# Incidence of refractive surprise after phacoemulsification in patients of cataract with primary pterygium

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## Abstract:

**PURPOSE:** The purpose of this study was to find the incidence of refractive surprise in patients of cataract with primary pterygium and compare it with patients of cataract without pterygium after phacoemulsification surgery.

**METHODS:** The present observational study included 30 patients who had cataract with pterygium and 30 patients of cataract without pterygium. A detailed ophthalmic examination was done in all the cases. Horizontal corneal encroachment of pterygium from the limbus was measured. Keratometry and biometric measurements were performed preoperatively to determine the target refraction which was kept between − 0.50D and + 0.50D. The achieved spherical equivalent (SE) and prediction error were calculated postoperatively. A difference of >± 1.00D SE from the targeted postoperative refraction was considered a refractive surprise.

**RESULTS:** The mean age of patients was 61 ± 8.32 years. The mean extension of pterygium on the cornea was 2.3 ± 0.91 mm. Refractive surprise was seen in 16.7% of cases of cataract with pterygium and 10% of cases of cataract without pterygium.

**CONCLUSION:** Only cataract surgery can be performed in patient having cataract with primary pterygium of up to 2.3 ± 0.91 mm horizontal corneal length, and the incidence of refractive surprise in these cases is comparable to that in patients of cataract without pterygium.

**Keywords:**

Asymptomatic, keratometry, prediction error, spherical equivalent, target refraction

## Introduction

Pterygium occurs worldwide, but it is commonly seen in the regions located 30° to the north and south of the equator.[1] A systematic review and meta-analysis of population-based studies estimated the prevalence of pterygium to be around 10.2% (range: 6.3%–16.1%).[2] Prolonged exposure to ultraviolet light may predispose an individual to pterygium formation.[3-5]

Alike pterygium, ultraviolet radiation is also a risk factor for development of cataract, and hence, cataract associated with pterygium is common.[6-8] Moreover, both cataract and pterygium occur with an increased frequency with advancing age.[9] Hashemi *et al*. observed that the prevalence of pterygium increased linearly with age, and the lowest and highest prevalence of pterygium was found in the age group of 5–20 years and 61–70 years, respectively.[10] It is no wonder that many elderly patients, as a consequence, develop cataract and pterygium concurrently.[11]

Cataract with pterygium can be managed either sequentially or simultaneously. Large pterygium causes corneal distortion and induces astigmatism that may affect the outcome following cataract surgery. Hence, it is believed that pterygium which interferes with keratometry readings should be removed before proceeding with cataract surgery.[12]

Cataract and pterygium surgery can also be done simultaneously as a single procedure.[13] Simultaneous surgery is particularly preferred in older patients for early visual recovery, fewer hospital visits, and lower costs.[14] However, small pterygia usually do not cause significant

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changes in corneal curvature, and it is presumed that biometry can be done accurately in such cases.[15] Furthermore, in these eyes, only cataract surgery can be planned without disturbing the pterygium.

Therefore, this study was planned with an objective to find the incidence of refractive surprise in cases of cataract with concurrent pterygium and compare it with patients of cataract (without pterygium) undergoing phacoemulsification surgery.

## Methods

This observational study was conducted on patients who attended the Outpatient Department of Ophthalmology at Sri Aurobindo Medical College and Post Graduate Institute, Indore, Central India, during January 2018–December 2018. Thirty consecutive patients, who fulfilled the inclusion criteria, had cataract with nasal pterygium, and 30 patients who had cataract without pterygium were included in the study.

The patients included were those having both type 1 and type 2 pterygia. Type 1 pterygium extended <2 mm onto the cornea, and type 2 pterygium involved up to 4 mm of the cornea from the limbus.[16] The patients above the age of 50 years with cataract were enrolled for the study. The patients of cataract with other ocular comorbidities (apart from pterygium) and a history of previous ocular surgery or recurrent pterygium and bi-headed pterygium or pseudo-pterygium were excluded from the study. The patients had predominant visual complaint and gave a history of pterygium which was present before the visual deterioration. They were given the surgical options, and those who opted for only cataract surgery were enrolled in the study.

The patient's history and ocular complaints were elicited. Slit-lamp biomicroscopic examination of the anterior segment was done. The length of pterygium was measured with Castroviejo Calipers after instillation of proparacaine (0.5%) eye drop with eye in the primary position, and the distance from the limbus to the apex of pterygium was recorded. Pterygium extension and the total area have a stronger correlation with corneal astigmatism than does width.[17]

A dilated fundus examination was performed to rule out posterior segment pathology. The selected patients underwent cataract surgery workup which included keratometry using an automated keratometer and axial length measurement using an ultrasonic A-scan and intraocular lens power calculation. Patients with axial lengths between 22 and 24.5 mm were only selected for the study. The average corneal power (ACP) was defined as half the sum of vertical and horizontal corneal powers measured by keratometry. Postoperative target refraction was determined in all the patients on biometry and kept between − 0.5D and + 0.5D as described by Abdelghany and Alio.[18]

Phacoemulsification surgery was performed by a single surgeon in all patients. A superior 2.8 mm clear corneal incision was placed, and two side port incisions (~1 mm) were made. As the vertical axis gets usually steepened due to the presence of pterygium, therefore, we preferred superior clear corneal incision. Tilting the eye slightly in the direction of pterygium improved the visibility and helped to complete capsulorhexis and cortical irrigation-aspiration successfully. A hydrophilic acrylic foldable monofocal intraocular lens (Aurofold from Aurolab, Madurai, India) was implanted in-the-bag. Incisions were closed by stromal hydration.

The patients who did not return for follow-up at their designated times and those who had encountered complications during the surgery were not enrolled in this study.

Postoperatively, at 1 month, refraction was done, and the subjective refraction reading was converted into spherical equivalent (SE). The prediction error (PE) was calculated from the difference between preoperative target refraction and achieved postoperative refraction in SE. A difference of >± 1D SE from the targeted refraction was considered a refractive surprise.[19]

### Statistical analysis

Statistical software, IBM SPSS version 17.0 for Windows, Armonk, New York, USA, was used for analysis. Descriptive and inferential statistics were applied to analyze the data. Results for continuous variables were presented as mean ± standard deviation, while categorical data were presented in numbers. The paired *t*-test and unpaired *t*-test were used to show the significance of difference between the mean of two groups. $P < 0.05$ was considered statistically significant.

This comparative study was approved by the Institutional Ethical Committee (SAIMS/RC/IEC/23) and followed the tenets of the Declaration of Helsinki. A written informed consent was obtained from all patients, and those who refused to be the part of the study at any point of time were excluded.

## Results

Of 60 patients, 31 (51.7%) patients were male and 29 (48.3%) were female. Their mean age was 61 ± 8.32 years (range: 50–73 years). Type 1 pterygium was seen in 14 (46.7%) patients, whereas 16 (53.3%) had type 2 pterygium. The mean length of extension of pterygium on the cornea was 2.3 ± 0.91 mm (range: 1–3.8 mm).

ACP (43.32 ± 1.61) in patients of cataract with pterygium was observed to be significantly lower ($P < 0.05$) compared to the ACP (44.63 ± 1.51) in patients of cataract without pterygium.

The target refraction, SE, and PE in patients of pterygium group were found to be comparable to patients without pterygium as shown in Table 1.

The incidence of refractive surprise was more in patients who had pterygium ($n$ = 5 out of 30, 16.7%) compared to those who did not have pterygium ($n$ = 3 out of 30, 10%). However, this difference in refractive surprise was not statistically significant [Table 2]. 83.3% of patients in pterygium group

achieved the target refraction and did not show postoperative refractive surprise, which was comparable to patients with no pterygium (90%).

On comparing the two groups of pterygium, no statistically significant difference was observed in target refraction, SE, and PE [Table 3]. Further, it was noticed that five patients of cataract with pterygium developed refractive surprise; of whom 60% (three out of five) belonged to type 2 group, and four out of five (80%) showed a myopic shift.

## Discussion

Exposure to ultraviolet radiation is a major risk factor for both cataract and pterygium; hence, the coexistence of cataract with pterygium is commonly encountered.[6,7] Nangia *et al*.[20] observed that the prevalence of pterygium in rural central India was 13% which was much higher than the pterygium prevalence in other studies from India.[21,22]

A pterygium flattens the cornea along the horizontal meridian, thereby leading to with-the-rule astigmatism.[9] The presence of pterygium changes the corneal refractive status of the eye so that intraocular lens power calculations in patients with cataract associated with pterygium may give erroneous results.[23] It has been reported that pterygium larger than 4 mm enters the measurement field and might lead to inaccurate measurements.[24] For patients with cataract and pterygium in the same eye, the ideal treatment approach is to perform a pterygium excision first and then plan for cataract surgery after the corneal changes have stabilized.[25,26] However, a combined simultaneous procedure is required in older patients for faster visual rehabilitation, fewer hospital visits, and lower cost.[14] The third option is to perform only cataract surgery while leaving the small asymptomatic pterygium undisturbed as suggested by Koc *et al*.[15] This study was planned with an aim to compare the incidence of refractive surprise between patients of cataract with pterygium and those without pterygium.

**Table 1: Target refraction, spherical equivalent, and prediction error in cataract patients with and without pterygium**

| Variables (diopters) | Study group | Mean±SD | *P* |
|---|---|---|---|
| Target refraction | With pterygium | 0.01±0.14 | >0.05 |
| | Without pterygium | −0.04±0.21 | |
| Spherical equivalent | With pterygium | −0.07±1.04 | >0.05 |
| | Without pterygium | −0.01±0.66 | |
| Prediction error | With pterygium | −0.07±1.03 | >0.05 |
| | Without pterygium | 0.04±0.61 | |

SD: Standard deviation

**Table 2: Incidence of refractive surprise in cases of cataract with and without pterygium**

| Refractive surprise | Frequency (*n*=30), *n* (%) | |
|---|---|---|
| | With pterygium | Without pterygium |
| ≤±1 D (no refractive surprise) | 25 (83.3) | 27 (90) |
| >±1 D (refractive surprise) | 5 (16.7) | 3 (10) |

**Table 3: Target refraction, spherical equivalent, and prediction error in cataract patients with type 1 pterygium and type 2 pterygium**

| Parameters | Type 1 pterygium | Type 2 pterygium | *P* |
|---|---|---|---|
| Target refraction | 0.0021±0.146 | 0.0087±0.145 | 0.902 |
| Spherical equivalent | −0.161±0.530 | 0.0169±1.352 | 0.649 |
| Prediction error | −0.160±0.574 | 0.01±1.329 | 0.659 |

Keratometry can be done correctly and with accuracy in cases of cataract with pterygium involving up to 4 mm of cornea from the limbus. The average horizontal diameter of the cornea is approximately 12–12.5 mm, and automated keratometry measures central 3 mm of the cornea from the steepest and flattest meridians.[23] The mean extension of pterygium on to the cornea was 2.3 ± 0.91 mm (range 1–3.8 mm) in our study that did not interfere with preoperative central keratometry reading. A length of 2.4 mm of pterygium was considered safe for cataract surgery that did not cause postoperative refractive deviation according to an earlier report.[15] However, Kim *et al*. observed that the preoperative keratometry can be relied on if the pterygium extension on the cornea is <2 mm while performing simultaneous cataract and pterygium surgery.[25]

The preoperative ACP was found to be lower in cases of cataract with coexisting pterygium compared to patients without pterygium in the present study. This is similar to a study where the mean keratometry was 42 ± 1.54 D and 43.81 ± 1.55 D in pterygium cases and their fellow healthy eyes, respectively.[15]

Kamiya *et al*., in their study, reported that 82% of eyes achieved the target refraction within ± 1D 3 months after simultaneous pterygium excision and phacoemulsification surgery.[14] The incidence of refractive surprise after phacoemulsification surgery in cataract with concurrent pterygium was 16.7%, while that in patients without pterygium was 10% in our study. Therefore, the target refraction within ± 1D after cataract surgery was achieved in 83.3% of cases of cataract with coexisting pterygium and 90% of patients without pterygium. Cataract surgery alone can be performed in patients with cataract associated with pterygium, when the horizontal length of the pterygium is <2.4 mm as reported by Koc *et al*.[15] Hence, excising pterygium is not always mandatory for achieving the postoperative target refraction following cataract surgery.

In our study, the target refraction, SE, and PE in type 1 pterygium group were found to be comparable to patients with type 2 pterygium. However, refractive surprise was more common in type 2 pterygium with cataract with majority (80%, 4 out of 5) showing a myopic shift. Other studies have also reported a reasonably predictable refractive results after cataract surgery with a slight myopic shift in cases of pterygium.[14,25,27] In these studies, although simultaneous pterygium and cataract surgery was performed, the authors attributed the postoperative myopic shift to the steepening of cornea due to pterygium removal.

There are certain potential limitations of the study. The length of pterygium was only measured, as it is believed to change the corneal shape maximally, and depth and area of pterygium were not considered in this study. Corneal topography was not done, which would have given the information about the global effect of pterygium on the cornea. Ultrasonography was performed to measure the axial length rather than optical biometry which gives more accurate readings. Small sample size and short follow-up period are some other limitations of the study. A similar study in future with a larger sample size and longer follow-up is recommended to further validate our results.

## Conclusion

The incidence of refractive surprise in cases of cataract with pterygium was found to be 16.7% which was comparable to cases of cataract without pterygium (10%). Only cataract surgery can be performed successfully in selected cases of cataract with pterygium of 2.3 ± 0.91 mm horizontal corneal length.

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### Conflicts of interest

There are no conflicts of interest.

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