(ECCE + PCIOL)	1.43	0.1	252	494	

Note: ECCE: Extracapsular cataract extraction; PCIOL: Posterior chamber intraocular lens

Sampling procedures

The year 2023 was chosen for record review as it offered the most recent and comprehensive data on the problem under investigation. Medical record numbers (MRNs) of all cataract patients who underwent surgery between January 1, 2023, and December 31, 2023, were retrieved from the ophthalmic operation room registry and listed in Excel, forming a sampling frame of 2,272 records. To ensure random selection, each MRN was assigned a random number using the RAND function, and the list was sorted accordingly. The corresponding medical records were reviewed, and those with missing key data were excluded through listwise deletion to ensure data quality and reliability of analysis. Ultimately, 459 eligible records meeting the study's inclusion criteria were included in the analysis. Figure 1 summarizes the sampling process.

Variables

Dependent variable

The dependent variable was the time to recovery from cataract surgery, defined as the duration (in weeks) from the date of cataract surgery until recovery was achieved.

Independent variables

Independent variables included the following:

Sociodemographic variables age, sex, and residence.

Preoperative factors cataract type (e.g., age-related, traumatic, congenital), level of visual acuity, ocular comorbidities (e.g., age-related macular degeneration (AMD), glaucoma, diabetic retinopathy), and systemic comorbidities (e.g., diabetes mellitus, hypertension, cardiovascular diseases).

Intraoperative factors Cataract surgery type (e.g., phacoemulsification, manual small-incision cataract surgery), type of anesthesia (e.g., local, general), site of lenses inserted (IOL), intraoperative complications (e.g., intraocular lens dislocation, posterior capsule rupture, vitreous loss) and surgeon status.

Postoperative factors postoperative complications (e.g., infection, inflammation, cystoid macular edema, secondary glaucoma, or retinal detachment).

Operational definition

Recovered Recovery from cataract surgery was defined as the clinician-assessed restoration of vision (≥6/12), resolution of discomfort, and ocular healing. Resolution of discomfort referred to the absence or significant reduction of postoperative symptoms, including pain,

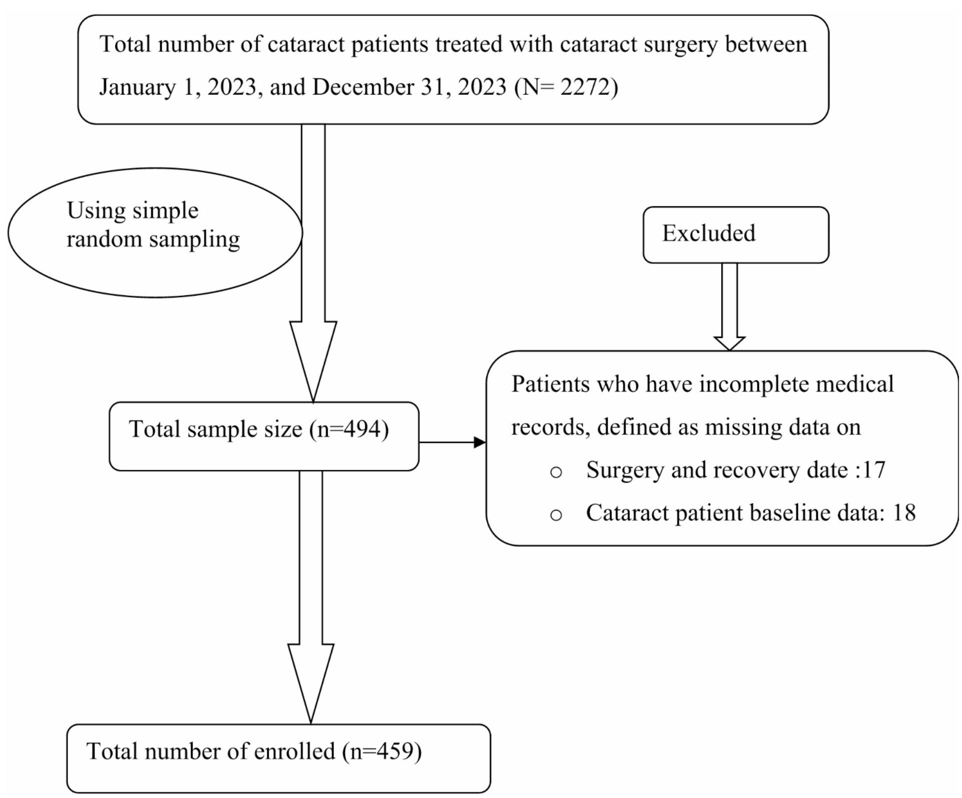

Fig. 1 A schematic representation of the sampling procedure for the study predictors of time to recovery from cataract surgery among cataract patients at Menelik II Comprehensive Specialized Hospital, 2024

foreign body sensation, excessive tearing, photophobia, and itching, as reported by the patient and confirmed by the clinician during follow-up. Ocular healing was determined by the absence of inflammation or infection during postoperative evaluations. Recovery also included patient satisfaction with vision and the ability to resume daily activities [32, 33].

Start time the date when surgery was performed.

Follow-up period From the date of surgery until either to a point where an event or censorship occurs.

The time to recovery was defined as the duration in weeks from the date of cataract surgery until the patient achieved full recovery.

Event the occurrence of full recovery.

Censored A cataract patient who was treated with cataract surgery but whose outcome was out of follow-up (> 26 weeks), who was lost to follow-up, or who was transferred to other health facilities.

Loss to follow-up refers to patients who visited the ophthalmic outpatient department (OPD) three times, were scheduled for a subsequent visit, but did not attend that visit, and whose final outcomes were not recorded.

Transferred-out Patients who moved to another health facility with a confirmed written documentation of a transfer out.

Visual acuity ability to resolve detail at 6 m on a Snellen chart [34]. In this study, the participants were categorized as having low acuity (worse than 6/60), medium acuity (6/18 to 6/60), or high acuity (6/12 to 6/18).

Ocular comorbidity refers to the presence of one or more additional eye conditions or diseases alongside cataracts in a patient, including age-related macular degeneration (AMD), glaucoma, diabetic retinopathy, retinal detachment, corneal diseases, refractive errors (e.g., myopia, hyperopia, astigmatism), and optic nerve disorders.

Systemic comorbidity refers to the presence of other medical conditions or diseases that a cataract patient may have in addition to cataracts, including diabetes mellitus, hypertension, cardiovascular diseases, respiratory disorders, neurological conditions, autoimmune diseases, renal and liver diseases, cancer, and metabolic disorders.

Intraoperative complications were assessed by 'Yes' or 'No' questions and were considered present if the cataract patients experienced adverse events or issues that occurred during the surgical procedure itself, such as intraocular lens dislocation, posterior capsule rupture, corneal edema, or vitreous loss.

Postoperative complications were assessed by 'Yes' or 'No' questions and were considered present if the cataract patients had adverse events that occurred after the surgical procedure was completed, typically within the immediate recovery period or during the healing process, such as infection, inflammation, delayed wound healing, cystoid macular edema, secondary glaucoma, or retinal detachment.

Data collection and quality assurance

Data were extracted from the electronic medical records system and patient cards of the hospital using a structured checklist adapted from a previous study [27]. Before data collection, the tool was pretested on 5% of the sample size. Two health management information system (HMIS) officers collected the data using the Kobo collection tool under the supervision of an ophthalmic nurse employed at the hospital. Data collectors and supervisor received two days of training on the study purpose, ethical considerations and data extraction protocols. Relevant information, including sociodemographic characteristics, preoperative assessment, intraoperative details, postoperative complications, and recovery outcomes, was systematically extracted. Incomplete follow-up records were excluded. To further ensure data quality, a 10% random sample of the extracted data was re-extracted by the supervisor to verify consistency, and necessary corrections were made. Daily supervision by the supervisor and the principal investigator ensured the completeness, consistency and timely submission of collected data to the Kobo database. Data cleaning was performed post-entry using frequency, cross-tabulation, sorting, and listing to identify missing values and outliers. Any identified errors were corrected by cross-referencing with the original documents.

Data processing and statistical analysis

Upon completion of the data collection activities, the dataset was exported to Excel and imported into STATA version 17 for analysis. Descriptive statistics summarized baseline characteristics. Continuous variables were assessed for normality using histograms and the Shapiro-Wilk test. Normality was violated ($p < 0.001$); therefore, the data are presented as medians with interquartile ranges (IQR). Categorical variables are summarized as frequencies and percentages.

Recovery time was calculated as the difference between the surgery and recovery dates. Due to the nature of follow-up documentation, it was assumed that some recovery times might be interval-censored, occurring between scheduled visits. To address these potential censoring, a parametric Weibull regression model was used. This model, assuming a Weibull distribution for recovery times, estimated the likelihood of recovery within intervals rather than at specific moments, enabling a more accurate estimation of recovery patterns in the study population. Four-week interval recovery probabilities were estimated using a life table. The Kaplan−Meier survival estimator was used to determine the median recovery time and to generate survival curves for comparing recovery times across groups. The log-rank test was used to assess significant differences in survival functions between these groups.

We assessed the proportional hazards and multicollinearity assumptions to ensure model validity. The proportional hazards assumption was confirmed using the Schoenfeld residuals global test ($p = 0.421$). Multicollinearity was evaluated using the variance inflation factor (VIF), with all values below the threshold of 10 (highest VIF = 9.54). No multicollinearity violations were detected. Detailed results are provided in Table 6 of electronic supplementary material.

To identify the best-fitting model, survival models were compared using log-likelihood, Akaike information criterion (AIC), and Bayesian information criterion (BIC) values. The multivariable Weibull regression model with an inverse Gaussian frailty component was selected as the preferred model (log-likelihood = -173.09, AIC = 398.19, BIC = 505.55). See Table 7 of electronic supplementary material for details. This model accounts for individual variation in recovery times and unobserved heterogeneity by incorporating the Weibull distribution for recovery time estimation and the inverse Gaussian frailty to adjust for unmeasured heterogeneity. It also controls for potential confounding factors by addressing variability across individuals that may influence recovery time.

Predictors of time to recovery were identified using bivariable and multivariable Weibull regression with inverse Gaussian frailty models. Initially, a bivariable Weibull regression model with a crude hazard ratio was used to identify candidate variables for the multivariable Weibull regression model at a *P* value < 0.25. All identified candidate variables were subsequently incorporated into the multivariable Weibull regression model. The findings were presented using adjusted hazard ratios (HRs) with 95% confidence intervals (CIs) to measure the strength of the association, and statistical significance was declared at a *P* value < 0.05. Variables that were statistically significant in the multivariate analysis were considered independent predictors of time to recovery from cataract surgery.

Table 2 Sociodemographic characteristics of cataract patients treated with cataract surgery at menelik II comprehensive specialized hospital from January 1, 2023, to December 31, 2023($n = 459$)

Variables	Category	Frequency	Percent (%)
Sex	Male	234	50.98
	Female	225	49.02
Age in years	< 16 Age	33	7.19
	16–30 Age	23	5.01
	31–45 Age	50	10.89
	46–60 Age	146	31.81
	> 60 Age	207	45.10
Residence	Rural	168	36.60
	Urban	291	63.40
Marital status	Single	85	18.52
	Married	348	75.82
	Divorced	11	2.40
	Widowed	15	3.27

Results

Sociodemographic characteristics of the study participants

The records of 494 cataract patients who underwent surgery in 2023 were reviewed. Of these, 35 patients (7.1%) had incomplete medical records and were excluded, leaving 459 (92.9%) for analysis. Among the included patients, 234 (50.98%) were male, and nearly two-thirds (293/459; 63.83%) resided in urban areas. The participants' ages ranged from 1 to 94 years, with a median age of 60 years (IQR = 21 years). A large proportion of the patients, 207 patients (45.10%), were over 60 years old, whereas 146 (31.81%) were aged 46 to 60 years (Table 2).

Preoperative characteristics of the study participants

Age-related cataracts were the most prevalent cataract, affecting 68.85% (316) of the patients. Over two-thirds of the patients 68.63% (315) had low visual acuity before surgery. Ocular comorbidities were present in 23.97% of patients, with glaucoma being the most common (66.36%). Systemic comorbidities affected 20.70% of the patients, with hypertension being the most prevalent (69.47%), followed by diabetes mellitus (33.68%). See Table 3 for details.

Intraoperative characteristics

Small-incision cataract extraction (SICE) was the most common (73.42%) surgical procedure, and local anesthesia was predominantly (92.59%) used. The majority (91.50%) of lens insertions occurred in the posterior chamber. A greater proportion of surgeries were performed by ophthalmologists (54.47%) than by ophthalmology residents (45.53%). Intraoperative complications occurred in 8.71% of the patients, with capsular tears being the most commonly observed, accounting for 50% of those with complications. See Table 4 for details.

Table 3 Preoperative characteristics of cataract patients treated with cataract surgery at menelik II comprehensive specialized hospital from January 1, 2023, to December 31, 2023($n = 459$)

Variables	Category	Frequency	Percent (%)
Types of cataract	Age related cataract	316	68.85
	Traumatic cataract	61	13.29
	Congenital cataract	23	5.01
	Secondary cataract	59	12.85
Level of Visual acuity	Low	315	68.63
	Medium	111	24.18
	High	33	7.19
Presences of ocular comorbidities	Yes	110	23.97
	No	349	76.03
Ocular comorbidity	Glaucoma	73	66.36
	Age related macular degeneration	14	12.73
	Uveitis	13	11.82
	Diabetic retinopathy	8	7.27
	Other ocular comorbidity	7	6.36
Presences of systemic comorbidities	Yes	95	20.70
	No	364	79.30
Systemic comorbidity	Hypertension	66	69.47
	Diabetes mellitus	32	33.68
	Asthma	6	6.32
	HIV/AIDS	6	6.32
	Cardiovascular disease	4	4.21
	Other systemic comorbidities	3	3.16

Note: Other ocular comorbidities include myopia, ocular hypertension, conjunctivitis, and disorders of the cornea; other systemic comorbidities include chronic kidney disease and cancer

Table 4 Intraoperative characteristics of cataract patients treated with cataract surgery at menelik II comprehensive specialized hospital from January 1, 2023, to December 31, 2023($n = 459$)

Variables	Category	Frequency	Percent (%)
Types of cataract surgery	Intracapsular Cataract Extraction	8	1.74
	Extracapsular Cataract Extraction	74	16.12
	Small Incision Cataract Extraction	337	73.42
	Phacoemulsification (Phaco)	40	8.71
Type of anesthesia	Local anesthesia	425	92.59
	General anesthesia	34	7.41
Site of lens inserted	Posterior chamber	420	91.50
	Sulcus fixated	25	5.45
	Anterior chamber	14	3.05
Eye operated	Oculus Dexter (OD)	237	51.63
	Oculus Sinister (OS)	217	47.28
	Oculus Uterque (OU)	5	1.09
Presences of intraoperative complication	Yes	40	8.71
	No	419	91.29
Intraoperative complication	Capsular tears	20	50.00
	Vitreous loss	7	17.50
	Iris prolapse	6	15.00
	Corneal edema	4	10.00
	Intraocular lens dislocation	3	7.5
	Others	3	7.5
Surgeon status	Ophthalmologist	250	54.47
	Ophthalmology resident	209	45.53

Note: Other intraoperative complications include posterior capsule rupture, iris tear, and uveal prolapse

Postoperative characteristics

Among the 459 patients, 53 (11.55%) experienced postoperative complications. The most common complications were inflammation 12 (22.64% of cases) and increased intraocular pressure (IOP) 11 (20.75% of cases). Other notable complications included posterior capsular opacification (PCO) in 8 patients (15.09% of cases) and infection in 7 patients (13.21% of cases). The less frequent complications were retinal detachment (6, 11.32%), secondary glaucoma (5, 9.43%) and others (cystoid macular edema and cataract lens fragments) (5, 9.43%). Overall, the majority of patients (406; 88.45%) did not experience any postoperative complications.

Time to recovery of patients who underwent cataract surgery

Overall, 459 cataract patients were followed for a total of 7,919.28 person-weeks. At the end of the study period, 368 (80.17%) patients had recovered after cataract surgery. The overall incidence rate of recovery was 46.47 (95% CI: 41.95–51.47) per 1000 persons per week. The overall median recovery time of patients was 18.14 weeks (IQR = 12.29–24), with (95% CI = 17.14–18.86) (Fig. 2).

The life table showed a gradual decrease in survival probability (i.e., not yet recovered) after cataract surgery, from 0.9978 at 4 weeks to 0.7665 at 8–12 weeks, 0.4150 at 16–20 weeks, and 0.1209 at 24–28 weeks, indicating that most recoveries occurred between 8 and 20 weeks (Table 5).

Time to recovery among different groups of cataract patients

Kaplan–Meier survival curves and log-rank tests were used to assess differences in recovery times across categorical variables. Shorter recovery was observed among younger patients (31–45 years: 13.43 weeks, $P = 0.0007$), married individuals (17.71 weeks, $P < 0.0246$), urban residents (16.85 weeks, $P = 0.0004$), patients with secondary cataracts (12.43 weeks, $P < 0.0001$), those undergoing phacoemulsification (13.43 weeks), patients with high preoperative visual acuity (12.43 weeks, $P < 0.0001$), and surgeries performed by ophthalmologists (14.29 weeks, $P < 0.0001$). Patients without comorbidities or complications also had significantly shorter recovery times

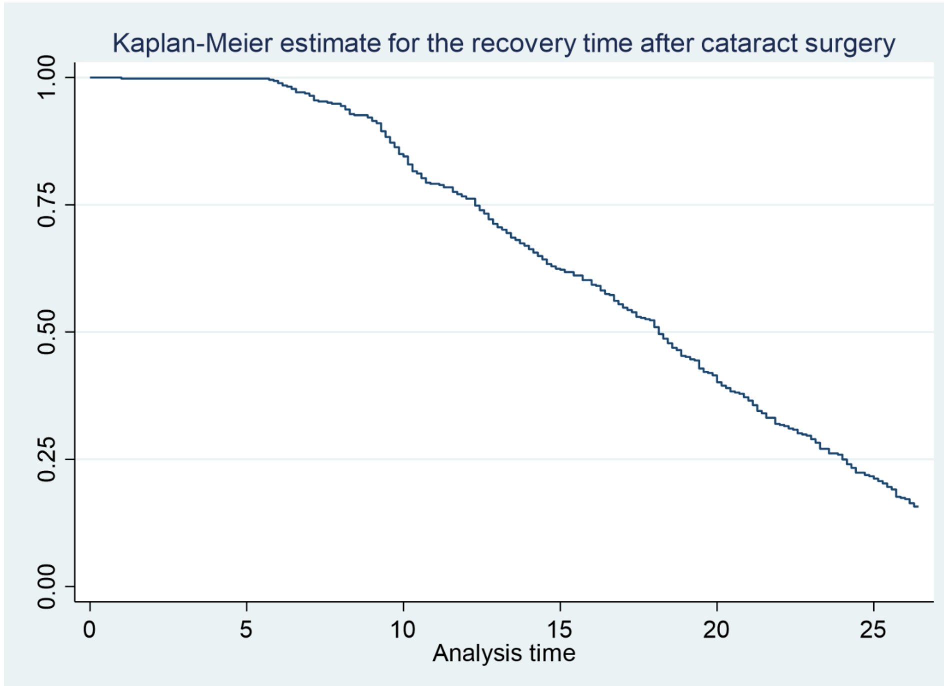

Fig. 2 Kaplan–Meier estimator curve for time to recovery among cataract patients at Menelik II Comprehensive Specialized Hospital from January 1, 2023, to December 31, 2023

Table 5 Life table of patient survival probabilities at 4-week intervals for the time to recovery from cataract surgery at menelik II comprehensive specialized hospital from January 1, 2023, to December 31, 2023

Interval	Total at the beginning	Recovery	Lost	Survival	[95% CI]
0–4	459	1	11	0.9978	0.9845–0.9997
4–8	447	22	3	0.9485	0.9235–0.9655
8–12	422	81	0	0.7665	0.7243–0.8030
12–16	341	73	1	0.6021	0.5550–0.6459
16–20	267	83	0	0.4150	0.3689–0.4603
20–24	184	68	6	0.2591	0.2191–0.3007
24–28	110	40	70	0.1209	0.0887–0.1584

($P < 0.001$). No significant differences were found by sex, anesthesia type, lens insertion site, or the eye operated on. Kaplan–Meier curves (Fig. 3, electronic supplementary material) and log-rank test results (Table 8, electronic supplementary material) provide further details.

Predictors of time to recovery from cataract surgery

In the initial analysis, a bivariable Weibull regression with inverse Gaussian frailty was used to determine the effect of each covariate on the time-to-recovery before proceeding to the multivariable analysis; at a value of $p < 0.25$ relaxed level of significance. The analysis revealed that age, marital status, residence, level of visual vacuity, type of cataract, presence of ocular comorbidities, presence of systemic comorbidities, type of cataract surgery, site of lens insertion, presence of intraoperative complications, status of the surgeon and presence of postoperative complications had significant effects on recovery time at this significance level.

After the first analysis, a multivariable Weibull regression model with an inverse Gaussian frailty component was employed at a significance level of $p < 0.05$ to adjust for confounding variables while accounting for unobserved heterogeneity among individuals. Patients over 60 years of age had a 75% slower recovery rate compared to those under 16 years (AHR = 0.25, 95% CI: 0.07–0.96). Whereas, patients living in urban areas had a 77% higher recovery rate than those in rural areas (AHR = 1.77, 95% CI: 1.15–2.70). Patients with a medium level of preoperative visual acuity experienced a 98% faster recovery time compared to those with low visual acuity (AHR = 1.98, 95% CI: 1.23–3.18), whereas patients with high visual acuity experienced a more than fivefold faster recovery time (AHR = 5.83, 95% CI: 1.72–19.77). Patients with ocular comorbidities had a 70% slower recovery rate (AHR = 0.30, 95% CI: 0.15–0.61), whereas those with systemic comorbidities had a 59% slower recovery rate (AHR = 0.41, 95% CI: 0.22–0.75).

Patients who underwent phacoemulsification surgery were associated with a 98% higher recovery rate compared to those who underwent small-incision cataract extraction (SICE) (AHR = 1.98, 95% CI: 1.06–3.67). In contrast, patients who underwent intracapsular cataract extraction (ICCE) were significantly associated with an 86% slower recovery time (AHR = 0.14, 95% CI: 0.03–0.89). Patients who underwent surgery by ophthalmologists experienced more than three times faster recovery rates (AHR = 3.44, 95% CI: 1.80–6.55) than those who underwent surgery by residents. Patients with intraoperative complications had a 71% slower recovery compared to those without complications (AHR = 0.29, 95% CI: 0.12–0.71), and patients with postoperative complications experienced an 83% slower recovery compared to those without postoperative complications (AHR = 0.17, 95% CI: 0.06–0.47). A significantly high degree of frailty (θ = 2.23) was observed, indicating substantial unobserved heterogeneity in recovery rates among patients. This suggests that unmeasured factors (e.g., patient characteristics not included in the model) contributed significantly to differences in recovery rates between individuals. See Table 9 of electronic supplementary material for details.

Discussion

In this study we assessed the time to recovery following a cataract surgery and its predictors among patients. The overall median recovery time was 18.14 weeks, with 80.17% of patients recovering, and an incidence rate of 46.47 per 1000 person-weeks. Age, residence, preoperative visual acuity, the presence of comorbidities, the type of cataract surgery, the presence of complications, and the surgeon status were independent predictors of recovery time.

The median recovery time observed in this study was longer than the recovery periods reported in developed countries, where guidelines suggest that recovery typically occurs between 4 and 12 weeks [21, 22]. Similarly, the American Academy of Ophthalmology reported that full recovery is usually achieved within 4–8 weeks [35]. This difference can be attributed to variations in patient demographics, surgical techniques, and complication rates between the populations studied [36]. Phacoemulsification, widely used in developed countries, involves smaller incisions, less tissue trauma, and faster visual rehabilitation [37]. However, its adoption in Ethiopia remains limited due to high equipment costs, the need for specialized training, and infrastructural challenges [24]. These barriers contribute to the continued reliance on alternative techniques such as small-incision cataract surgery (SICS) and extracapsular cataract extraction (ECCE), which may lead to longer recovery periods.

Compared to a previous study conducted in Northern Ethiopia, which reported a median recovery time of 23 weeks [27], this study observed a shorter recovery period. The difference may be explained by the setting of this study, which was conducted at a tertiary national referral facility in Ethiopia, where severe cases are more commonly managed, potentially leading to prolonged recovery times. However, the use of advanced surgical techniques, such as phacoemulsification, and the expertise of the surgeons may have mitigated the impact of case complexity, resulting in relatively faster recovery compared to other local studies.

Patients over 60 years old had a 75% slower recovery compared to those younger than 60. This finding aligns with those of previous studies that have consistently shown that older age is associated with slower recovery after cataract surgery [38, 39]. Age-related physiological changes, such as reduced wound healing capacity and the presence of multiple comorbidities, are more common in older adults and may contribute to slower recovery. This highlights the importance of tailored clinical approaches for older patients to address their unique needs during the postoperative period. Compared with rural residents, urban residents had a 77% faster recovery. This finding is consistent with studies conducted in other areas, which suggest that urban residents generally have better access to healthcare services, including follow-up care, which likely contributed to their faster recovery [27, 40]. Furthermore, urban residents may benefit from less physically demanding jobs, making it easier to adhere to postoperative restrictions and their proximity to healthcare facilities allows for regular monitoring and timely interventions.

This study indicates that preoperative visual acuity significantly influences recovery time. Patients with medium preoperative visual acuity recovered 98% faster than those with low acuity do, whereas those with high acuity recover more than five times faster. The supporting literature reinforces these findings, suggesting that initial visual acuity is a crucial determinant of recovery time. Studies conducted in Ethiopia and Malaysia link better preoperative acuity to improved postoperative outcomes and faster recovery [27, 41]. Similarly, studies from China have shown that patients with high preoperative visual acuity are more likely to achieve favorable postsurgery vision [42, 43]. These insights underscore the critical need for preoperative evaluations to optimize surgical outcomes and recovery trajectories.

Cataract patients with systemic comorbidities had a 59% slower recovery rate than did those without comorbidities, a finding consistent with studies from Malaysia, which reported similar impacts of comorbidities on postsugary recovery [41]. Similarly, ocular comorbidities were associated with a 70% reduction in the recovery rate, which aligns with studies from Ethiopia [44], and The Review of Ophthalmology, which highlighted the challenges posed by glaucoma and other eye conditions to recovery [45]. The slower recovery of these patients may be attributed to the additional burden of managing multiple health issues, complicating the recovery process. These findings emphasize the need for clinicians to address both systemic and ocular comorbidities when planning and managing postoperative care to optimize recovery outcomes.

Patients who underwent phacoemulsification recovered 98% faster than those who underwent small-incision cataract surgery (SICS), consistent with studies from Japan and India, which reported fewer complications and less trauma with phacoemulsification [46, 47]. However, a study on diabetic retinopathy patients indicated that visual improvement might not depend on the surgical technique used [48]. Patients who underwent intracapsular cataract extraction (ICCE) experienced an 86% slower recovery rate than did those who underwent small-incision cataract surgery (SICS), aligning with studies linking intracapsular cataract extraction (ICCE) to higher complication rates and delayed recovery [49]. The faster recovery with phacoemulsification may be attributed to its less invasive nature, minimizing trauma and promoting faster healing. In contrast, slower recovery following intracapsular cataract extraction (ICCE) may be due to larger incisions and sutures, leading to complications like corneal edema and delayed wound healing.

Patients who undergo cataract surgery by ophthalmologists recover more than three times faster than those treated by residents do. This highlights the importance of the surgeon's expertise in ensuring optimal recovery. Studies from the United States, Nigeria, and Israel have revealed that greater surgical experience leads to fewer complications, reduced postoperative corneal edema, and faster recovery [50–52]. This emphasizes the need for prioritizing experienced surgeons in cataract surgery to enhance patient recovery and surgical outcomes.

This study also revealed that intraoperative and postoperative complications significantly affect recovery times. Intraoperative complications led to a 71% slower recovery, and postoperative complications caused an 83% slower recovery than in patients without complications. These findings align with studies from Spain and India, which reported delayed recovery due to intraoperative events, such as posterior capsule rupture [53, 54]. Similarly, postoperative complications have been associated with poorer outcomes and prolonged recovery in regions like Finland and the United Kingdom [55, 56]. The slower recovery may result from the need for additional interventions to manage complications, prolonging the healing process. The delayed recovery may be due to the need for additional interventions to address complications, which prolong the healing process. These findings highlight the importance of adopting meticulous surgical techniques and vigilant postoperative care to minimize complications and improve recovery outcomes.

This study's findings provide important insights into the factors influencing recovery time after cataract surgery in Ethiopia, emphasizing the need for tailored interventions to optimize recovery based on key predictors like age, residence, and preoperative visual acuity, type of surgery, comorbidities, and surgeon expertise. The study also highlights the need for future research exploring the impact of advanced surgical techniques and postoperative care adherence on recovery outcomes. Understanding these factors in greater depth could inform clinical guidelines and improve patient care, especially in resource-limited settings.

Strengths and limitations of the study

The strength of this study lies in the use of a Weibull survival model with an inverse Gaussian frailty component, which allowed for the assessment of both observed and unobserved factors affecting recovery time. The use of Kobo Collect enhanced data accuracy and quality through built-in validation rules.

However, the retrospective nature of this study limited the inclusion of certain key variables, such as socioeconomic status, level of patient education, occupational demands, lifestyle habits, dietary patterns, surgery duration, post-operative refractive surprise and adherence to postoperative car, all of which may have influenced recovery but were not available for analysis. This introduces the potential for residual confounding. Furthermore, we acknowledge that postoperative recovery was defined based on clinician assessment, which, while consistent with clinical practice in our setting, introduces subjectivity and may not be universally applicable. Objective parameters such as refractive stability, corneal edema resolution, cessation of postoperative medications, and uveitis resolution, which could provide a more standardized recovery endpoint, were not available in the retrospective data and are now noted as study limitations.

The exclusion of incomplete medical records may have introduced selection bias, as patients with incomplete follow-up data might have had different recovery trajectories compared to those included in the analysis. The presence of interval-censored data, where recovery times were unknown between follow-up visits, also introduces some uncertainty into the analysis. Lastly, the use of a single-facility data source limits representativeness and generalizability. These limitations should be considered in future research and clinical practice.

Conclusions and recommendations

The median recovery time from cataract surgery in this study was longer than in developed countries. Recovery time was significantly influenced by patient age, residence, preoperative visual acuity, comorbidities, surgical techniques, surgeon expertise, and complications. Older patients, those with comorbidities or complications, and those undergoing less advanced surgeries like intra capsular cataract extraction had slower recovery rates.

To enhance recovery times, efforts should focus on improving access to phacoemulsification, strengthening preoperative assessments, improving healthcare access for rural populations, and minimizing intraoperative and postoperative complications, and enhancing surgeon expertise to ensure high-quality surgical performance. Future multi-center, prospective studies are needed to validate these findings and further investigate additional factors affecting postoperative recovery.

Abbreviations

AHR	Adjusted hazard ratio
CI	Confidence Interval
ECCE	Extracapsular cataract extraction
ECCE	Extracapsular cataract extraction
ICCE	Intracapsular cataract extraction
IOL	Intraocular lens
IOP	Intraocular pressure
IQR	Interquartile range
OD	Oculus Dexter
OS	Oculus Sinister
OU	Oculus uterque
PCIOL	Posterior chamber intraocular lens
PCO	Posterior capsular opacification
PCR	Posterior capsule rupture
Phaco	Phacoemulsification
SICE	Small incision cataract extraction

Supplementary Information

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Supplementary Material 1

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Author contributions

Gininu Wendmeneh (G.W.), Yilma Chisha (Y.C.) and Melkamu Merid (M.M.) made significant contributions to the conception, design, execution, analysis, and interpretation of the study. G.W. was responsible for data acquisition and management and drafted the initial manuscript. G.W. and M.M. collaboratively conducted a critical review and revision of the manuscript. Y.C. and M.M. supervised the research and managed project administration. All authors read and approved the final manuscript.

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Data availability

The dataset supporting this research is available from the corresponding author upon reasonable request. This research is original and has not been submitted to or published in any journal.

Declarations

Ethics approval and consent to participate

Ethical approval was granted by the Institutional Research Ethics Review Board (IRB) of Arba Minch University, College of Medicine and Health Science, on May 7, 2024 (Protocol number: GW23147). Written authorization was obtained from the Addis Ababa City Administration Health Bureau and the research office of Menelik II Comprehensive Specialized Hospital to access medical records. Informed consent was waived due to the retrospective nature of the study. Patient data were anonymized by using medical record numbers, ensuring that no identifiable information was accessed. Data collection adhered to strict ethical and confidentiality standards.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author details

[1]School of Public Health, College of Medicine and Health Sciences, Arba Minch University, Arba Minch, Ethiopia
[2]Department of Health Service Quality Improvement, Menelik II Comprehensive Specialized Hospital, Addis Ababa, Ethiopia
[3]Department of Health Sciences, Faculty of Medicine, Lund University, Lund, Sweden

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References

1. Bourne RRA, Steinmetz JD, Saylan M, Mersha AM, Weldemariam AH, Wondmeneh TG, et al. Causes of blindness and vision impairment in 2020 and trends over 30 years, and prevalence of avoidable blindness in relation to VISION 2020: the right to sight: an analysis for the global burden of disease study. Lancet Glob Heal. 2021;9(2):e144–60.
2. Kohli T. To end extreme poverty, we must also end blindness| World Economic Forum. 2021.
3. Berhane Y, Worku A, Bejiga A, Adamu L, Alemayehu W, Bedri A et al. Prevalence and causes of blindness and low vision in Ethiopia. 21, Ethiop J Health Dev. 2008.
4. WHO. WHO EMRO| Cataract| Health topics. 2024 [cited 2024 Apr 6]; Available from: https://www.emro.who.int/health-topics/cataract/
5. Aboobaker S, Courtright P. Barriers to cataract surgery in Africa: a systematic review. Middle East Afr J Ophthalmol. 2016;23(1):145.
6. Lee CS, Gibbons LE, Lee AY, Yanagihara RT, Blazes MS, Lee ML, et al. Association between cataract extraction and development of dementia. JAMA Intern Med. 2022;182(2):134–41.
7. Foss A. Prompt access to cataract surgery is vital for preventing falls in older people. Med J Aust. 2022;217(2):84–5.
8. Keay L, Ho KC, Rogers K, McCluskey P, White AJR, Morlet N, et al. The incidence of falls after first and second eye cataract surgery: a longitudinal cohort study. Med J Aust. 2022;217(2):94–9.
9. Burton MJ, Ramke J, Marques AP, Bourne RRA, Congdon N, Jones I, et al. The lancet global health commission on global eye health: vision beyond 2020. Lancet Glob Heal. 2021;9(4):e489–551.
10. Thomas BJ, Sanders DS, Oliva MS, Orrs MS, Glick P, Ruit S, et al. Blindness, cataract surgery and mortality in Ethiopia. Br J Ophthalmol. 2016;100(9):1157–62.

11. Chen H, Lin Z, Chen J, Li X, Zhao L, Chen W, et al. The impact of an interactive, multifaceted education approach for congenital cataract on parental anxiety, knowledge and satisfaction: a randomized, controlled trial. Patient Educ Couns. 2020;103(2):321–7.
12. Yang X, Chen H, Zhang T, Yin X, Man J, He Q et al. Global, regional, and national burden of blindness and vision loss due common eye diseases from 1990 to 2019. Ophthalmology. 2021;13(15):19614–42.
13. Heruye SH, Nkenyi LNM, Singh NU, Yalzadeh D, Ngele KK, Njie-Mbye YF et al. Current trends in the pharmacotherapy of cataracts. Pharmaceuticals. 2020;13(1).
14. Ruparelia S. A lens into the past: the history of cataract surgery. Dalhous Med J. 2022;48(1):4.
15. Foster A. Vision 2020: the cataract challenge. Community Eye Heal. 2000;13(34):17–9.
16. Nizami AA, Gulani AC, Cataract. PubMed. StatPearls Publishing PP - Treasure Island (FL); 2022.
17. Ministry F. National Strategic Action Plan for Eye Health 2016–2020. 2016;1–59.
18. Habtamu E, Eshete Z, Burton MJ. Cataract surgery in Southern Ethiopia: distribution, rates and determinants of service provision. BMC Health Serv Res. 2013;13(1):480–480.
19. Meshesha BR, Sibhatu MK, Beshir HM, Zewude WC, Taye DB, Getachew EM, et al. Access to surgical care in Ethiopia: a cross-sectional retrospective data review. BMC Health Serv Res. 2022;22(1):1–12.
20. Yoshizaki M, Ramke J, Zhang JH, Aghaji A, Furtado JM, Burn H, et al. How can we improve the quality of cataract services for all? A global scoping review. Clin Exp Ophthalmol. 2021;49(7):672–85.
21. Centre SNE. A patient guide - Cataract and Cataract Surgery. 2017.
22. Armadale eye clinic. How long does it take to recover from cataract surgery? Time of Healing. 2021 [cited 2024 Sep 9]. Available from: https://armadale-eye.com.au/how-long-does-take-recover-from-cataract-surgery/
23. Practice pluse group. Cataract surgery recovery time a patient guide. 2025 [cited 2025 Mar 17]. Available from: https://practiceplusgroup.com/knowledge-hub/cataract-surgery-recovery-guide/
24. Hamid A. Recovering from Cataract Surgery: Everything You Need to Know - Optegra. 2023.
25. John F, Doane MD. How to minimize cataract surgery recovery time?| Discover Vision Centers. 2023 [cited 2024 Feb 25]; Available from: https://www.discovervision.com/blog/how-long-does-it-take-to-recover-from-cataract-surgery/
26. Rodriguez D. Cataract surgery recovery| What is the recovery process like? Barnet Dulaney Perkins Eye Center. 2022.
27. Beyene AM, Eshetie A, Tadesse Y, Getnet MG. Time to recovery from cataract and its predictors among eye cataract patients treated with cataract surgery: a retrospective cohort study in Ethiopia. Ann Med Surg. 2021;65:102275–102275.
28. Addisu Z, Solomon B. Patients' preoperative expectation and outcome of cataract surgery at Jimma university specialized hospital -Department of ophthalmology. Ethiop J Health Sci. 2011;21(1):47.
29. Darville-Beneby R, Lomanowska AM, Yu HC, Jobin P, Rosenbloom BN, Gabriel G et al. The impact of preoperative patient education on postoperative pain, opioid use, and psychological outcomes: a narrative review. Can J Pain. 2023;7(2).
30. Ala A, Alsaadi FE, Ahmadi M, Mirjalili S. Optimization of an appointment scheduling problem for healthcare systems based on the quality of fairness service using whale optimization algorithm and NSGA-II. Sci Rep. 2021;11(1).
31. Fikrie A, Mariam YG, Amaje E, Bekele H. Knowledge about cataract and associated factors among adults in Yirgalem town, Sidama National regional State, Southern Ethiopia, 2020: a community based cross sectional study design. BMC Ophthalmol. 2021;21(1):79.
32. WHO. Report of the 2030 targets on effective coverage of eye care. 2022. Available from: https://iris.who.int/bitstream/handle/10665/363158/9789240058002-eng.pdf?sequence=1
33. Sarmiso S, Tediso D, Tafese T, Gari T. Time to recovery following cataract surgery and its predictors among patients undergoing surgery at two selected Public Hospitals in Hawassa, Sidama, Ethiopia. PLoS One. 2024 [cited 2025 Mar 29];19(11):e0313118. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC11534261/
34. Tedros Adhanom. 2019. World report on vision. World Heal Organ. 2019;214(14):180–235.
35. Ashley Behrens M. Cataract Surgery| Johns Hopkins Medicine. 2024.
36. American Academy of Ophthalmology. 10 Cataract Surgery Side Effects, and How to Cope. 2023 [cited 2025 Jan 20]. Available from: https://www.aao.org/eye-health/tips-prevention/side-effects-cataract-surgery-complications-cope
37. Bipin G, Richard S. Extracapsular cataract extraction to phacoemulsification: why and how? Eye (Lond). 1998;12 (Pt 6)(6):976–82.
38. Wong TY. Effect of increasing age on cataract surgery outcomes in very elderly patients. BMJ. 2001;322(7294):1104–6.
39. Ji MJ, Kim S, Jun Lee M, Beom Han S. Evaluation of visual outcome after cataract surgery in patients aged 85 years or older. J Korean Ophthalmol Soc. 2016;57(2):214–20.
40. Vijaya L, George R, Rashima A, Raju P, Arvind H, Baskaran M, et al. Outcomes of cataract surgery in a rural and urban South Indian population. Indian J Ophthalmol. 2010;58(3):223–8.
41. Yong GY, Mohamed-Noor J, Salowi MA, Adnan TH, Zahari M. Risk factors affecting cataract surgery outcome: the Malaysian cataract surgery registry. PLoS ONE. 2022;17(9).
42. Zhu X, Ye H, He W, Yang J, Dai J, Lu Y. Objective functional visual outcomes of cataract surgery in patients with good preoperative visual acuity. Eye. 2017;31(3):452–9.
43. Rongrong Z, Fu L, Yan Y, Tiantian W, Changfan W. Factors affecting early postoperative visual acuity in cataract patients with high myopia. Int J Ophthalmol Clin Res. 2020;7(3):117.
44. Markos CM, Tamrat LT, Asferaw MA. Outcomes and associated factors of cataract surgery among adults attending a tertiary hospital in addis Ababa, Ethiopia. Patient Relat Outcome Meas. 2020;11:231–9.
45. Brandt JD, Sacramento MD. C. When Glaucoma Patients Have Cataract Surgery. 2014. [cited 2024 Dec 25]. Available from: https://www.reviewofophthalmology.com/article/when-glaucoma-patients-have-cataract-surgery
46. Bissen-Miyajima H, Weikert MP, Koch DD. Cataract surgery: maximizing outcomes through research. Springer Japan. 2014:1–211.
47. Madhumallika Pathak A, Odayappan M, Nath, Ramalakshmi Raman SB, Nachiappan S. Comparison of the outcomes of phacoemulsification and manual small-incision cataract surgery in posterior polar cataract - A retrospective study. BMC Ophthalmol. 2017;17(1):1.
48. Chaudhary A, Kumari S. A comparative study of post-operative results with different grades of diabetic retinopathy after phacoemulsification and small incision cataract surgery (SICS) [with various types of IOLs]. IP Int J Ocul Oncol Oculoplasty. 2021;6(4):232–6.
49. Center for sight. Types of cataract surgery. Which Is Right For You?; 2023.
50. Lhuillier L, Jeancolas AL, Renaudin L, Goetz C, Ameloot F, Premy S, et al. Impact of ophthalmic surgeon experience on early postoperative central corneal thickness after cataract surgery. Cornea. 2017;36(5):541–5.
51. Odugbo O, Babalola O, Morgan R. Influence of rank of surgeon on the outcome of cataract surgery in plateau state Nigeria. Jos J Med. 2011;5(2):21–6.
52. Cnaany Y, Goldstein A, Lavy I, Halpert M, Chowers I, Ben-Eli H. Ophthalmology residents' experience in cataract surgery: preoperative risk factors, intraoperative complications, and surgical outcomes. Ophthalmol Ther. 2024;13(6):1783–98.
53. González N, Quintana JM, Bilbao A, Vidal S, De Larrea NF, Díaz V, et al. Factors affecting cataract surgery complications and their effect on the postoperative outcome. Can J Ophthalmol. 2014;49(1):72–9.
54. Vajpayee RB, Sharma N, Dada T, Gupta V, Kumar A, Dada VK. Management of posterior capsule tears. Surv Ophthalmol. 2001;45(6):473–88.
55. Porela-Tiihonen S, Kokki H, Kaarniranta K, Kokki M. Recovery after cataract surgery. Acta Ophthalmol. 2016;94(5):1–34.
56. Fouad YA, Jabbehdari S, Neuhouser A, Soliman MK, Chandra A, Yang YC, et al. Visual outcomes and postoperative complications of eyes with dropped lens fragments during cataract surgery: multicenter database study. J Cataract Refract Surg. 2023;49(5):485–91.

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