ORIGINAL ARTICLE

Bali Journal of Ophthalmology (BJO) 2026, Volume 10, Number 1: 7-11
P-ISSN.2089-1180, E-ISSN.2302-2914

Bali Journal of Ophthalmology

Characteristics of high myopia cataract patients undergoing phacoemulsification with capsular tension ring implantation at Bali Mandara Eye Hospital

Cokorda Istri Dewiyani Pemayun[1], Jovita Jutamulia[1*], I Gusti Putu Eka Suryawan Widnyana[1]

[1]Ophthalmology Department, Bali Mandara Eye Hospital, Denpasar, Indonesia

*Corresponding email: Jovita Jutamulia; Ophthalmology Department, Bali Mandara Eye Hospital, Denpasar, Indonesia; jovita.jutamulia@gmail.com

Received: 2026-02-15
Accepted: 2026-04-18
Published: 2026-05-22

ABSTRACT

Introduction: The prevalence of cataract is increasing among patients with high myopia, making cataract surgery in this population more frequent and more complex than in eyes without high myopia. The capsular tension ring (CTR) may help improve capsular stability and reduce the risk of postoperative complications. Therefore, this study aimed to describe the characteristics of patients with cataract and high myopia who underwent phacoemulsification with CTR implantation at Bali Mandara Eye Hospital, a tertiary referral eye hospital in Bali, from July 2024 to July 2025.

Methods: This descriptive study used secondary data from medical records of patients with cataract and high myopia who underwent phacoemulsification with CTR implantation. Data, including age, sex, education level, and visual acuity before and one month after the procedure, were extracted and analyzed. The data were presented descriptively in frequency tables and narrative form.

Results: In this study, 211 phacoemulsification procedures with CTR implantation were performed, and 105 procedures on 77 patients met the inclusion criteria. The majority of patients were 50 years old or older (72.7%), female (65.0%), and had a higher education level (31.1%). Before the procedure was carried out, the majority of patients had visual acuity in the blindness category (90.4%), while one month postoperatively, most achieved normal vision (53.4%).

Conclusion: Patients with cataract and high myopia who underwent phacoemulsification with CTR implantation were generally older and mostly female. The procedure was followed by improved visual acuity in the majority of patients.

Keywords: cataract, high myopia, phacoemulsification, capsular tension ring, visual acuity.
Cite This Article: Pemayun, C.I.D., Jutamilia, J., Widnyana, I.G.P.E.S. 2026. Characteristics of high myopia cataract patients undergoing phacoemulsification with capsular tension ring implantation at Bali Mandara Eye Hospital. *Bali Journal of Ophthalmology* 10(1): 7-11.

INTRODUCTION

The global prevalence of both cataract and high myopia has continued to increase.[1–3] Cataract and refractive errors are the leading causes of visual impairment and blindness worldwide.[1] In Indonesia, cataract is the leading cause of blindness, severe visual impairment, and moderate visual impairment, while uncorrected refractive error is a major cause of mild visual impairment.[4] High myopia, a specific type of refractive error, is defined as myopia of ≤ −6.00 diopters (D) or an axial length (AL) of ≥ 26 mm.[5] High myopia is associated with a greater risk of several pathological ocular changes, including myopic macular degeneration, glaucoma, retinal detachment, and cataract.[3] These complications not only impair visual function but also introduce additional challenges in surgical management.

The surgery for cataract in patients with high myopia is generally more complex than in non-myopic patients. Axial elongation and thinning of the ocular wall result in elongation and weakening of the zonular fibers, thereby increasing the risk of capsular bag instability, anterior chamber fluctuations, and intraoperative lens dislocation during phacoemulsification. Subsequently, the capsular tension ring (CTR) can be used to reduce these risks and improve intraocular lens (IOL) stability.[6,7]

With the increase in the number of cataract patients presenting with high myopia, the frequency of phacoemulsification procedures involving CTR implantation has also increased. However, data regarding the clinical characteristics and visual outcomes of these patients, particularly in Indonesia, remain limited. Published studies evaluating the use of CTR in high myopia cataract patients in Indonesia are scarce. Furthermore, most existing studies are conducted in different populations, which may not accurately reflect real-world clinical practice in local tertiary care settings. Therefore, this descriptive study was designed to provide baseline clinical characteristics and visual outcomes in this population. This study aimed to describe the characteristics of cataract patients with high myopia who underwent phacoemulsification with

CTR implantation at Bali Mandara Eye Hospital, a tertiary referral eye hospital in Bali, from July 2024 to July 2025.

METHODS

This descriptive study used secondary data obtained from medical records at Bali Mandara Eye Hospital, a tertiary referral eye hospital in Bali, from July 2024 to July 2025. This study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval was granted by the Ethics Committee of Bali Mandara Eye Hospital (Nomor 27/KEPK/RSM.BM) and the Research Ethics Committee of the Faculty of Medicine, Universitas Udayana (No: 2372/UN14.2.2.VII.14/LT/2025). Institutional approval and authorization from the Bali Provincial Government were also obtained (Nomor: B.30.070/369/IZIN-E/DPMPTSP).

Patients with high myopia cataract who underwent phacoemulsification with CTR implantation in the study period were included and examined at a one-month postoperative follow-up. Patients with incomplete medical records and patients with other ocular conditions that can affect the visual acuity were excluded.

Demographic data such as age, gender, and education level were obtained. The age group was divided into two, including those under < 50 years old and those ≥ 50 years old. The education level was divided into 4 categories, including no formal education, primary/elementary school, junior high school, senior high school, and higher education. The categorization of elementary, junior high, and senior high school education follows Indonesian government regulations, which comprises 6 years of elementary school, 3 years of junior high school, and 3 years of senior high school.

Visual acuity is defined as a measure of how clearly and sharply a person can see.[8] Visual acuity was measured by the Snellen eye chart, and the World Health Organization (WHO) classification was used to categorize visual acuity. WHO classified visual acuity into 4 categories, including normal vision (6/6-6/12), mild visual impairment (>6/12– 6/18), moderate visual impairment (>6/18 – 6/60), severe visual impairment (>6/60 – 3/60), and blindness (<3/60).[9]

Data obtained from medical records were processed using computerized methods. Descriptive analyses were performed, and the results are presented in tabular form to provide an overview of the characteristics of cataract patients with high myopia undergoing phacoemulsification with CTR implantation, and statistical analysis was performed using SPSS. Visual acuity was converted from Snellen to the logarithm of the minimum angle of resolution (logMAR) for analysis. Preoperative and postoperative visual acuity were compared using the Wilcoxon signed-rank test. A p-value of <0.05 was considered statistically significant.

RESULTS

In this study, 211 phacoemulsification procedures with CTR implantation were identified, 87 procedures in 2024 and 124 procedures in 2025. After applying the inclusion and exclusion criteria, 105 procedures were included in the final analysis, comprising 44 procedures in 2024 and 61 procedures in 2025. The sample in this study consisted of 105 procedures from 77 patients.

The demographic characteristics obtained include age, gender, and education level, which are shown in **Table 1**. The majority of patients are in the age group ≥ 50 years old (72.7%), with the youngest being 20 years old and the oldest being 78 years old. Gender distribution showed females were more likely than males to undergo phacoemulsification procedures with CTR (65.0% vs 35.0%). Additionally, most patients have higher education (31.1%), followed by senior high school and elementary school, then junior high school, and no formal education.

The visual acuity before and after the procedure is shown in **Table 2**. The majority of patients had vision in the blindness category before phacoemulsification and CTR implantation (90.4%). None of the patients had normal vision or mild visual impairment prior to the procedure. Subsequently, one month postoperatively, visual acuity improved, with the normal vision category becoming the most prevalent (53.4%), and no patients remaining in the severe visual impairment or blindness categories. Preoperative and postoperative visual acuity showed a statistically significant improvement (Wilcoxon signed-rank test, $p < 0.001$).

DISCUSSION

This descriptive study used secondary data obtained from medical records to characterize high myopia cataract patients undergoing phacoemulsification with CTR implantation. An increase in the number of procedures from 2024 to 2025 (44 vs. 61) was observed, consistent with global

Table 1. Demographic characteristics

Variable	n (%)
Age	
< 50 years old	21 (27.3%)
≥ 50 years old	56 (72.7%)
Gender	
Female	50 (65.0%)
Male	27 (35.0%)
Education level	
No formal education	3 (3.9%)
Elementary school	22 (28.6%)
Junior high school	6 (7.8%)
Senior high school	22 (28.6%)
Higher education	24 (31.1%)

Table 2. Visual acuity before and one month after the procedure

Vision acuity categories	Before procedure (%)	1 Month after procedure (%)
Normal (6/6 – 6/12)	0 (0%)	56 (53.4%)
Mild visual impairment (>6/12– 6/18)	0 (0%)	20 (19.0%)
Moderate visual impairment (>6/18 – 6/60)	3 (2.9%)	29 (27.6%)
Severe visual impairment (>6/60 – 3/60)	7 (6.7%)	0 (0%)
Blindness (<3/60)	95 (90.4%)	0 (0%)

trends showing a rising prevalence of high myopia and cataract.[2,3,10–12] Holden BA et al., estimate that by 2050, approximately 49.8% of the world's population will have myopia, and 9.8% will have high myopia.[3] Wan Z et al., also estimated that by 2050, the number of older adults living with cataract could increase to approximately between 160.8 and 211.4 million people.[11] The increasing prevalence of both conditions has implications for the increasing need for cataract surgery, including phacoemulsification with CTR implantation.

The majority of patients were aged ≥ 50 years (72.7%), which is consistent with the epidemiology of cataract showing an increasing incidence with advancing age.[2,11–14] Several studies have reported varying peak ages for cataract occurrence, typically occurring in the sixth and seventh decades of life.[2,12] In addition, Holden BA et al. projected an expansion in the age range of individuals affected by myopia, from 10–39 years in 2000 to 10–79 years in 2050.[3] Other studies investigating cataract in patients with high myopia have similarly reported mean ages above 50 years, which corresponds with the results of this study.[5,7,15,16]

The majority of patients were female (65.0%), which is in line with previous reports showing that the incidence of cataract is higher in females than in males.[2,5,11–14] Jiang X et al., reported a female-to-male cataract incidence ratio of 1.17:1, while other studies have shown ratios as high as 1.30:1.[2,14] This difference is likely associated with several factors, including hormonal changes, greater exposure to biomass fuel during cooking, limited access to healthcare services, and genetic variation.[12] A similar pattern has been observed in myopia, where females have been reported to exhibit a higher prevalence of myopia than males, potentially due to less outdoor activity and a greater intensity of near-work activities.[10,17]

The relationship between education and cataract occurrence or surgery is still unclear. Studies suggest that individuals with higher education often have greater health awareness and better access to healthcare, facilitating earlier surgical intervention. Conversely, other studies show that lower educational levels are associated with an increased risk of developing cataract.[13,18] In this study, the largest proportion of patients had higher education (31.1%), followed by senior high school and elementary school, both with the same proportion (28.6%). The differences between education groups were modest. This may reflect the Indonesian socioeconomic context, in which compulsory basic education results in a large number of elementary school graduates. At the same time, financial constraints limit access to higher education for many individuals.[19] In addition, family members with higher education may play a role in improving health awareness among patients with lower education and encouraging them to undergo surgery. These factors may explain the educational distribution observed in this study.

The surgical outcomes in patients with cataract and high myopia can be challenging due to combined anatomical and functional factors that influence IOL stability. Axial elongation, zonular weakness, and capsular structural changes in high myopia can increase the risk of IOL decentration or rotation following surgery.[5,7,20,21] Therefore, the use of CTR has been proposed to enhance capsular bag stability in these cases. Several studies have shown that CTR implantation improves IOL stability in highly myopic patients undergoing phacoemulsification.[6,7,15,16,22–24] The stable IOL positioning is crucial for postoperative visual quality, particularly in maintaining refractive accuracy and optimal final visual acuity. However, in the present study, the absence of a comparison group limits the ability to determine the independent effect of CTR on surgical outcomes, and therefore, causal conclusions cannot be established.

Visual acuity improved substantially, with a marked shift from the blindness category preoperatively (90.4%) to the normal vision category postoperatively (53.4%). Studies examining postoperative visual acuity following phacoemulsification with CTR implantation remain limited, but some studies show notable benefits. Miyoshi T et al. reported that visual acuity outcomes were slightly better in patients who received a CTR compared with those who did not, consistent with the results of this study.[22] Zhao HY et al. reported that CTR use results in more accurate refractive outcomes without requiring adjustments to IOL power calculations.[6] While CTR use may contribute to improved intraoperative stability and postoperative outcomes, the observed improvement cannot be solely attributed to CTR implantation due to the descriptive nature of this study.

Despite overall improvement, not all patients achieved normal visual acuity. This may be attributed to incomplete postoperative recovery and underlying retinal or macular pathologies commonly associated with high myopia, including myopic maculopathy, chorioretinal atrophy, posterior staphyloma, and other degenerative changes.[3,20,25] In patients without high myopia or other complications, visual recovery after phacoemulsification is typically assessed within 4–6 weeks.[26] However, in highly

myopic patients, an optimal evaluation time has not been established, as optical adaptation and healing may require a longer duration.[16] Residual visual impairment may also be linked to comorbidities frequently observed in high myopia, such as retinal detachment, open-angle glaucoma, and degenerative changes of the posterior retina.[3,20,25] These structural abnormalities can limit visual recovery even after successful cataract surgery. Furthermore, some posterior segment conditions may only become apparent after surgery, once media opacity is removed, allowing for more accurate retinal evaluation.

This study has some limitations. First, the short follow-up duration of only one month limits the assessment of long-term visual outcomes and postoperative complications. Second, the retrospective design introduces potential information bias due to reliance on the completeness and accuracy of medical records. Third, selection bias may be present, as only cases with complete data and follow-up were included in the analysis. Finally, the absence of a control group precludes comparison with patients who did not receive CTR, thereby limiting the ability to draw causal inferences regarding its effectiveness.

Despite these limitations, this study provides valuable real-world data from a tertiary referral center in Indonesia. This contributes to the limited literature on clinical characteristics and outcomes of high myopia cataract patients undergoing phacoemulsification with CTR implantation. Further prospective studies with longer follow-up and comparative designs are needed to better evaluate the role of CTR in this population.

CONCLUSION

In conclusion, patients with cataract and high myopia undergoing phacoemulsification with CTR implantation were predominantly older and female, and the majority experienced improved visual acuity. Further studies with larger sample sizes and longer follow-up periods are needed.

DISCLOSURES

Funding

The authors received no financial support for the study, authorship, and/or publication of this article.

Conflict of Interest

The authors declared no potential conflicts of interest with respect to the study, authorship, and/or publication of this article.

Authors' Contribution

CP was involved in the conception, design, analysis, and supervision of the manuscript. JJ conducted and analysed the study. IW was involved in the design and supervision of the manuscript. All authors contributed to the preparation of the manuscript and approved the final version for submission to the journal.

AI Usage Declaration

The authors used ChatGPT (OpenAI) to assist in improving the clarity and grammar of the manuscript. In addition, the manuscript underwent professional language editing by a third-party service. These were used only for language refinement and did not contribute to data analysis, interpretation, or generation of scientific content. All content has been reviewed and approved by the authors. The authors take full responsibility for the accuracy and originality of the work.

ACKNOWLEDGMENTS

The authors express profound gratitude to Bali Mandara Eye Hospital for facilitating sample collection.

REFERENCES

1. World Health Organization. Blindness and vision impairment [Internet]. 2023. Available from: https://www.who.int/news-room/fact-sheets/detail/blindness-and-visual-impairment
2. Jiang X, Xu B, Zhai J, Huang S, Cheng H, Ma L, et al. Global trends in cataract burden: a 30-year epidemiological analysis and prediction of 2050 from the Global Burden of Disease 2021 study. British Journal of Ophthalmology. 2025;0:1–9. Available from: https://bjo.bmj.com/content/early/2025/08/18/bjo-2025-327776
3. Holden BA, Fricke TR, Wilson DA, Jong M, Naidoo KS, Sankaridurg P, et al. Global Prevalence of Myopia and High Myopia and Temporal Trends from 2000 through 2050. Ophthalmology. 2016;123(5):1036–42. Available from: https://www.aaojournal.org/action/showFullText?pii=S0161642016000257
4. Rif'Ati L, Halim A, Lestari YD, Moeloek NF, Limburg H. Blindness and Visual Impairment Situation in Indonesia Based on Rapid Assessment of Avoidable Blindness Surveys in 15 Provinces. Ophthalmic Epidemiol. 2021;28(5):408–19. Available from: https://pubmed.ncbi.nlm.nih.gov/33380229/
5. He W, Yao Y, Zhang K, Du Y, Qi J, Zhang Y, et al. Clinical Characteristics and Early Visual Outcomes of Highly Myopic Cataract Eyes: The Shanghai High Myopia Study. Front Med (Lausanne). 2022;8:671521. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC8764297/
6. Zhao HY, Zhang JS, Li M, Chen DJ, Wan XH. Effect of capsular tension ring on the refractive outcomes of patients with extreme high axial myopia after phacoemulsification. Eur J Med Res. 2024;29(1):142. Available from: https://pubmed.ncbi.nlm.nih.gov/38402171/
7. Hu X, Qi J, Cheng K, He W, Zhang K, Zhao C, et al. Effectiveness of prophylactic capsular tension ring implantation during cataract surgery in highly myopic eyes. J Cataract Refract Surg. 2024;50(10):1030–6. Available from: https://pubmed.ncbi.nlm.nih.gov/39313860/
8. Porter D. Visual Acuity [Internet]. 2022. Available from: https://www.aao.org/eye-health/glasses-contacts/visual-acuity-3
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 Health. 2021;9(4):e489–551. Available from: https://www.thelancet.com/action/showFullText?pii=S2214109X20304885
10. Wong YL, Saw SM. Epidemiology of Pathologic Myopia in Asia and Worldwide. Asia Pac J Ophthalmol (Phila). 2016;5(6):394–402. Available from: https://pubmed.ncbi.nlm.nih.gov/27898442/
11. Wan Z, Bai J, Wang W, Peng Q. Global, regional, and national burden of cataract among older adults from 1990 to 2021: a comprehensive analysis based on the global burden of disease study 2021. Front Med (Lausanne). 2025;12:1679828. Available from: https://pubmed.ncbi.nlm.nih.gov/40978749/
12. Hashemi H, Pakzad R, Yekta A, Aghamirsalim M, Pakbin M, Ramin S, et al. Global and regional prevalence of age-related cataract: a comprehensive systematic review and meta-analysis. Eye. 2020;34(8):1357. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC7376226/
13. He M, Wang W, Huang W. Variations and Trends in Health Burden of Visual Impairment Due to Cataract: A Global Analysis. Invest Ophthalmol Vis Sci. 2017;58(10):4299–306. Available from: https://pubmed.ncbi.nlm.nih.gov/28846778/
14. Nizami AA, Gurnani B, Gulani AC. Cataract. Principles and Practice in Ophthalmic Assisting: A Comprehensive Textbook. 2024;511–22. Available from: https://www.ncbi.nlm.nih.gov/books/NBK539699/

15. Tribus C, Alge CS, Haritoglou C, Lackerbauer C, Kampik A, Mueller A, et al. Indications and clinical outcome of capsular tension ring (CTR) implantation: A review of 9528 cataract surgeries. Clinical Ophthalmology. 2007;1(1):65–9. Available from: https://www.dovepress.com/indications-and-clinical-outcome-of-capsular-tension-ring-ctr-implanta-peer-reviewed-fulltext-article-OPTH
16. Liang J, Yan H, Xie X, Zhang J, Zhang Y, Qu L. Effect of capsular tension ring implantation on intraocular lens calculation formula selection for long axial myopia. BMC Ophthalmol. 2024;24(1):368. Available from: https://bmcophthalmol.biomedcentral.com/articles/10.1186/s12886-024-03602-7
17. Surico PL, Parmar UPS, Singh RB, Farsi Y, Musa M, Maniaci A, et al. Myopia in Children: Epidemiology, Genetics, and Emerging Therapies for Treatment and Prevention. Children. 2024;11(12):1446. Available from: https://www.mdpi.com/2227-9067/11/12/1446
18. Samosir ES, Himayani R, Berawi K. Hubungan Tingkat Pendidikan, Jenis Pekerjaan Dan Status Nutrisi Terhadap Kejadian Katarak Senilis Di RSUD Jendral Ahmad Yani Kota Metro 2022. Jurnal Kesehatan dan Agromedicine. 2023; 10(2): 39–44. Available from: https://juke.kedokteran.unila.ac.id/index.php/agro/article/view/3218
19. Nababan CS, Delvi L, Pratiwi YN. Kilas Balik Kebijakan Wajib Belajar Dan Inpres Pada Masa Orde Baru. Puteri Hijau: Jurnal Pendidikan Sejarah 2024; 8: 368–72. Available from: https://jurnal.unimed.ac.id/2012/index.php/ph/article/view/50917
20. Wei L, Zhang K-K, Lu Y, Zhu X-J. Myopia and Cataract. Nature Cell and Science. 2023;1:24–31. Available from: https://cellnatsci.com/2958-695X/article/10-61474-ncs-2023-00002a
21. Świerczyńska M, Tronina A, Smędowski A. Understanding cataract development in axial myopia: The contribution of oxidative stress and related pathways. Redox Biol. 2025;80:103495. Available from: https://www.sciencedirect.com/science/article/pii/S2213231725000084
22. Miyoshi T, Fujie S, Yoshida H, Iwamoto H, Tsukamoto H, Oshika T. Effects of capsular tension ring on surgical outcomes of premium intraocular lens in patients with suspected zonular weakness. PLoS One. 2020;15(2):e0228999. Available from: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0228999
23. Lin H, Zhang J, Jin A, Zhang Y, Zhang Y, Jin L, et al. Capsular Tension Ring Implantation for Intraocular Lens Power Calculation in Highly Myopic Eyes: Secondary Analysis of a Randomized Clinical Trial. JAMA Ophthalmol. 2025;143(5):373–81. Available from: https://jamanetwork.com/journals/jamaophthalmology/fullarticle/2831676
24. Sun Y, Hu Y, Wang C, Liu F. Effect of Capsular Tension Ring on Toric IOL Stability and Visual Outcomes in Cataract Patients with High Myopia:A Cohort Study including Two Types of Toric IOL. J Cataract Refract Surg. 2025;51(9):769–76. Available from: https://pubmed.ncbi.nlm.nih.gov/40779665/
25. Haarman AEG, Enthoven CA, Willem Tideman JL, Tedja MS, Verhoeven VJM, Klaver CCW. The Complications of Myopia: A Review and Meta-Analysis. Invest Ophthalmol Vis Sci. 2020;61(4):49. Available from: https://pubmed.ncbi.nlm.nih.gov/32347918/
26. Gurnani B, Kaur K. Phacoemulsification. StatPearls. 2025; Available from: https://www.ncbi.nlm.nih.gov/books/NBK576419/