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Factors influence bullous keratopathy post cataract surgery at National Eye Center of Cicendo Eye Hospital (PMN RSMC), West Java, Indonesia

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ABSTRACT

Background: Bullous keratopathy is one of the leading causes of vision loss following cataract surgery. Several factors have been elucidated regarding the influence of bulosa keratopathy post cataract surgery. This study aims to evaluate pre-, intra-, and postoperative predisposition factors for bullous keratopathy following cataract surgery.

Methods: A retrospective descriptive study was done using data extracted from medical records. Patients diagnosed with bullous keratopathy after cataract surgery who underwent further examination procedures for at least 3 months were included. Patients with a history of glaucoma, Fuch's dystrophy, or other intraocular procedures were excluded. Data were analyzed by SPSS version 20 for Windows.

Results: Fourteen cases were included in this study. Most cases were female (78.57%) aged ≥60 years old (64.29%). There were postoperative changes in visual acuity and corneal status in most patients without any change in intraocular pressure. The majority of patients underwent manual small incision cataract surgery with posterior chamber intraocular lens implantation. Intraoperative complications were vitreous prolapse and Descemet membrane stripping, while postoperative complications were uveitis and lens adhesion.

Conclusion: Bullous keratopathy after cataract surgery was more common in elderly females. There were notable changes in visual acuity and corneal status postoperatively. Further large-scale analytic study is warranted to confirm the predictive factors and causality.

Keywords: Bullous keratopathy, corneal endothelial cell loss, cataract extraction, Indonesia

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INTRODUCTION

Bullous keratopathy is one of the leading causes of vision loss following cataract surgery.[1] Several causes of bullous keratopathy are cataract surgery with or without intraocular lens (IOL) implantation, primary or secondary rejection of corneal graft, absolute glaucoma, and corneal endothelial dystrophy (Fuch's dystrophy).[2] As much as 60% of bullous keratopathy is caused by iatrogenic factor, in which cataract surgery is the most common cause for either pseudophakic or aphakic bullous keratopathy.[1,2] Pseudophakic bullous keratopathy represents the final clinical presentation of corneal opacification, characterized by the presence of bullae in corneal epithelium due to loss of corneal endothelial function.[3] Comprehension about this disease is required for proper management, considering the incidence of pseudophakic bullous keratopathy (PBK) is estimated to be 0.1% in patients undergoing cataract surgery in United States.[3-6]

The onset of pseudophakic bullous keratopathy and aphakic bullous keratopathy vary from months to several years following cataract surgery.[3,4] This condition begins with severe corneal edema after cataract surgery and may persist or worsen. Corneal edema starts from the superior or peripheral and temporal cornea with subsequent spread to the central cornea thus causing decreased visual acuity. The early process of corneal edema may cause discomfort without decreased visual function, but with progressively increasing severity it can cause periodic and persistent pain.[4,7]

Damage to the cornea accumulated before, during, and after cataract surgery contributes to the development of bullous keratopathy as the number of corneal endothelial cells reduces. Contributing factors for pseudophakic and aphakic bullous keratopathy have been well-studied.[1,4,7] This study aimed to describe the pre-, intra-, and postsurgical factors relating to the occurrence of bullous keratopathy after cataract surgery at the National Eye Center of Cicendo Eye Hospital in West Java, Indonesia.

METHODS

This was a retrospective descriptive study using data extracted from patient medical records. Patients diagnosed with bullous keratopathy after cataract surgery who underwent further examination

Table 1. Baseline characteristics

Characteristics	Total (N=26)	Proportion (%)
Location		
Cicendo eye hospital	14	53.85
Others	12	46.15
Sex		
Male	11	42.31
Female	15	57.69
Age		
<60 years old	11	42.31
≥60 years old	15	57.69

Table 2. Preoperative clinical characteristics

Characteristics	Total (N=14)	Proportion (%)
Visual acuity		
<1/60	7	50
1/60-3/60	7	50
≥ 3/60	-	-
Intraocular pressure		
< 21 mmHg	14	100
≥21 mmHg	-	-
Corneal status		
Clear	7	50
Cicatrix	5	35.72
Superior thinning	1	7.14
Crocodile shagreen	1	7.14
Cataract Grading		
I	-	-
II	1	7.14
III	4	28.57
IV	9	64.29
Comorbidity		
Diabetes	3	21.43
Hypertension	3	21.43
Both	3	21.43
None	5	35.71

procedures for at least 3 months from January 2009 to April 2012 were included. Exclusion criteria in this study including the history of glaucoma, Fuch's dystrophy, or other intraocular procedures, and incomplete medical record.

Descriptive data in this study was grouped into baseline, preoperative, intraoperative, and postoperative characteristics. The baseline characteristics were hospital where the surgery was conducted, sex, and age. Preoperative clinical characteristics consisted of visual acuity, intraocular pressure (IOP), corneal status, cataract grading, and systemic comorbidity. Intraoperative characteristics consisted of surgical technique, viscoelastic substance, irrigation fluid, IOL material, and complication. Finally, the postoperative clinical characteristics were visual acuity, IOP, corneal status, and complication. Data were analyzed by SPSS version 20 for Windows.

RESULTS

From the total of 26 patients included in this study, 14 (53.85%) of which underwent cataract surgery at Cicendo Eye Hospital, while the remaining 12 (46.15%) had surgery performed in other locations (Table 1). The study population was slightly predominated by elderly (57.69%) females (57.69%). Further analysis would include variable numbers of patients who fulfilled predetermined eligibility criteria especially in data completeness.

An identical proportion of the patients had preoperative visual acuity of 1/60-3/60 and less than 1/60, while all patients had normal preoperative IOP (Table 2). Half of the patients had normal cornea and the most frequent manifestation of preexisting corneal haziness was corneal cicatrix. The proportion of patients increases with the increase of cataract grading. The majority of patients had hypertension or diabetes comorbidity (64.29%).

Procedural characteristics with manual small incision cataract surgery (MSICS), dispersive viscoelastic substance, Ringer's lactate as irrigation solution, and posterior chamber polymethyl methacrylate (PMMA) IOL implantation was the most common. Although no immediate complication was identified in 50% patients, 42.86% experienced vitreous prolapse and few (7.14%) experienced descemet membrane stripping (Table 3).

Postoperative clinical characteristics in Table 4 were tabulated based on the location where the cataract surgery was performed. Generally, the postoperative visual acuity was less than 1/60 and the surgery was uneventful. However, it was observed that the proportion of patients with visual acuity less than 1/60 was higher in other locations. All patients maintained normal IOL, despite sustaining microbullae. A small number of patients (14.28%) experienced uveitis and IOL adhesion to the endothelial surface as postoperative complications.

DISCUSSION

Advancements in cataract surgical procedures have improved the outcome considerably alongside its increasing trend worldwide.[8] Inversely proportional decrease in the surgical adverse effects did not preclude the possibility. Previous studies observed the complication rate difference by numerous factors, which can be categorized in pre-, intra-, and postoperative timeline.[9] Despite the seemingly

Table 3. Intraoperative Characteristics

Characteristics	Total (N=14)	Proportion (%)
Surgical technique		
Phacoemulsification	6	42.86
MSICS	8	57.14
Viscoelastic substance		
Cohesive	6	42.85
Dispersive	8	57.14
Irrigation fluid		
BSS	6	42.85
RL	8	57.14
Type of IOL		
Anterior IOL		
Acrylic	-	-
PMMA	2	14.29
Posterior IOL		
Acrylic	2	14.29
PMMA	9	64.28
Aphakic	1	7.14
Complication		
Vitreous prolapse	6	42.86
Descemet membrane stripping	1	7.14
None	7	50

BSS: balanced salt solution, IOL: intraocular lens, MSICS: manual small incision cataract surgery, PMMA: polymethyl methacrylate, RL: Ringer's lactate.

Table 4. Postoperative clinical characteristics

Characteristics	Cicendo Eye Hospital N(%)	Other location N(%)
Visual acuity		
<1/60	11 (78.57)	10 (83.33)
≥1/60	3 (21.43)	2 (16.67)
Intraocular pressure		
<21 mm	14 (100)	12 (100)
≥21 mm	-	-
Corneal status		
Microbullae	14 (100)	12 (100)
Complication		
Uveitis	1 (7.14)	-
Lens adhesion	1 (7.14)	-
None	12 (85.71)	-

low incidence of bullous keratopathy (1-2%) as one of the complications, it is important to consider that the multiplier or the cataract surgery rate is ever-growing.[10] Existing literature investigating contributing factors of bullous keratopathy after cataract surgery was lacking, and to the best of our knowledge, this is the first study attempting to address this particular complication.

The loss of corneal endothelial cells in surgical trauma was identified as the principal cause of bullous keratopathy.[10] Intriguing findings by Inomata et al.[11] revealed that corneal thickness depended on age, sex, and body size in mice. The thickness initially increased up to a certain extent before continuing to decline in spite of increasing body size. Additionally, an interspecies allometric analysis found a significant correlation to humans. Studies in human subjects confirmed these findings. Central corneal thickness, endothelial cell density, and hexagonality were lower in the aging population. Furthermore, corneal variability was also reported between races.[12-14] In this study, the difference in proportion of age and gender may affect the patients' surgical outcome. Although thorough preoperative assessment did not affect the postoperative outcome,[15] identification of comorbidity at risk, such as diabetes, was crucial in avoiding bullous keratopathy.[16]

Phacoemulsification and MSICS were regarded to have similar efficacy and safety profile in treating age-related cataract.[17] Preference of one over the other may be adjudicated by cost or resource reasons. Similarly, the purpose of cohesive or dispersive agent was chiefly influenced by their respective characteristics.[18] A randomized clinical trial proposed the benefit of balanced salt solution over Ringer's lactate in increasing corneal thickness and improving postoperative inflammation.[19] Combined together, the choice of viscoelastic and irrigation fluid may impact intraoperative rheology and fluidics aspects relevant to the study aim.[20] Detailed stratification of IOL implantation, including the implantation status, implantation site, and IOL material was structured considering the most recent finding of the association between IOL implantation and decrease in endothelial cell density.[21]

The proportion of patients with visual acuity of <1/60 increased postoperatively, in conjunction with the total conversion of corneal status into microbullae. Note that half of the patients had corneal opacities due to cicatrix and crocodile shagreen to begin with, which were not detected in the postoperative assessment. The appearance of microbullae probably attributed the lack of expected gain in vision quality.[22]

This study had some limitations: small sample size, lack of comprehensive variables, and interobserver variability. There was an absence of data on surgical duration and endothelial cell count and morphology.

CONCLUSION

Bullous keratopathy after cataract surgery was more common in elderly females. There were notable changes in visual acuity and corneal status postoperatively. Further large-scale analytic study

is warranted to confirm the predictive factors and causality.

AUTHOR CONTRIBUTIONS

All authors contributed to the concept, design, definition of intellectual content, literature research, clinical studies, data analysis, manuscript preparation, editing, and review; all authors served as guarantors for this study.

CONFLICT OF INTEREST

The authors have nothing to disclose.

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ETHICAL CONSIDERATIONS

Written ethical clearance was obtained from the Ethical Committee of Medical Faculty of Universitas Udayana, Sanglah General Hospital and its copy was available to be reviewed by the Editor-in-Chief of this journal.

REFERENCES

1. Cohen EJ, Brady SE, Leavitt K, et al. Pseudophakic bullous keratopathy. Am J Ophthalmol. 1988;106(3):264-269.
2. Mac Rae SM, Edelhauser HF. Postoperative corneal edema. Am J Ophthalmol. 1983;95(4):552-554.
3. Pricopie S, Istrate S, Voinea L, Leasu C, Paun V, Radu C. Pseudophakic bullous keratopathy. Rom J Ophthalmol. 2017;61(2):90-94.
4. Berkowitz P, Orton RB, Boyaner D, Brownstein S. Pseudophakic bullous keratopathy. A clinical-pathologic analysis. Can J Ophthalmol. 1979;14(1):3-9.
5. Yi DH, Dana MR. Corneal edema after cataract surgery: incidence and etiology. Semin Ophthalmol. 2002;17(3-4):110-114.
6. Al-Aqaba M, Alomar T, Lowe J, Dua HS. Corneal nerve aberrations in bullous keratopathy. Am J Ophthalmol. 2011;151(5):840-849.e1.
7. American Academy of Ophthalmology. External disease and cornea: Fundamentals and principles of ophthalmology. San Fransisco: American Academy of Ophthalmology. 2011-2012. pp. 337-383.
8. Davis G. The Evolution of Cataract Surgery. Mo Med. 2016;113(1):58-62.
9. Stein JD. Serious adverse events after cataract surgery. Curr Opin Ophthalmol. 2012;23(3):219-225.
10. Pricopie S, Istrate S, Voinea L, Leasu C, Paun V, Radu C. Pseudophakic bullous keratopathy. Rom J Ophthalmol. 2017;61(2):90-94.
11. Inomata T, Mashaghi A, Hong J, Nakao T, Dana R. Scaling and maintenance of corneal thickness during aging. PLoS One. 2017;12(10):e0185694.
12. Tananuvat N, Khumchoo N. Corneal thickness and endothelial morphology in Normal Thai eyes. BMC Ophthalmol. 2020;20(1):167.
13. Islam QU, Saeed MK, Mehboob MA. Age related changes in corneal morphological characteristics of healthy Pakistani eyes. Saudi J Ophthalmol. 2017;31(2):86-90.
14. Galgauskas S, Norvydaitė D, Krasauskaitė D, Stech S, Ašoklis RS. Age-related changes in corneal thickness and endothelial characteristics. Clin Interv Aging. 2013;8:1445-1450.
15. Keay L, Lindsley K, Tielsch J, Katz J, Schein O. Routine preoperative medical testing for cataract surgery. Cochrane Database Syst Rev. 2019;1(1):CD007293.
16. Yamazoe K, Yamaguchi T, Hotta K, Satake Y, Konomi K, Den S, Shimazaki J. Outcomes of cataract surgery in eyes with a low corneal endothelial cell density. J Cataract Refract Surg. 2011;37(12):2130-6.
17. Ye Z, He SZ, Li ZH. Efficacy comparison between manual small incision cataract surgery and phacoemulsification in cataract patients: a meta-analysis. Int J Clin Exp Med. 2015;8(6):8848-8853.
18. Higashide T, Sugiyama K. Use of viscoelastic substance in ophthalmic surgery - focus on sodium hyaluronate. Clin Ophthalmol. 2008;2(1):21-30.
19. Vasavada V, Vasavada V, Dixit NV, Raj SM, Vasavada AR. Comparison between Ringer's lactate and balanced salt solution on postoperative outcomes after phacoemulsfication: a randomized clinical trial. Indian J Ophthalmol. 2009;57(3):191-195.
20. Benjamin L. Fluidics and rheology in phaco surgery: what matters and what is the hype?. Eye (Lond). 2018;32(2):204-209.
21. Shaaban YM, Badran TAF. Three-Year Effect of Phakic Intraocular Lenses on the Corneal Endothelial Cell Density. Clin Ophthalmol. 2020;14:149-155.
22. Sharma N, Singhal D, Nair SP, Sahay P, Sreeshankar SS, Maharana PK. Corneal edema after phacoemulsification. Indian J Ophthalmol. 2017;65(12):1381-1389.