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Original Research Article

Effect of Pterygium on Corneal Astigmatism at BMIMS, Pawapuri, Nalanda, Bihar

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Abstract

Background: Pterygium is one of the oldest diseases known in the history of Medicine. It is a degenerative condition of the subconjunctival tissue, which proliferates as a triangular sheet of vascularised granulation tissue to invade the cornea, destroying the superficial layers of the stroma and Bowman’s membrane, the whole being covered by conjunctival epithelium. The aim of this study was to use keratometric readings of the automated Bausch and Lomb keratometer to determine the change in pterygium induced astigmatism following pterygium excision and also to determine the relationship between pterygium size and corneal astigmatism after it is removed from the corneal surface.

Methods: This study was conducted in Department of Ophthalmology, BMIMS, Pawapuri, Nalanda, Bihar from August 2021 to July 2022. Thirty eyes of 30 patients were selected for the study. Patients aged 25 - 65 years with nasal primary pterygium and a length of 2.5 mm or more were included in the study. The exclusion criteria were pseudopterygium, recurrent pterygium, corneal scarring from any cause and any previous ocular surgery.

Results: The median (mean rank) pre-operative astigmatism of 2.25 (15.50) reduced to a median (mean rank) postoperative astigmatism of 1.30 (14.96). This decrease in the postoperative astigmatism was statistically significant ($p < 0.001$). There was a statistically non-significant correlation between the postoperative astigmatism and the pterygium size ($r_s = -0.29$, $p = 0.12$).

Conclusion: Pterygium removal from the corneal surface caused significant improvement in astigmatism.

Keywords: Pterygium, Corneal, Ocular, Pseudopterygium

Background

Pterygium is a degenerative condition of the subconjunctival tissue which proliferate as vascularized granulation tissue to invade the cornea, destroying the superficial layers of the stroma and Bowman’s membrane, the whole being covered by conjunctival epithelium.

The pterygium appears as a triangular encroachment of the conjunctiva upon the cornea with numerous small opacities lying deeply in the neighbouring part of cornea in front of its blunt apex.

Pterygium is more commonly present on the nasal conjunctiva and extends to the nasal cornea, although, it can be present temporally. When pterygium is double (i.e. both nasal and temporal in same eye), the temporal lesion develops later.

Pathologically, pterygium is a degenerative and hyperplastic condition of sub conjunctival tissue. The subconjunctival tissue undergoes elastotic degeneration and proliferates as vascularised granulation tissue under the epithelium, which ultimately encroches the cornea. The corneal epithelium, Bowman's layer and superficial stroma are destroyed.

The amount of astigmatism present is resultant of astigmatism at cornea and lens. Astigmatism at lens is contributing negligible part to it except in complicated cases. Cornea is major determinant of astigmatism and also important in cases of 'Iatrogenic astigmatism'.

Though Mitocmycin-C application in Pterygium surgery is a successful procedure, but due to it's varying recurrence rate and ocular toxicity there was need for search of another antiproliferative agent with less ocular toxicity and less recurrence rate of Pterygium.

Recently, some newer techniques are used in pterygium surgery to cut short the recurrence rates in both primary and recurrent pterygium. In these techniques, bare sclera is covered with different tissues – Conjunctival limbal autograft, Conjunctival autograft, Amniotic membrane graft, Double layered amniotic membrane graft with intra-operative triamcinolone.

Material and Methods

Present study was done in Department of Ophthalmology, Bhagwan Mahavir Institute of Medical Sciences, Pawapuri, Nalanda, Bihar from August 2021 to July 2022. Total 30 eyes of 30 patients were selected for the study. A written informed consent was obtained from all the patients. After obtaining ocular and systemic history, ocular examination was done which included Snellen visual acuity, manifest refraction and slit lamp anterior segment examination. The size of the pterygium was measured using the Haag Streit slit lamp biomicroscope by projecting a horizontal slit beam from the limbus to the apex of the pterygium and recording the length in millimeters.

This study has been done using Bausch and Lomb keratometer which utilizes the principle of constant object size and variable image size for its operation. The image doubling means in this keratometer is unique in that double image are produced not side by side but also oriented by 90^0C from each other. The separation between the doubled images can be increased or decreased by moving the prism further or nearer to the image plane.

Having covered the other eye, the patient is asked to look into the instrument with the eye to be examined during taking readings of the corneal curvature. The instrument is moved forward or backward till the mires are accurately focused. The dial is then rotated till mires are approximated. One plus mire should overlap the other plus mire and it should appear as one plus mire. The mires are then approximated along the vertical meridian by making the minus mires to overlap.

The adjustment of axis has been done by tilting the instrument along the anteroposterior axis to accurately overlap the mires. Then the corneal curvature (in mm) or keratometric power (in Diopter) both in horizontal and vertical meridians were noted from both the knobs. An average of three readings was taken in each meridian to increase the accuracy of the readings. The conjunctival graft was placed 2 mm from the limbus with care taken to maintain the limbal orientation of the graft towards the cornea and also not to turn the epithelial side down. A tobramycin /dexamethasone ointment was applied and the eye was padded. The eye pad was removed on the first postoperative day and tobramycin/dexamethasone eye drops three times daily were prescribed for 04 weeks. All the patients were followed-up on day 6,15 and 28 and then monthly for 6 months. Keratometric data was obtained on day 15 and 28 with the same automated keratometer used pre-operatively. Patients were followed up for 06 months postoperatively.

Statistical analysis was performed using Statistical Package for Social Sciences (SPSS) version 22.0 for windows. Mean ± standard deviation was used for description of age statistics. A p-value < 0.05 was considered statistically significant.

Results

Average age of the patient was 43.43 ± 14.3 years and male to female ratio was 3:1. Pterygium length ranged from 2.5 to 4.5 mm with a median of 3.05 ± 0.11 mm.

The median (mean rank) pre-operative astigmatism was 2.25 (15.50) which reduced to a median (mean rank) postoperative astigmatism of 1.30 (14.96) as mentioned in Table 1. This decrease in the postoperative astigmatism was statistically significant (p < 0.001).

Pre-operatively 23 (76%) patients had with the rule astigmatism, 6 (20%) had oblique astigmatism and 01 (3.3%) patient had against the rule astigmatism.

Pterygium size correlated negatively with the postoperative corneal astigmatism (rs = -0.29) but this was statistically non-significant (p = 0.12) as mentioned in Table 2. Only one patient (3.3%) out of 30 had recurrence of pterygium

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Table 1: Comparison of keratometric astigmatism before and after pterygium excision (n=30).

Keratometric astigmatism (Diopter)	Before excision (n=30)	After excision (n=30)	p-value
Median (mean rank)	2.25(15.50)	1.30(14.96)	<0.001

Table 2: Correlation between postoperative astigmatism and pterygium size (n=30).

Pterygium size (mm)	Postoperative astigmatism (Diopter)	R_s	p-value
3.05±0.11	1.30±0.22	-0.29	0.12

Discussion

Post-operative astigmatism is one of the most important factors which hinder attainment of near normal unaided visual acuity following intraocular lens implantation. The astigmatism is largely due to alteration in the corneal curvature but may also be due to the intraocular lens (uncommon). The ultimate astigmatic result is predominantly influenced by wound size and site of incision.

Pterygium-induced astigmatism can lead to visual complaints. Previous studies have shown pterygium induces with-the-rule astigmatism. The astigmatism appears to be due to an alteration in the tear film caused by the lesion. As the head of the pterygium approaches the apex of cornea, a tear meniscus develops between the corneal apex and the elevated pterygium, causing an apparent flattening of normal corneal curvature.

The astigmatism decreased significantly following pterygium excision. The mean preoperative refractive cylinder decreased from 4.60±2D to 2.20±2.04D postoperatively (P=0.00001). Visual improvement was noted in 15 eyes (41.67%). The improvement in vision may be due to two causes - a) reduction in astigmatism, and b) removal of pterygium from visual axis as in grade IV pterygium.

The astigmatism seen in the patients represents both naturally occuring astigmatism and induced astigmatism. It may be incorrect to label the entire astigmatism as "induced". I would like to believe that majority of the astigmatism seen in the study was caused by the pterygium itself since it was always "with-the-rule" whereas naturally occuring astigmatism can occur at any of the axes.

The present study verifies that as the size of pterygium increases, the amount of induced astigmatism increases in direct proportion. Successful pterygium surgery reduces the pterygium-induced refractive astigmatism and improves the visual acuity.

Various authors have reported variable amount of astigmatism by comparing the length of pterygium using corneal topography. Pterygium which are less than 2.5 mm induce less astigmatism of 1.25 D compared to those greater than 2.5 mm which induce on average 3.94 D of astigmatism [1] Hansen *et al*. reported that pterygium greater than 3.0 mm induced 1.97 D of astigmatism versus 1.11 D in less than 3 mm [2].

Kampitak reported a 2 D or more of astigmatism with length greater than 2.25 mm [3]. Recently, Jaffar *et al*. found a strong correlation with a mean size of 2.84 ± 0.557 mm and inducing a 3.46 ± 1.441 D ($p=0.01$) of astigmatism [4]. On the contrary, Fong *et al*. results did not accord with other studies who found that pterygium had to be greater than 3.5 mm to induce 1 D of astigmatism. Based on the findings of the published literature, the authors operated upon only those pterygia whose length exceeded 2.5 mm. In this study, the median pterygium size was 3.05 mm which induced a median astigmatism of 2.25 D.

Pterygium surgery significantly reduces corneal astigmatism [5]. After removal, there is a significant influence on the corneal refractive parameters which includes spherical power, astigmatism, asymmetry and irregularity [6]. This decrease in corneal astigmatism is statistically significant when measured either with automated keratometer or computerised videokeratoscope [5-8] In this study, the authors used the conventional automated keratometer and found a statistically significant reduction in the magnitude of corneal astigmatism ($p < 0.001$). Postoperatively, how will the size of pterygium affect the magnitude of refractive changes is difficult to predict even with the use of corneal topography [6]. Nohutcu reported that pterygium whose length exceeds 2.5 mm from the limbus has a significantly higher influence in decreasing the amount of postoperative astigmatism [9].

Contrary to that, Vives operated upon pterygia whose mean length was 2.0 ± 0.6 mm but found no statistically significant correlation between the length of pterygium and postsurgical astigmatism at 01 month ($p=0.11$) and even at 03 months postoperatively ($p=0.09$) [1].

Pterygium with a length of 2.0 mm but with a width of 3.0 mm can create as much as 2.50 D or more of corneal astigmatism. So not only the length of corneal encroachment but the width is equally important in determining the postsurgical astigmatism [10]. Additionally, measuring postoperative astigmatism with automated keratometer and computerized videokeratoscope also produces different results.

The conventional keratometer evaluates the corneal refractive power from just 03 or 04 data points, so many authors suggest using corneal topography in evaluating the postoperative changes following pterygium excision [11]. In this study, the role of the pterygium length was analyzed and found that it did not correlate statistically with the postexcisional corneal astigmatism. Other parameters like width and total area of the pterygium were not included that may influence the postoperative astigmatism. Moreover, we used the automated keratometer in analyzing the postexcisional cornea.

Conclusion

Overall results of the 30 patients in our study to concluded that all the patients had induced with the rule astigmatism and the amount of astigmatism increases with the increase in the size of the pterygium.

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