

Corneal Keratometry Changes Post Pterygium Excision

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Abstract: Pterygium is a common disease which can cause annoying symptoms like redness, irritation and foreign body sensation. If large in size, it can lead to astigmatism. Excision of pterygium results in reduction in astigmatism and patient feels aesthetically better. To determine the difference in mean corneal keratometry before and after pterygium excision, by using automated refraction with keratometry. Quasi - experimental study (pretest and posttest design). 60 patients is selected for study by using cochrane formula* of hospital based study. (We have done the pilot test of one week data the average opd of the department was 84 per day out of these 84 patients 16 patients from pterygium. So $p = 0.19$ and we put these p on cochrane formula and find sample of 59 patients which is round of to 60). This study was conducted on 60 patients visiting the outpatient department with primary pterygium, before and after pterygium surgery for corneal keratometry changes. Automated refraction and automated keratometry were used to calculate the cylindrical error and the corneal surface power respectively. The mean and standard deviation were calculated for the corneal curvatures and the refractive cylinder before and after the operation. Paired sample t-test and one way ANOVA were used to compare the corneal curvatures and refractive cylinder before and after pterygium excision. P-value < 0.05 was considered significant. The preoperative cylindrical error decreased from 4.23 ± 1.67 D to 2.09 ± 1.95 D postoperatively. Similarly, before surgery, the keratometry readings were 43.61 ± 1.12 D in horizontal meridian and 44.74 ± 1.41 D in vertical meridian. One week after the pterygium surgery these values were 44.45 ± 0.85 D in horizontal meridian and 45.23 ± 0.78 D in vertical meridian. Pterygium excision brings a statistically significant change in corneal keratometry readings which lead to a decrease in cylindrical correction needed. This causes an improvement in subjective visual acuity in patients who have undergone pterygium surgery.

Keywords: Keratometry, Pterygium, Pterygium excision, Refraction.

INTRODUCTION

Pterygium, which is also known as surfer's eye, is a growth of pink, fleshy tissue on conjunctiva. The pathophysiology of pterygia is characterized by elastotic degeneration of collagen and fibro vascular proliferation, with an overlying covering of epithelium. Mechanisms explaining the astigmatism are: the tractional force of contractile elements within the pterygium lead to mechanical distortion and flattening of the cornea in its horizontal meridian leading to hypermetropic with the rule astigmatism. Pterygium induced with-the-rule corneal astigmatism is hemimeridional on the side of the pterygium resulting in a localized flattening of the cornea central to the leading apex.

The localized pooling of tears at the advancing edge head of the pterygium is also responsible for corneal flattening [1] Pterygium is known to occur more frequently in areas with UV light, in hot dry windy and

dusty environment [2,3]. There is also a hereditary factor for its causation [4]. Occurrence of pterygium also varies with the geographical location. Prevalence rate varies from 5-15% in different areas of the world depending upon the proximity of a location to the equator [5,6]. Pterygia are reported to occur more frequently in the males as compared to the females. Incidence is highest between the ages of 20-24 years [6]. Patients with pterygium have a variety of complaints ranging from no symptoms to significant redness, itching, ocular motility disturbance and blurred vision [7].

The visual disturbance in patients having pterygium is thought to be due to cornea curvature abnormalities resulting either due to the pooling of tears over the apex of the lesion or due to the mechanical traction of the pterygium over the cornea[8]. The patients with pterygium can be observed until the lesion exhibits growth towards the cornea. Indications of

pterygium excision include visual deterioration, disturbed ocular motility and cosmesis. 9 Multiple options have been advocated in treating a pterygium. These range from simple excision to the conjunctival or amniotic membrane grafts, external beta irradiation and the use of topical chemotherapeutic agents such as intraoperative or postoperative mitomycin-C[10-13].

The curvature abnormalities seen in patients with pterygium, have been measured in previous studies by using corneal topography, manual keratometry and automated refraction[14-16]. Present study was conducted to highlight this effect of the pterygium excision on the corneal curvatures and astigmatism by using automated keratometry and automated refraction.

METHODOLOGY

60 patients were selected for study by using cochran formula of hospital based study.

cochran formula

$$N=Z^2* p *(1-p)/e^2$$

Where

Z=confidence level let 95% (standard value of 1.96)

P=Estimated prevalence or proportions or sensitivity of project area

e=Allowed error

Approval of study was taken from the local ethical committee. Study population consisted of patients with a primary ocular pterygium. Only the patients having > 1.5 D with the rule astigmatism (as measured by automated refraction), were included in the study. Patients with recurrent pterygium, double pterygium, acutely inflamed pterygium on slit lamp examination and the patients not consenting for pterygium excision were excluded. Informed written consent was taken from each patient before conducting the study.

All patients were thoroughly examined preoperatively for visual acuity using Snellen's chart, slit lamp examination of anterior segment, extra ocular movements, automated keratometry, automated refraction and fundus examination.

Pterygium was then graded depending upon the extent of corneal invasion as seen on slit lamp examination.

Grade-I: crossing the limbus but not reaching the pupil margin.

Grade-II: crossing the limbus and reaching upto the pupil margin.

Grade-III: reaching beyond the pupil margin (involving the visual axis).

Corneal curvatures were measured using Bausch and Lomb keratometer while refraction was performed using zeis autorefractometer. Corneal curvature values were recorded separately for horizontal and vertical meridians. All patients under-went automated refraction to assess the power of refractive cylinder.

After performing the examination and documenting the findings, pterygium excision was performed under topical anesthesia using 0.5% proparacaine drops. All surgeries were performed by the author himself. Area of pterygium was sterilized by instilling two drops of 5% povidone-iodine. Ocular speculum was then applied to the lids. After irrigating the ocular surface with copious amount of basal salt solution, the head and neck of the pterygium covering the cornea were removed by D-O'Brien's Bare-sclera technique. The pterygia tissue was detached from corneal surface taking care not to damage the Bowman's membrane during the removal of fibrous tags. The rough corneal surface was made regular and smooth by using fine dissection and polishing the corneal surface with the help of No.15 surgical blade. Care was taken not to expose the Tenon's capsule during the conjunctival excision so as to minimize the risk of postoperative granuloma formation. Hemostasis was achieved by cauterizing the large bleeding vessels. After completion of the surgery, a pad was applied to the operated eye for 24 hours. On the next morning, all patients were examined on slit lamp. Topical antibiotic-steroid combination eye drops and oral analgesics were prescribed to all the patients and they were discharged from the hospital. All patients were followed up on day 07 when their visual acuity, slitlamp examination, keratometry and refraction were again performed. The postoperative values of refractive cylinder and corneal surface curvatures were recorded. The pre and postoperative values were then compared. Paired t-test and ANOVA was used to compare the corneal curvatures and refractive cylinder. P-value <0.05 was considered statistically significant.

RESULTS

Our study included 60 patients of primary ocular pterygium. All eyes had nasal pterygium (Figure 1 a, b). Most of the patients in this study were males in their third decade of (Table 1). Grade-I and grade-II pterygium was seen in majority of the patients presenting to our outdoor patient department, while grade-III lesion was seen in very few patients (Table 2). It was observed in our study that the magnitude of refractive cylinder increased in direct proportion to the grade of the pterygium. All grade-II and III lesions were observed to induce a greater cylindrical error as compared to a Grade-I lesion (Table 2). Another important observation made in our study was that pterygium excision brought a significant decrease in cylindrical error postoperatively (Table 2). Similar findings were also made during measurements of keratometry readings. A greater variability in

keratometry readings was observed with an increasing grade of the pterygium (Table 3). It can be seen from the Table 3 that pterygium excision also brought a

significant change in the keratometric readings. These results were considered statistically significant at $p < 0.05$.



Fig-1a: Preoperative photograph showing nasal pterygium in the right eye



Fig-1b: Postoperative photograph after pterygium excision

Table-1: Age and sex of patients

Age group	Male	Female	Total
31-40	20	8	28
41-50	10	12	22
51-60	6	4	10
Grand Total	36	24	60

Table 2: Grade of Pterygium and Refractive Cylinder

Grade	No. of Patients	Pre-op cyl	Post op cyl	Pre-op Combined mean cyl \pm SD	Post-op Combined mean cyl \pm SD	T value (over all)	P value (over all)
I	30(50%)	1.66 \pm 0.50 D	0.90 \pm 0.62 D	4.23 \pm 1.67D	2.09 \pm 1.95D*	6.4566	<0.0001*
II	26(43%)	2.76 \pm 0.74 D	1.40 \pm 1.23 D				
III	4(7%)	3.47 \pm 1.46 D	1.43 \pm 1.19 D				

Cyl = Cylinder; T = paired T test value; * $p < 0.05$

Table-3: Corneal curvatures before and after pterygium excision.

	Pre-Op K-values (Mean \pm SD)	Post Op K-values (Mean \pm SD)	T value	P value
K1	43.61 \pm 1.12 D	44.45 \pm 0.85 D	4.6277	<0.0001*
K2	44.74 \pm 1.41 D	45.23 \pm 0.78D	2.3555	0.0201*

Table-3: Corneal curvatures difference between before and after pterygium excision according to Grade

K-values difference (before and after)	G-I	G-II	G-III	F value	P value
K1	0.38 ± 0.32D	0.85 ± 0.56D	1.38 ± 0.47 D*	13.312	<0.0001*
K2	0.26 ± 0.27D	0.29 ± 0.48D	0.34 ± 0.75D	0.086	0.918

K1 = Corneal curvature in horizontal meridian (Diopters)

K2 = Corneal curvature in vertical meridian (Diopters)

D= Diopters

T = Paired T test value

F = one way ANOVA value

*= statistically significant (p<0.05)

DISCUSSION

We have studied the keratometric readings in all grades of pterygium and calculate significant difference of astigmatism in all grades post operatively. Calculation is based on very basic instruments Bausch and lomb keratometer and autorefractometer which requires basic knowledge of instrument and is easily available in every rural and urban ophthalmic surgical setup. This is pure rural study taking into account the nature of the disease.

Pterygium causes a decreased visual acuity which is thought to be due to an alteration in tear film or by mechanical effects of the lesion[1-3]. Lin *et al.* report that a significant degree of astigmatism occurs when pterygium covers upto 45% of corneal surface from limbus to the visual axis[4]. This phenomenon was also observed in our study.

Popat *et al.* [15] studied changes in corneal astigmatism before and after pterygium excision surgery on 100 eyes of 95 patients who had primary pterygium. Mean astigmatism preoperatively was found to be 6.20 ± 3.58 Diopters (D) which subsequently decreased to 1.20 ± 1.27 D on 45th post-operative day-showing 5.09 ± 3.32 D of change in astigmatism which was statistically significant(paired t-test, p<0.05).

In another study, Gumus *et al.* used corneal topography and wavefront analysis to evaluate the ocular refractive error induced by pterygium. Their study verified that pterygium induces a change in the toric-aspheric shape of the cornea, thus leading to an ocular astigmatic aberration. Additionally they also showed that the astigmatic error seen in these patients was a function of the size of the pterygium[16].

CONCLUSION

As per the results of above conducted case series we have come to a conclusion that pterygium excision increases corneal keratometric readings by decreasing the flattening of cornea caused by pterygium hence decreasing corneal astigmatism.

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