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EFFECTS OF PTERYGIUM EXCISION ON IOL POWER CALCULATION AND ITS CO-RELATION WITH PTERYGIUM SIZE

Dr. ANKITA SINGH
Junior Resident, Department of Ophthalmology, School of Medical Sciences and Research, Sharda University, Greater Noida, Uttar Pradesh. Email:ankita9458708408@gmail.com

Dr. (Maj.) ABHA GAHLOT*
Professor, Department of Ophthalmology, School of Medical Sciences and Research, Sharda University, Greater Noida, Uttar Pradesh. *Corresponding Author Email: abha.gahlot@sharda.ac.in

Dr. CHARU MALIK
Assistant Professor, Department of Ophthalmology, School of Medical Sciences and Research, Sharda University, Greater Noida, Uttar Pradesh. Email: charu.malik@sharda.ac.in

Dr. (Brig.) PONINDER KUMAR DOGRA
Professor and Head of Department, Department of Ophthalmology, School of Medical Sciences and Research, Sharda University, Greater Noida, Uttar Pradesh. Email: Poninder.dogra@sharda.ac.in

Dr. SHIVANI YADAV
Junior Resident, Department of Ophthalmology, School of Medical Sciences and Research, Sharda University, Greater Noida, Uttar Pradesh. Email: shivaniaryadav@gmail.com

Dr. BHUMIKA CHACHRA
Junior Resident, Department of Ophthalmology, School of Medical Sciences and Research, Sharda University, Greater Noida, Uttar Pradesh. Email: bhumikachachra9@gmail.com

Abstract

Background: *Pterygium is a common ocular surface disorder associated with ultraviolet exposure, with increased prevalence among individuals involved in outdoor activities and those residing in equatorial regions. The astigmatism induced by pterygium can distort keratometric measurements, thereby affecting the accuracy of intraocular lens (IOL) power calculation. Previous studies assessing changes in corneal curvature and IOL power after excision have reported variable results, with limited data from the Indian population. This study aims to evaluate the impact of pterygium excision on IOL power and examine its correlation with pterygium size through comparison of pre- and post-excision corneal parameters.* ***Materials and Methods:*** *This prospective interventional study included 40 patients with primary nasal pterygium (2–4 mm). Preoperative assessment included keratometry, axial length, corneal astigmatism, and IOL power calculation. All patients underwent pterygium excision with conjunctival limbal autograft. Postoperative evaluation was performed at 1 month. Changes in parameters were analysed using paired statistical tests, and correlation with pterygium size was assessed.* ***Results:*** *A total of 40 eyes of 40 patients (mean age 65.8 ± 9.6 years; range 40–80 years) were analyzed. Pterygium excision led to significant corneal steepening, with mean keratometry increasing from 44.70 ± 1.92 D to 45.35 ± 1.32 D (p = 0.03). Intraocular lens (IOL) power decreased from 22.20 ± 2.60 D to 21.00 ± 2.80 D (p = 0.02), while corneal astigmatism reduced from 2.45 ± 0.74 D to 2.10 ± 0.86 D (p = 0.02). Axial length remained unchanged (p = 0.23). A strong positive correlation was observed between pterygium size and magnitude of IOL power change, with larger lesions showing greater variability and reduction in IOL power.* ***Conclusion:*** *Pterygium significantly alters*

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corneal curvature and influences IOL power calculation. The magnitude of change correlates with lesion size, supporting pterygium excision prior to cataract surgery for improved refractive accuracy.

Keywords: *Pterygium, Intraocular Lens Power, Keratometry, Astigmatism, Corneal Curvature, Biometry.*

INTRODUCTION

Pterygium, derived from the Greek word *pterygos* meaning "wing," is a common fibrovascular proliferative disorder of the ocular surface characterized by encroachment of conjunctival tissue onto the cornea. [1] It occurs more commonly at the nasal limbus and is strongly associated with chronic ultraviolet (UV) exposure, particularly among individuals residing in tropical and subtropical regions and those involved in outdoor occupations. [2,5] Apart from cosmetic concerns and ocular irritation, pterygium may induce significant corneal flattening and irregular astigmatism, leading to visual impairment.[5] Surgical excision remains the standard treatment, especially in progressive lesions affecting the visual axis or inducing significant astigmatism.[6] Previous studies have demonstrated that pterygium alters corneal topography and keratometric measurements, thereby influencing intraocular lens (IOL) power calculation.[7,9] Accurate IOL power calculation is crucial in cataract surgery to achieve optimal postoperative refractive outcomes. Since pterygium-induced corneal distortion may lead to inaccurate keratometry readings, cataract surgery performed before pterygium excision can result in postoperative refractive surprise. Several studies have reported significant changes in corneal curvature and IOL power following pterygium excision, with the magnitude of change correlating with pterygium size. [10, 12] However, limited literature is available from the Indian population regarding this association.

The present study was therefore undertaken to evaluate the effect of pterygium excision on IOL power calculation and to determine the correlation between pterygium size and change in IOL power.

MATERIAL AND METHODS

This prospective interventional analytical study was conducted in the Department of Ophthalmology at Sharda Hospital, School of Medical Sciences & Research, Greater Noida, over a period of one year after obtaining approval from the Institutional Ethics Committee. The study adhered to the tenets of the Declaration of Helsinki, and informed consent was obtained from all participants. A total of 40 patients aged 40 and 80 years with primary nasal pterygium scheduled for pterygium excision were included in the study.

Study Design: Hospital-based comparative interventional analytical study

Study Location: The study was conducted in the Department of Ophthalmology at Sharda Hospital, School of Medical Sciences & Research, Greater Noida, Uttar Pradesh.

Study Duration: October 2023 – October 2024

Sample size: 40 patients.

Sample size calculation: The sample size was calculated using Cochran's formula with a 95% confidence interval, 9% margin of error, and a prevalence of 8.5%, yielding a minimum required sample size of 37, which was rounded to 40 eyes

Inclusion criteria:

Patients ages between 40 to 80 years with primary nasal pterygium of size 2mm to 4mm undergoing pterygium excision surgery.

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Exclusion Criteria:

1) Subjects with previous history of ocular trauma or surgery.
2) Subjects with combined nasal and temporal pterygium.
3) Subjects wtih corneal ectasia, keratitis, Glaucoma or fundus pathologies

Procedure methodology:

All patients underwent detailed ophthalmic evaluation including uncorrected and best-corrected visual acuity assessment using logMAR chart, slit-lamp biomicroscopy, keratometry, corneal astigmatism assessment, axial length measurement, and IOL power calculation. Pterygium size was measured horizontally from the limbus to the apex of the pterygium over the cornea using slit-lamp biomicroscopy. All patients underwent pterygium excision with conjunctival limbal autograft under peribulbar anesthesia. The pterygium head was dissected from the corneal surface followed by excision of the fibrovascular tissue. The corneal bed was polished carefully, and conjunctival limbal autograft was secured over the bare scleral area with proper limbus-to-limbus orientation. Postoperative evaluation was performed at 1 month and included repeat keratometry, corneal astigmatism assessment, axial length measurement, and IOL power calculation.

Statistical analysis

Data were compiled in Microsoft Excel worksheet and analysis was done with the help of SPSS version 26.0. Continuous variables were expressed as mean ± standard deviation. Preoperative and postoperative values of keratometry, intraocular lens (IOL) power, corneal astigmatism, and axial length were compared using paired t-tests. Correlation between pterygium size and change in IOL power was assessed using Pearson's correlation coefficient. A p-value < 0.05 was considered statistically significant.

RESULT

A total of 40 eyes of 40 patients were included in the present study. The mean age of the participants was 65.8 ± 9.6 years (range, 40–80 years). The mean horizontal length of the pterygium was 2.78 ± 0.42 mm (range, 2.0–3.4 mm).

Table no 1: shows pre- and postoperative mean keratometry, axial length, intraocular lens (IOL) power, and corneal astigmatism

Parameter	Pre-operative	One month postoperative	P-value
Keratometry (D)	44.70 ± 1.92	45.35 ± 1.32	0.03
Axial length (mm)	22.56 ± 0.70	22.72 ± 0.68	0.23
IOL power (D)	22.20 ± 2.60	21.00 ± 2.80	0.02
Corneal Astigmatism(D)	2.45 ± 0.74	2.10 ± 0.86	0.02

In table 1. Mean keratometry increased significantly from 44.70 ± 1.92 D to 45.35 ± 1.32 D (p = 0.03). Axial length showed no significant change (22.56 ± 0.70 mm vs 22.72 ± 0.68 mm; p = 0.23). IOL power decreased significantly from 22.20 ± 2.60 D to 21.00 ± 2.80 D (p = 0.02), while corneal astigmatism also showed a significant reduction from 2.45 ± 0.74 D to 2.10 ± 0.86 D (p = 0.02).

Table 2: Change in Intraocular Lens (IOL) Power According to Pterygium Size

Pterygium Size (mm)	Preoperative IOL Power (D) Mean ± SD	Postoperative IOL Power (D) Mean ± SD	Mean Change in IOL Power (D) Mean ± SD	p-value
2.0–2.2	21.65 ± 0.21	20.90 ± 0.14	0.75 ± 0.10	0.041
2.3–2.5	22.15 ± 0.24	21.10 ± 0.18	1.05 ± 0.12	0.026

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2.6–2.8	22.45 ± 0.21	21.30 ± 0.16	1.15 ± 0.14	0.018
2.9–3.1	22.85 ± 0.25	21.60 ± 0.18	1.25 ± 0.16	0.011
3.2–3.4	23.35 ± 0.21	21.90 ± 0.14	1.45 ± 0.18	0.006

Table 2 demonstrates a progressive increase in the magnitude of IOL power reduction with increasing pterygium size following pterygium excision. Eyes with smaller pterygia (2.0–2.2 mm) showed a mean reduction of 0.75 ± 0.10 D, whereas larger lesions (3.2–3.4 mm) demonstrated a greater mean reduction of 1.45 ± 0.18 D. A gradual linear increase in the change in IOL power was observed across increasing pterygium sizes, suggesting greater corneal distortion and higher impact on keratometric measurements in larger lesions. All comparisons were statistically significant

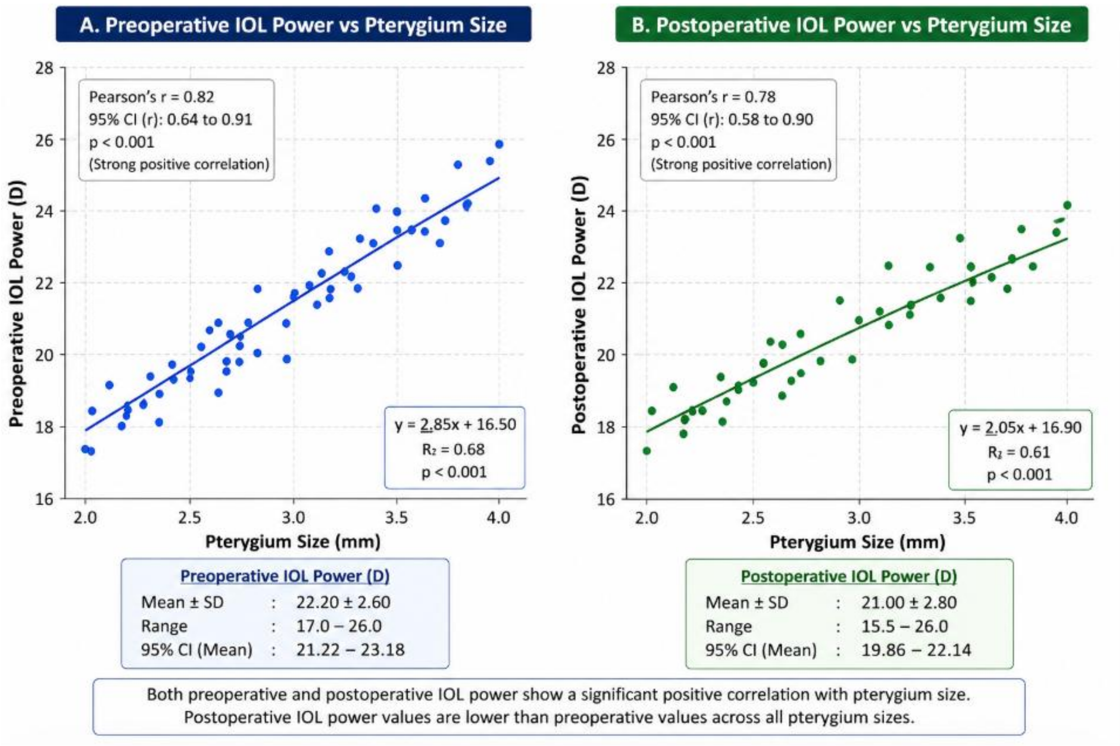

Figure 1

In Figure 1, Scatter plot analysis demonstrated a strong positive correlation between pterygium size and intraocular lens (IOL) power both preoperatively and postoperatively. Preoperative IOL power showed a correlation coefficient of r = 0.82 (95% CI: 0.64–0.91, $p < 0.001$), with the regression equation y = 2.85x + 16.50 ($R^2 = 0.68$). Postoperative IOL power remained significantly correlated with pterygium size (r = 0.78, 95% CI: 0.58–0.90, $p < 0.001$), with the regression equation y = 2.05x + 16.90 ($R^2 = 0.61$). Mean IOL power decreased from 22.20 ± 2.60 D preoperatively to 21.00 ± 2.80 D postoperatively, with postoperative values consistently lower across all pterygium sizes. rephrase not able to understand

DISCUSSION

The present study evaluated the effect of pterygium excision on corneal parameters and intraocular lens (IOL) power, along with its relationship to pterygium size. A significant increase in mean keratometry from 44.70 ± 1.92 D to 45.35 ± 1.32 D (p = 0.03) was observed following excision, indicating corneal steepening after removal of the fibrovascular tissue. This finding supports the established concept that pterygium induces localized corneal flattening, and its excision helps restore

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normal corneal curvature.[8,10] Tomidokoro et al.[8] similarly demonstrated significant corneal steepening following pterygium excision and reported that larger pterygia produced greater flattening of the horizontal meridian. Kheirkhah et al.[9] also observed improvement in corneal topographic parameters after surgery, suggesting restoration of corneal regularity following removal of the fibrovascular tissue.

In the present study, mean IOL power decreased significantly from 22.20 ± 2.60 D preoperatively to 21.00 ± 2.80 D postoperatively ($p = 0.02$). This reduction is clinically important because preoperative biometry in the presence of pterygium may result in overestimation of IOL power and subsequent postoperative refractive surprise. Similar findings were reported by Kamiya et al.[10], who demonstrated improved predictability of IOL power calculation after pterygium excision. Likewise, Koc et al.[11] found that pterygium significantly altered keratometric readings and influenced IOL power estimation, particularly in larger lesions.

Corneal astigmatism also showed a significant reduction from 2.45 ± 0.74 D to 2.10 ± 0.86 D ($p = 0.02$) after surgery. This improvement may be attributed to release of the tractional forces exerted by the pterygium on the cornea. Errais et al.[2] similarly reported a significant reduction in corneal astigmatism after pterygium excision, with improvement in corneal symmetry and topographic regularity. Tang et al.[12] further demonstrated that increasing pterygium dimensions were associated with greater induced astigmatism and greater changes in corneal power.

In contrast, axial length remained relatively unchanged (22.56 ± 0.70 mm vs 22.72 ± 0.68 mm; $p = 0.23$), suggesting that the observed refractive changes were predominantly corneal rather than axial in origin. Similar findings have been reported in previous studies, where postoperative refractive changes were mainly attributed to alterations in corneal curvature rather than changes in axial length.[10,11]

An important finding of the present study was the positive correlation between pterygium size and magnitude of change in IOL power. Both preoperative and postoperative IOL power values increased with increasing pterygium size; however, postoperative values remained consistently lower across all lesion sizes, as demonstrated in Figure 1. Table 2 further illustrates that the reduction in IOL power increased progressively with lesion size, ranging from approximately 0.7 D in smaller pterygia to more than 1.3 D in larger lesions. These findings suggest that larger pterygia induce greater corneal distortion and consequently have a greater impact on IOL power estimation.

Additionally, greater variability in IOL power was observed in larger pterygia, indicating reduced predictability of keratometric measurements in these cases. Koc et al.[11] similarly observed that larger pterygia were associated with increased corneal irregularity and greater variability in keratometric readings. Joshi et al.[13] compared simultaneous and sequential pterygium and cataract surgery and concluded that sequential surgery provided more reliable IOL power estimation due to stabilization of corneal curvature following pterygium excision.

From a clinical perspective, the findings of the present study support the recommendation that pterygium excision should be performed prior to cataract surgery, particularly in lesions exceeding 2 mm, in order to improve the accuracy of biometry and optimize postoperative refractive outcomes.

CONCLUSION

Pterygium excision results in corneal steepening and a significant reduction in IOL power, improving refractive predictability. The magnitude of IOL power change increases with pterygium size, indicating greater corneal distortion in larger lesions. Therefore, pterygium excision should be performed prior

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to cataract surgery, especially in cases with larger lesions, to ensure accurate biometry and optimal visual outcomes.

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