

The Relationship Between Clinical Characteristics with Visual Outcome in Post Cataract Surgery at Tidore Islands City Regional Hospital

Izzatulhasanah¹, Ganesa Wardana², Nur Upik En Masrika^{3,*}

¹Medical Study Program, Faculty of Medicine, Universitas Khairun, Ternate, Indonesia

²Department of Ophthalmology, Faculty of Medicine, Universitas Khairun, Ternate, Indonesia

³Department of Biomedical Science, Faculty of Medicine, Universitas Khairun, Ternate, Indonesia

*Corresponding Author. Email: nurupik@unkhair.ac.id, Telp: +628114308822

ABSTRACT

Introduction: Cataracts are a leading cause of blindness worldwide. The prevalence of blindness due to untreated cataracts remains quite high in Indonesia. In Eastern Indonesia, where there are limited healthcare facilities and scarce published data, this problem is particularly pronounced. Although cataract surgery is an effective intervention for restoring vision, postoperative visual outcomes can vary based on various patient-related clinical factors. No reported studies have addressed this issue in North Maluku. This study aims to analyze how clinical characteristics influence visual outcomes in patients after cataract surgery at Tidore Islands City Regional Hospital.

Method: This research employed an observational analytical study with cross sectional design. This study used secondary data recorded at the Tidore Islands City Regional Hospital in 2020–2023 that meets the inclusion and exclusion criteria. The clinical characteristics assessed included age, gender, occupation, cataract stage, postoperative complications, and systemic comorbidities such as diabetes mellitus and hypertension. Visual acuity was measured using Snellen chart and converted into logMAR units for analysis and classification according to WHO criteria. Data analysis was performed using simple logistic regression.

Results: Simple logistic regression showed no association between visual outcomes and age ($p=0.089$), gender ($p=0.160$), or occupation ($p=1.395$). Significant associations were observed for cataract stage ($p=0.014$), postoperative complications ($p=0.004$), and presence of comorbidities ($p<0.001$).

Conclusion: Age, gender, and occupation were not associated with visual outcomes. Cataract stage, postoperative complications, and comorbidities were significantly associated with outcomes. Diabetes mellitus was the most influential factor.

Keywords: Cataract, cataract extraction, comorbidity, diabetes mellitus, visual acuity



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Email:
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Introduction

Cataract is a condition that affects the eye, causing the previously clear lens to become cloudy, thereby blocking light from entering the retina. The incidence of cataracts is notably high, primarily due to the aging process.¹ Cataracts are the leading cause of severe visual impairment and blindness worldwide. According to data from the World Health Organization (WHO) in 2018, approximately 2.2 billion people experience some form of visual impairment or blindness, with 94 million cases attributed to cataracts.² Cataracts are also the primary cause of blindness in Southeast Asia, with an estimated 12 million (30%) people blind and 78 million (32%) visually impaired in 2010.³

Indonesia has the highest rate of blindness in Southeast Asia⁴. In response to this, the Rapid Assessment of Avoidable Blindness (RAAB) survey was conducted across 15 provinces in Indonesia from 2013 to 2017. The survey revealed a blindness prevalence of 3%, with 81% of cases caused by untreated cataracts. The highest proportion of untreated cataract-related blindness was found in West Papua (95.5%), followed by Maluku (88.0%) and South Kalimantan (87.7%).^{5,6}

The primary treatment for cataracts to prevent blindness is surgery. The aim of cataract surgery is to improve visual acuity.⁷ According to WHO guidelines, visual acuity outcomes after surgery are categorized into three groups: good outcome, borderline outcome, and poor outcome.⁸

A study conducted by Sengo in 2023 involving 484 cataract surgery patients found that the majority achieved a good visual outcome (74.3%), followed by borderline outcome (23.5%), and poor outcome (2.2%).⁹ Another study by Markos (2020) identified several factors influencing postoperative visual acuity, with age, preoperative vision, and intraoperative complications showing significant associations with visual outcomes ($p < 0.05$).¹⁰

North Maluku is a region that has not been included in the RAAB survey assessments; therefore, there are no definitive data on blindness rates or visual acuity outcomes.⁵ A previous study by Assayidatina (2022) at Dr. H. Chasan Boesoirie General Hospital focused only on the clinical characteristics of outpatients undergoing cataract treatment.¹¹ Despite extensive research on cataract, comprehensive data on specific clinical characteristics influencing postoperative visual outcomes remain limited, particularly in underrepresented regions such as North Maluku. Based on these considerations, this study aims to analyze how clinical characteristics influence visual outcomes in patients after cataract surgery at Tidore Islands City Regional Hospital.

Methods

This study is an observational analytic study with a cross-sectional approach. It was conducted to determine the relationship between clinical characteristics and visual outcomes after cataract surgery at Tidore Islands City Regional Hospital during the period of September to November 2023. The study sample consisted of all cataract patients who had undergone surgery, assessed based on the operated eye. The sample size was calculated using Slovin's formula, resulting in 224 samples that met the inclusion and exclusion criteria.

The inclusion criteria were cataract patients aged ≥ 45 years with complete medical records containing data such as age, gender, visual outcome, cataract stage, complications, and comorbidities. The exclusion criteria included patients with traumatic cataracts, congenital cataracts, and cataracts accompanied by other media opacity disorders such as refractive errors (myopia, hypermetropia, presbyopia and astigmatism), glaucoma, corneal disorders, retinal disorders, or optic nerve diseases. To minimize potential confounding, patients with astigmatism were excluded during the study design phase, and this variable was not included in the analysis. Visual acuity was measured using Snellen chart and converted into logMAR units for analysis and classification according to WHO criteria.

Data collection was conducted using secondary data obtained from the medical records of post-operative cataract patients at Tidore Islands City Regional Hospital from October 2020 to August 2023. The sampling technique used in this study was simple random sampling. The collected data were processed using the IBM SPSS statistical software and analyzed through univariate, bivariate (simple logistic regression), and multivariate (multiple logistic regression) methods. A significant level of $p < 0.05$ was considered statistically significant. This study was conducted with permission from Tidore Islands City Regional Hospital, as stated in Letter No. 684/G.8/22/798.10/2023 and the Faculty of Medicine, Khairun University, as stated in Letter No. 2757/UN44.C9/KM.05/2023. All patient data were anonymized by replacing names with initials and using only medical record numbers to ensure confidentiality.

Result

Figure 1 shows the flow diagram of study samples. Initially, 508 eyes from patients who had undergone cataract surgery at Tidore Islands City Regional Hospital were assessed for eligibility. Furthermore, 284 eyes were excluded due to not meeting the inclusion criteria ($n = 115$), having incomplete data ($n = 86$), or having refractive disorders such as astigmatism ($n = 83$). Finally, 224 eyes that met all inclusion criteria were included in the analysis.

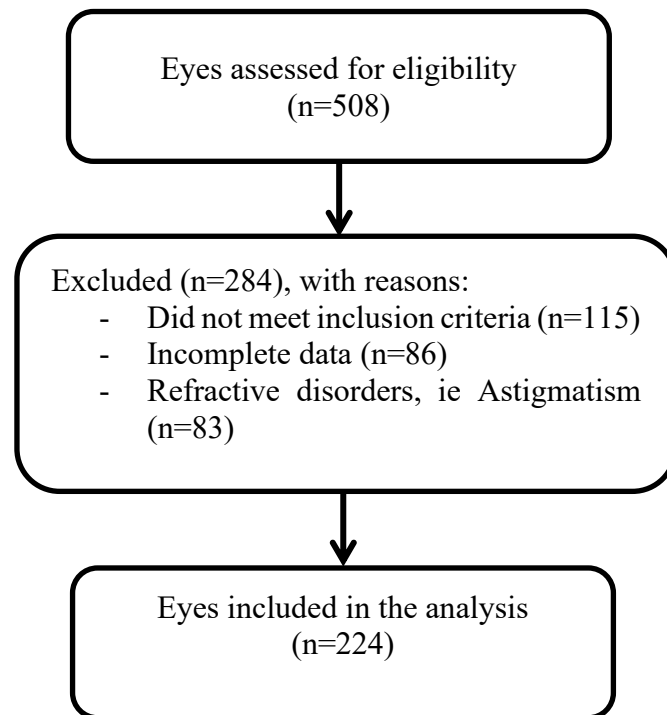


Figure 1. Flow diagram of cataract sample selection

Table 1 shows most patients were aged 60–74 years (58%), male (55.4%), and worked outdoors (55.4%). The majority had immature cataracts (66.5%), no postoperative complications (83.5%), and no comorbidities (41.1%). Good to borderline visual outcomes were observed in 67% of cases.

Based on the logistic regression analysis presented in Table 2, there were no significant associations between visual outcomes and demographic characteristics such as age, gender, and occupation ($p > 0.05$). However, clinical factors like the stage of cataracts, postoperative complications, and comorbidities (like diabetes, high blood pressure, or both) were significantly associated to patient's visual improvement after surgery ($p < 0.05$), indicating they could affect visual outcomes after cataract surgery.

Data in Table 3 shows the results of statistical analysis using multivariate logistic regression to determine the most influential independent variable on visual outcomes after cataract surgery at Tidore Islands City Regional Hospital. The results showed that the most influential variable was comorbidity of Diabetes Mellitus (DM), with an Exp(B) value of 5.872.

Table 1. Clinical characteristics of post-cataract surgery patients at Tidore Islands City Regional Hospital

Variable	Frequency (N = 224)	Percentage (%)
Age		
45-59 years	61	27.2
60-74 years	130	58.0
75-90 years	33	14.7
>90 years	0	0.0
Gender		
Male	124	55.4
Female	100	44.6
Occupation		
Outdoor	124	55.4
Indoor	100	44.6
Visual Outcome		
Good to borderline outcome (0.00-1.00)	150	67.0
Poor outcome (>1.00)	74	33.0
Cataract Stage		
Immature	149	66.5
Mature	75	33.5
Postoperative Complications		
With complications	37	16.5
Without complications	187	83.5
Comorbidities		
Diabetes Mellitus	24	10.7
Hypertension	79	35.3
DM and HT	29	12.9
Neither DM nor HT	92	41.1

DM = Diabetes Mellitus, HT = Hypertension

Table 2. Association between clinical characteristics and visual outcomes after cataract surgery

Clinical Characteristics	Visual Outcome Post-Cataract Surgery, n (%)		Simple Logistic Regression	
	Good to borderline outcome	Poor outcome	OR (95% CI)	P-Value
Age				
45-59 years	44 (72.1)	17 (27.9)	0.464 (0.191 – 1.123)	0.089
60-74 years	88 (67.7)	42 (32.3)		
75-90 years	18 (54.5)	15 (45.5)		
Gender				
Male	89 (71.8)	35 (28.2)	0.615 (0.351 – 1.078)	0.089
Female	61 (61.0)	39 (39.0)		
Occupation				
Outdoor	79 (63.7)	45 (36.3)	1.395 (0.792 - 2.457)	0.250
Indoor	71 (71.0)	29 (29.0)		
Cataract Stage				
Immature	108 (72.5)	41 (27.5)	0.483 (0.270 – 0.863)	0.014*
Mature	42 (56.0)	33 (44.0)		
Postoperative Complications				
Present	17 (45.9)	20 (54.1)	2.898 (1.411 – 5.952)	0.004*
Absent	133 (71.1)	54 (28.9)		
Comorbidities				
DM	10 (41.7)	14 (58.3)	6.650 (2.510 – 17.617)	<0.001*
HT	50 (63.3)	29 (36.7)		
DM and HT	14 (48.3)	15 (51.7)		
Neither DM nor HT	76 (82.6)	16 (17.4)		

CI = Confidence Interval, DM = Diabetes Mellitus, HT = Hypertension, OR = Odds Ratio
 Simple logistic regression test, * $P < 0.05$, statistically significant

Table 3. Multivariate analysis of the relationship between cataract stage, postoperative complications, and comorbidities with visual outcomes after cataract surgery

		Sig.	Exp(B)
Step 1 ^a	Immature	0.065	0.552
	Postoperative Complications	0.008*	2.841
	Comorbidities	0.001*	
	DM	0.001*	5.872
	HT	0.005*	2.818
	DM and HT	0.001*	4.742
	Constant	<0.001*	0.259

DM = Diabetes Mellitus, HT = Hypertension, Exp(B)= Exponential of the Coefficient B (Odds Ratio), Sig.= (*P*-value)

Multiple logistic regression test, **P*<0.05, statistically significant

Discussion

Clinical characteristics of post-cataract surgery patients

Based on patient clinical characteristics data, the most prominent age group was 60–74 years, accounting for 130 eyes (58%). This is consistent with the study by Sidrafiani (2021), which found that the largest number of cataract surgeries occurred among elderly patients aged 60–74 years (39.29%). Older individuals are more prone to systemic conditions such as hypertension and diabetes, and they are also more susceptible to post-surgical complications, which can negatively affect visual outcomes.^{12, 13}

In terms of gender distribution, male patients represented a slightly larger proportion, with 124 eyes (55.4%), similar to a study conducted with study by Gde at RSUP Sanglah (2016–2017), which reported 78.1% of post-operative cataract patients were male.¹⁴ Although cataract incidence is generally higher among women, especially after menopause due to declining oestrogen levels, this study observed a predominance of male patients.¹⁵

Regarding occupation, 124 patients (55.4%) were engaged in outdoor work, a factor known to contribute to cataract development due to prolonged exposure to ultraviolet (UV) light. This finding aligns with research by Allern (2015), which showed that approximately 64.9% of senile cataract cases involved patients who had significant UV exposure from outdoor occupations.¹ UV radiation accelerates cataract formation by generating reactive oxygen species that damage lens proteins.¹⁶

In terms of visual outcomes, most patients (67%) achieved good to borderline vision

following surgery, while 33% had poor outcomes. This trend is supported with the study by Markos (2020) conducted at Saint Paul's Hospital, where a majority of the 309 eyes analyzed demonstrated good to borderline postoperative vision.¹⁰

Regarding cataract stage, most cases were diagnosed as immature senile cataracts, which comprised 66.5% of the total cases, whereas mature cataracts made up only 33.5%. This observation aligns with the findings of Gracella (2014), who reported that immature senile cataracts were more prevalent, especially among patients aged 60–69 years (32.5%), whereas mature cataracts were less common in the elderly (only 3.3% in patients aged 80–96 years).¹⁷

Based on the distribution of post-operative complications, the study showed that more eyes did not experience complications (187 cases, 83.5%) compared to those with post-operative complications (37 cases, 16.5%). This finding is consistent with a study by Nurjanah (2019), which found that more eyes did not experience complications post-surgery (22 cases, 70.9%) compared to those with post-operative complications.¹⁸

In terms of comorbidities, systemic conditions were commonly observed among the patients: 24 cases (10.7%) had diabetes mellitus (DM), 79 cases (35.3%) had hypertension (HT), 29 cases (12.9%) had both DM and HT, and 92 cases (41.1%) had neither condition. This is consistent with research by Hidayaturahmah in 2021, where the study showed more post-operative cataract eyes had comorbid DM, with 240 cases (51.7%) compared to 224 (48.3%) without DM comorbidity.¹⁹ Both DM and hypertension play a significant role in cataract development. Hypertension affects the protein structure, while DM leads to sorbitol accumulation, which eventually causes vision impairment and worsens cataracts.⁷

Association between clinical characteristics and visual outcomes after cataract surgery

The bivariate analysis explored the relationship between various clinical characteristics and visual outcomes after cataract surgery. First, no statistically significant relationship was found between age and visual outcome. The proportion of good to borderline vision was relatively high across all age groups: 72.1% in patients aged 45–59, 67.7% in those aged 60–74, and 54.5% in patients aged 75 years or older. Logistic regression analysis showed p-values of 0.089 and 0.160 (>0.05), indicating no significant correlation. This is in line with a study by Markos (2020), which reported a similar non-significant result ($p = 0.091$) in patients aged 70–79 years.¹⁰ Although literature suggests that advancing age may be associated with denser cataracts and potentially worse outcomes, this assumption was not statistically supported in the current study.¹⁴

When it comes to gender, most male (71.8%) and female (61%) patients had good to borderline results, and the logistic regression p-value of 0.089, indicates there is no significant

association between gender and outcomes. These findings align with those of Priyadharshini (2021), who reported that while females showed a higher rate of poor outcomes (67.3%), the result was not statistically significant ($p = 0.505$).²⁰ Although women have a higher lifetime risk of cataract due to hormonal factors, studies have shown that men may experience a slightly higher likelihood (11%) of reduced visual acuity post-surgery.²¹

Similarly, no significant association was found between occupation and visual outcome. Patients in outdoor jobs had a 63.7% rate of good to borderline outcomes, while those in indoor jobs had a slightly higher rate at 71%. Statistical testing showed a p-value of 1.395 (>0.05), indicating no significant relationship. This is consistent with research by Devi (2017), who reported a p-value of 0.516.²² Although UV exposure from outdoor work is a known cataract risk factor, its direct effect on post-operative visual outcome appears minimal.²³

In contrast, a significant association was identified between cataract stage and visual outcome. Patients with immature cataracts had better outcomes (72.5%) compared to those with mature cataracts (56%), with a p-value of 0.014 (<0.05). This result is consistent with the study by Widagdo (2023), who found that 91.1% of immature cataracts had good visual outcomes, while only 42.8% of mature cataracts did. Immature cataracts are typically less dense and easier to remove surgically, leading to better recovery of vision.²⁴

There was also a statistically significant relationship between post-operative complications and visual outcome ($p = 0.004$). Among patients who experienced no complications, 71.1% had good to borderline vision, whereas among those with complications, only 45.9% achieved similar outcomes. The most common complication in this study was intraocular lens (IOL) dislocation.²⁵ This finding is supported by Sa'at (2022), who reported that 92.3% of patients without complications had better outcomes, and complications such as IOL dislocation can lead to trauma and zonular instability, reducing visual acuity.²¹

Finally, comorbidities showed a strong and significant correlation with visual outcomes. Good to borderline results were found in 41.7% of patients with DM, 63.3% with hypertension, 48.3% with both, and 82.6% among those with neither. Logistic regression analysis yielded p-values of <0.001 for DM, 0.005 for HT, and <0.001 for DM and HT, which all statistically significant. These results agree with Sa'at (2022), who found that 80% of patients with systemic diseases had poor outcomes. Hypertension increases oxidative stress, while DM results in metabolic disturbances such as sorbitol accumulation, both contributing to poorer postoperative vision.²¹

Multivariate analysis

Multivariate analysis was conducted to identify the clinical characteristics most influencing visual outcomes post-surgery. The results indicate that the higher the odds ratio (OR) value for a variable, the greater its influence on the visual outcome post-cataract surgery. This suggests that eyes with a comorbidity of DM have a 5.872 times higher risk of having poor visual outcomes compared to eyes with other clinical characteristics. Therefore, in this study, the most influential factor on visual outcome is the comorbidity of DM. Furthermore, although some studies suggest that high postoperative astigmatism may influence visual acuity, this study excluded such cases in the design phase to reduce confounding bias. Thus, astigmatism was not evaluated as a predictor. It is important to note, however, that visual outcomes may also be influenced by the natural course of postoperative recovery. While most of the healing and stabilization of visual acuity typically occurs within the first few weeks following cataract surgery, complete adaptation particularly in elderly patients or those with systemic comorbidities such as DM may take several months.

This study has limitations, including the use of secondary data, which limits the availability of supporting data; the other visual outcomes were assessed only based on postoperative refraction data without long-term visual follow-up; and it was conducted in only one hospital, thus limiting the generalisability of the findings to a wider population. Additionally, refractive disorders including astigmatism were excluded according to the study's criteria. As a result, their potential influence on visual outcomes was beyond the scope of this analysis.

Conclusion

There is no relationship between age, gender, and occupation with visual outcome, but there is a significant relationship between cataract stage, postoperative complications, and comorbidities with visual outcome. Among these, comorbidity of DM is the most influential clinical characteristic affecting visual outcome.

Conflicts of Interest

Nothing to declare

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Nothing to declare

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Nothing to declare

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