Time to Keratometric Stability after Pterygium Excision Surgery in a Tertiary Hospital in the Philippines

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ABSTRACT

Background. Pterygium is a common benign fibrovascular growth of the conjunctiva extending onto the cornea that induces corneal distortion and astigmatism as it progresses. Following excision, transient keratometric instability may occur, making the timing of refractive procedures dependent on the restoration of corneal stability.

Objectives. The study aimed to identify the time to achieve keratometric stability after pterygium excision surgery and associated factors.

Methods. This was an observational retrospective cohort study of patients who underwent pterygium excision within a period of 6 months. Data were abstracted from electronic medical records. The Kaplan-Meier method and log-rank test were used to analyze the time to keratometric stability. Cox proportional hazards regression analysis was used to identify the associated factors.

Results. A total of 58 eyes that underwent pterygium excision from January 2022 to December 2023 were included in the analysis. There was no statistically significant difference in terms of age, sex, laterality, polarity, and surgical technique. Ninety-one percent (n=53) demonstrated keratometric stability three months after pterygium excision. All eyes (100%) reached keratometric stability at the post-operative six-month period. The median time to reach keratometric stability was 4 weeks (1 month), and the maximum time is six months.

Conclusion. Higher-grade pterygia required longer to achieve postoperative keratometric stability, informing optimal timing of subsequent procedures. Biometry for cataract surgery is best performed ≥3 months after excision (≈6 months for Grade 3) to ensure accurate IOL calculation, with further studies needed to evaluate varied cases and long-term outcomes.

Keywords: keratometric stability, pterygium excision, visual acuity

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INTRODUCTION

Pterygium is a benign fibrovascular degeneration of the bulbar conjunctiva that develops over the cornea. Geographic pooled data in 20 countries showed a prevalence rate of 10% in the general population.[1] As the pterygium advances through the cornea, it causes mechanical flattening and distortion of the cornea along the axis of the pterygium.[2,3] Following the removal of pterygium, corneal keratometry will remain unstable for a time, resulting in myopic shift, corneal steepening, and a decrease in astigmatism.[4] Keratometric stability after pterygium excision is a crucial element for patients who require subsequent refractive surgery.

The cornea's curvature affects the way light is refracted as it enters the eye, and an accurate measurement of this curvature is essential for proper IOL calculation. Hence, keratometry values play a crucial role in biometry and intraocular lens (IOL) computation.

When calculating for IOL power using SRK/T Formula, every 1D change in keratometry can result in a 0.9D change in the IOL power.

Several studies have reported the time to keratometric stability following pterygium excision at 1 month, 2 months, and 6 months.[5-7] Various factors, including age, size, and position of the pterygium, may affect post-excision keratometry. Wiącek et al. found a significant correlation between age and average keratometric value after surgery due to more pronounced traction forces in older patients.[8] Nejima et al. reported that the pterygium's size and placement may affect the time to keratometric stability.[9] Joshi et al. found that IOL power was highly unpredictable in patients who underwent simultaneous pterygium and cataract surgery, with variability of ± 1.0 D of the targeted refraction.[4]

Currently, there are no established protocols locally regarding the time frame for when to perform biometry for cataract surgery after excision of pterygium. The time between both surgeries can vary from simultaneous to months apart. This study aims to evaluate the time to keratometric stability after pterygium excision to establish a clinical guideline among patients who need consecutive surgeries.

METHODS

Study Design

This study was an observational retrospective cohort study of patients who underwent pterygium excision at a Tertiary hospital in Barangay San Julian, City of Batac, Ilocos Norte, from January 2022 to December 2023.

Study Participants

The study included eyes with primary pterygium of any grade or location. Patients must have undergone pterygium excision from 2022 to 2023 and completed follow-up at 1 day, 1 week, 2 weeks, 1 month, 2 months, 3 months, and 6 months post-excision. Visual acuity was measured using the Bailey-Lovie Chart, and keratometry was measured using the Huvitz MRK-3100 Premium Auto-ref/keratometer. Patients with systemic or ophthalmic conditions such as hypertension, diabetes, or retinal diseases that would not affect corneal keratometry were included. One (1) eye per patient was included to avoid inter-eye correlation in the statistical analysis.

Exclusion criteria were eyes with previous pterygium excision surgery, a history of trauma, corneal scars (e.g., from HSV), connective tissue diseases, keratoconus, or other conditions that could affect keratometric readings. Patients who did not complete follow-up or had incomplete visual acuity or keratometry data, or data not obtained with the specified instruments, were also excluded.

Sample Size Calculation

The sample size was calculated using Cox Regression or Proportional Hazard Regression: $h(t) = h_0(t)\mathbf{exp}(b_1X_1)$ where the power is set at 80, alpha set at 5%, and the hazard ratio of 4. The computed sample size was 55. Statistical analysis was performed using the Kaplan-Meier method to estimate the time to keratometric stability and the log-rank test to compare the differences. Cox proportional hazards regression analysis was used to identify the factors associated with time to keratometric stability. Subgroup analysis was also done, wherein the strata were pterygium characteristics, and stratified sampling was used.

Chart Review

Patient charts were reviewed to collect demographic information (age, sex, occupation), clinical data (laterality, grade of the disease, visual acuity), treatment (type of surgery and adjuvant therapy done), and outcomes (keratometry and visual acuity).

Outcome Measure

The primary outcome measure was the time taken for keratometric stability, defined as the period between the date of surgery and the first date when the postoperative keratometry measurement was within ± 0.25 diopters (D) in consecutive post-operative measurements. Keratometric measurement was taken using Huvitz MRK-3100 Premium Auto-ref/keratometer at 1 day, 1 week, 2 weeks, 1 month, 2 months, 3 months, and 6 months (recording the average of 3 measurements) post pterygium excision. Subset analysis was done on factors that may affect time to keratometric stability, such as age, grade, and position of the pterygium, laterality, and surgical technique.

Data Management

All data collected was de-identified and remained confidential through the use of coded numbers instead of patient names. This study was reviewed and approved by the St. Cabrini Medical Center-Asian Eye Institute Ethics Review Committee. Informed consent was waived due to the retrospective chart review design. All data were anonymized and handled confidentially.

RESULTS

Demographic Data

Of the 66 service patients who underwent pterygium excision within the study period, 58 eyes were enrolled. The mean age was 60 years (range 40 to 78 years Baseline characteristics of patients are shown in Table 1. There were no statistically significant differences in the baseline data among the patients in terms of age, sex, laterality, polarity, and surgical technique. There was a statistically significant difference in the grade of the pterygium (p-value of 0.003), with 72.42% of patients having a grade of G2T2 included in this cohort.

Table 1. Baseline demographic data of patients with pterygium

Profile		Count	Percentage (%)	Sig.
Age Group (years)	40 – 49	13	22.41	0.256
	50 - 59	13	22.41	
	≥60	32	55.17	
Sex	Male	26	44.83	0.657
	Female	32	55.17	
Grade of Disease	G2T1	1	1.72	0.003*
	G2T2	42	72.41	
	G2T3	1	1.72	
	G3T2	5	8.62	
	G3T3	9	15.52	
Laterality	OD	27	46.55	0.808
	OS	31	53.45	
Polarity	Bipolar	4	6.90	0.288
	Nasal	49	84.48	
	Temporal	5	8.62	
Primary/Recurrent	Primary	58	100.00	n/a
Surgical Technique	Graft	31	53.45	0.406
	Transpo	27	46.55	

**significance at p-value <0.05*

Keratometric Stability after Pterygium Excision

Ninety-one percent (91%; n=53) demonstrated keratometric stability three months after pterygium excision, whereas 100% of the eyes (n=58) reached keratometric stability within the post-operative six-month period. The median time to reach keratometric stability was one month, and the maximum time was six months. The cumulative percentages on time to keratometric stability are shown in Table 2 and Figure 1. All eyes that showed corneal keratometric stability remained stable throughout the study period, with no noted regression in keratometry.

Factors Affecting Time to Keratometric Stability

The factors associated with time to keratometric stability are shown in Table 3. The results of the Cox regression analysis showed a significant relationship between the grade of pterygium before surgery and time to keratometric stability. As the grade of pterygium prior to surgery increases, the rates to achieve keratometric stability also increase (HR 0.64). The time to stability by grade of pterygium is shown in Table 4. The single G2T1 case achieved keratometric stability after 2 weeks. Among the G2T2 patients, 83.33% achieved stability within one month. G3T2 and G3T3 patients achieved stability after two weeks to six months. Survival curves

Table 2. Cumulative percentage of eyes with keratometric stability after surgery

Stable Time	1 week	2 weeks	1 month	3 months	6 months
Total (%)	2 (3%)	20 (34%)	21 (36%)	10 (17%)	5 (9%)
Cumulative (%)	2 (3%)	22 (38%)	43 (74%)	53 (91%)	58 (100%)

Table 3. Factors associated with time to keratometric stability after pterygium surgery

Factors	Sig.	Exp(B)	95.0% CI for Exp(B)	
			Lower	Upper
Age	0.13	0.97	0.94	1.01
Sex	0.22	0.65	0.32	1.30
Grade of Disease	0.02*	0.64	0.44	0.95
Laterality	0.94	0.97	0.49	1.94
Side	0.06	2.57	0.95	7.01
Surgical Technique	0.97	0.99	0.51	1.91

**significance at p-value <0.05*

Table 4. Stable time by grade of disease

Grade of Disease	Stable Time					Grand Total
	1 week	2 weeks	1 month	3 months	6 months	
G2T1	-	1 (100.0%)	-	-	-	1 (1.7%)
G2T2	2 (4.8%)	18 (42.9%)	15 (35.7%)	6 (14.3%)	1 (2.4%)	42 (72.4%)
G2T3	-	-	1 (100.0%)	-	-	1 (1.7%)
G3T2	-	1 (20.0%)	2 (40.0%)	1 (20.0%)	1 (20.0%)	5 (8.6%)
G3T3	-	-	3 (33.3%)	3 (33.3%)	3 (33.3%)	9 (15.5%)
Grand Total	2 (3.4%)	20 (34.5%)	21 (36.2%)	10 (17.2%)	5 (8.6%)	58 (100.0%)

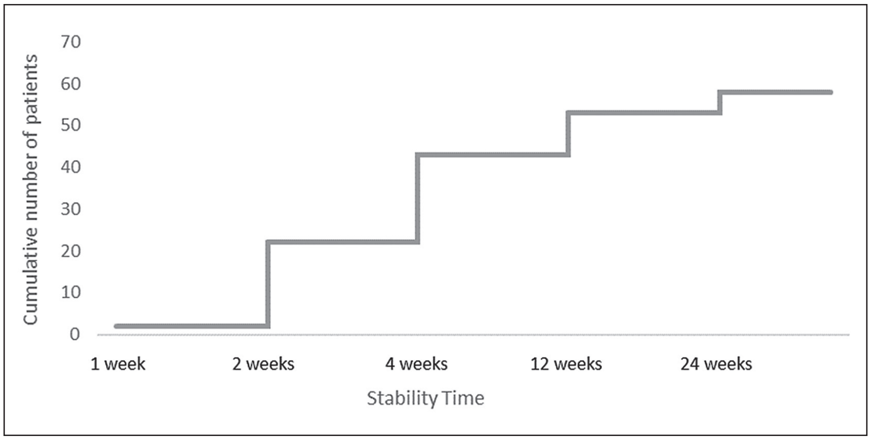

Figure 1. Cumulative percentage of eyes with keratometric stability after surgery.

showed that lower-grade pterygia reached stability earlier than higher grades.

DISCUSSION

This study evaluated the time to stability of post-operative keratometry after pterygium surgery while taking clinical relevance into account. The time to keratometric stability in this study is 6 months (100% of the eyes), albeit 91% were already stable at the third month.

The European Society of Cataract Surgeons recommended waiting six to eight weeks prior to biometry for cataract surgery.[10] While Venkateswaran et al. advise waiting 8-12 weeks to allow the corneal epithelium and ocular surface to heal before performing biometry for cataract surgery.[11] Our results indicate that eight weeks may be insufficient to achieve the keratometric stability necessary for accurate IOL power calculations.

The current study found a statistically significant association (p-value of 0.2) between the grade of pterygium and the time it takes to attain keratometric stability. As the grade of pterygium increases, the time taken to achieve keratometric stability also increases. This study suggests that early surgery for patients when the pterygium grade is lower is advisable, as they reach keratometric stability faster. It is best to plan cataract surgery 3 months after pterygium excision for grade 2 pterygium and wait until 6 months for grade 3 pterygium to ensure keratometric stability. Other factors, such as the type of surgical excision (conjunctival autograft vs transpositional flap) and the location of the pterygium (nasal, temporal, or bipolar), did not have a significant difference in time to keratometric stability. This study included only primary pterygium cases with few Grade 3, temporal, or bipolar cases, limiting subgroup analysis. Long-term keratometric stability beyond 6 months was not assessed.

CONCLUSION AND RECOMMENDATIONS

Within the post-operative three months, 91% of the patients demonstrated clinical stability of keratometric power, with 100% of patients reaching stability by six months. The higher the grade of the pterygium, the longer it took to achieve keratometric stability following surgical excision.

This study provides an insight into the keratometric changes following pterygium excision, supporting improved timing of subsequent ocular procedures, including intraocular lens power calculation and cataract surgery planning.

Biometry for cataract surgery should ideally be no earlier than three months after pterygium excision to obtain an accurate IOL power calculation. For patients with Grade 3 pterygium, delaying biometry until around six months is recommended to ensure keratometric stability.

Further studies should include patients with recurrent pterygium, varied pterygium locations (temporal, bipolar), and alternative surgical techniques (e.g., bare sclera, amniotic membrane grafting), as well as extended follow-up beyond six months. These will help refine guidelines and assess long-term keratometric behavior after surgery.

Statement of Authorship

All authors certified fulfillment of ICMJE authorship criteria.

Author Disclosure

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