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To Compare the Changes in Corneal Astigmastism and Topography Pre and Post Surgically In Patients with Different Grades of Pterygium Undergoing Pterygium Excision with Autoconjunctival Grafting Surgery

Dr. Ramesh Kumar, Dr. Ananya Singh, Dr. Arvind Chauhan

Abstract:
PURPOSE: Pterygium is known to affect refractive astigmatism which can have significant impact on vision. This study was undertaken to study the change in corneal astigmatism after pterygium excision with auto conjunctival grafting and compare the changes in astigmatism in various grades of pterygium in terms of autorefraction and topography. This was a single centre prospective observational study.
METHODS: In 53 patients (23 females, 30 male) with a mean age of 50 +/- years the pterygium was graded on the basis of slit lamp examination and quantified using projected preoperative clinical slides and was corelated with visual acuity, refractive, topographic astigmatism. All 50 patients underwent pterygium excision with auto conjunctival grafting. The preoperative and postoperative refractive and topographic measurements evaluated using automatedrefractometer and Topcon.
RESULTS: Astigmatic error decreased significantly after pterygium excision. The mean preoperative astigmatic error decreased from 4.08+/-0.52D to 1.92+/-0.53D. The increasing grade of pterygium resulted in a highly significant elevation of the preoperative astigmatic error. The amount of keratometric and topographic astigmatism correlated significantly with increasing grades of pterygium. The amount of astigmatism decreased significantly following pterygium excision in grade II, grade III, grade IV. In grade I, pterygium decrease in astigmatism was not statistically significant (p = 0.5).
CONCLUSIONS: Increasing grade of the pterygium results in increased amount and irregularity of preoperatively induced corneal astigmatism. This may explain the patient's decrease in visual acuity before the pterygium reaches the optical axis. Surgical excision of pterygium improves visual acuity and reduces astigmatic error. Our data may help to determine the adequate time point for primary pterygium excision. Corneal astigmatism values in patients with pterygia is a useful indicator for surgical success.
Keywords: *Corneal astigmatism, auto conjunctival grafting, topography.*

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Pterygium is a wing-shaped ocular surface lesion traditionally described as an encroachment of bulbar conjunctiva onto the cornea, pterygia are described as a proliferative disorder resembling an aberrant wound healing response .Pterygium is common ocular surface lesions thought to originate from limbal stem cells altered by chronic UV exposure.

Morphological a pterygium consists of three distinct parts: the cap, the head and the body/tail.

The indications for pterygium surgery are (a) visual impairment; (b) recurrent inflammation; (c) motility restriction; (d) cosmetic disfigurement.

Early in the disease process, pterygia are usually asymptomatic; however, there can be signs of dry eye (such as burning, itching or tearing) as the lesion causes irregular wetting of the ocular surface. As the disease progresses, the lesion increases in size and becomes more apparent to the naked eye and may become cosmetically unpleasant for the patient. Further growth may cause visual symptoms due to induced astigmatism or direct encroachment onto the visual axis. Pterygium leads to significant changes in corneal refractive status, which increase with the increase in the grade of pterygia and improve following pterygium excision.

Pterygium leads to a considerable effect on corneal refractive status which has been previously measured in various studies by refraction, keratometry and corneal topography.

Our study is designed to study the change in corneal astigmatism after pterygium excision with auto conjunctival grafting and compare the changes in astigmatism in various grades of pterygium in terms of autorefraction and topography.

Surgery is the primary treatment of pterygium. Visual acuity can be improved by successful pterygium excision surgery during which astigmatism is reduced and pterygium is reduced from the visual axis. Many surgical techniques have been used for pterygium surgery such as bare sclera technique, conjunctival autograft

technique, amniotic membrane grafting. As compared to the bare sclera technique, changes in astigmatism are significantly more with amniotic membrane and autoconjunctival graft technique mainly due to better healing and less granulation tissue formation.

I. Methods

This prospective observational study was approved by the institutional ethical committee and adhered to the tenets of the Declaration of Helsinki. Informed consent was obtained from all the participants. Fifty three eyes of 53 patients with primary pterygia were studied before and after surgery.

INCLUSION CRITERIA: - Patients of age 20 – 60 years with primary pterygium with >-2D were included in the study.

EXCLUSION CRITERIA :- Patients with recurrent pterygium, double headed pterygium and pterygium with any anterior and posterior segment pathology were excluded from the study.

Pterygium was graded depending on the extent of corneal involvement.

Group 1: Grade 1: When the apex is at limbus

Grade 2: When the apex is at midway between the limbus and outer border of normal pupil.

Grade 3: When the apex is at the normal pupillary margin or covers the pupillary margin.

Grade 4: When the apex is between the opposite limbus and pupillary area and apex is turned slightly upwards.

The surgical technique used among the study population is pterygium excision with autoconjunctival grafting.

During follow up, patients are examined for visual acuity; Autorefraction and Corneal topography readings is recorded using above instruments as mentioned above in preoperative assessment. These measurements are done on 1st postoperative day, 7th postoperative day (1 week follow up) and 30th postoperative day (1 month follow up).

Preoperative and postoperative values are compared using paired t – test.

Preoperative astigmatism and topographic parameters were compared against the grade of pterygium using ANOVA test.

II. Observations And Results

TABLE NO 1: Distribution of cases according to age and sex:

	FEMALE	MALE	
Age in years	No of patients %	No of patients %	Total no of patients
20 – 30	2	3	5
30 – 40	10	12	22
40 – 50	9	10	19
50 – 60	2	5	7

TABLE NO 2: Comparison of postoperative mean corneal astigmatism on preoperative and postoperative day 1, postoperative day 7 and postoperative 1 month.

Preoperative mean astigmatism	4.08+/-0.52	
Postoperative day 1	2.73+/-0.42	<0.001
Postoperative day 7	1.98+/-0.40	<0.001
Postoperative 1 month	1.92+/-0.53	<0.001

TABLE NO: 3

Grades of pterygium	**GRADE I**	**GRADE II**	**GRADE III**	**GRADE IV**
Gradewise Distributation of cases	5	20	24	4
Pre-op mean astigmatism	2+/- 0.22	2.40+/-0.50	3.37+/-0.59	8.56+/-0.79
Post-op mean astigmatism (1 month)	0.90+/-0.23	1.14+/-0.41	1.57+/-0.64	4.10+/-0.87
p-value	0.5	<0.001	<0.001	<0.001
Pre-op mean BCVA	0.80+/-0.10	0.56+/-0.20	0.40+/-0.10	0.07+/-0.02
Post-op mean BCVA (1 month)	0.95+/-0.00	0.77+/-0.20	0.56+/-0.15	0.15+/-0.02
p- value	0.17	<0.001	<0.001	<0.001
Pre-op mean SRI	0.24+/-0.22	0.44+/-0.42	1.40+/-0.78	2.01+/-0.67
Post-op mean SRI (1 month)	0.15+/-0.10	0.24+/-0.20	1.20+/-0.56	1.81+/-0.45
p-value	<0.001	<0.001	<0.001	<0.001
Pre-op mean SAI	0.72+/-0.35	1.50+/-1.00	3.25+/-1.09	4.50+/-1.65
Post-op mean SAI (1 month)	0.20+/-0.21	0.80+/-0.36	1.40+/-0.51	2.00+/-0.66
p- value	<0.001	<0.001	<0.001	<0.001

(SRI = Surface regularity index)

(SAI = Surface asymmetry index)

TABLE NO: 4 Comparison of mean pre operative and post operative astigmatism (postoperative 1 month):		
Preoperative mean astigmatism	Postoperative mean astigmatism	P – value
4.08+/- 0.52	1.92+/-0.53	<0.001
Comparison of mean preoperative and postoperative BCVA (postoperative 1 month):		
Preoperative mean BCVA	Postoperative mean BCVA (postoperative 1 month)	P - value
0.45+/-0.10	0.60+/-0.09	<0.001
Comparison of mean preoperative SAI and postoperative SAI (postoperative 1 month):		
Mean preoperative SAI	Mean postoperative SAI	p-value
2.49+/-1.02	1.10+/-0.09	<0.001
Comparison of mean preoperative SRI and postoperative SRI (postoperative 1 month):		
Mean preoperative SRI	Mean postoperative SRI	p- value
1.02+/-0.52	0.85+/-0.32	<0.001

III. Discussion

Pterygium induced refractive change often leads to visual impairment. Previous studies have shown that pterygium causes corneal distortion which induces a significant amount of astigmatism [5,6,7,8]. The exact mechanism of flattening in horizontal meridian due to pterygium is not clear. It is thought to be caused by the formation of tear meniscus between the corneal apex [9,10] and the elevated pterygium, causing an apparent flattening of the normal corneal curvature [11]. As this flattening is along the horizontal meridian, it usually causes with the rule corneal astigmatism. Pterygium excision induces a reversal of pterygium related corneal flattening [12]. Consequently successful pterygium surgery should reduce corneal astigmatism [13].

Maheshwari [14] demonstrated that after removal of the pterygium, cornea becomes more regular. Comparison of pre and postoperative corneal topography also revealed significant changes in the majority of topographic parameters. Pterygium can cause an asymmetric distortion of the cornea, because the lesion typically extends radially from the corneal periphery. There is commonly an increase in corneal and refractive astigmatism with pterygium as well as an increase in Higher-order wavefront error (HO-WFE), with an effect proportional to the extent of the lesion [18,19]. Because the condition approaches lateral to the visual axis, a change in Surface Asymmetry Index (SAI) is not usually a feature of the condition.

In our study, 5 eyes had grade 1 pterygium, 20 eyes had grade 2 pterygium, 24 eyes had grade 3 pterygium and 4 eyes had grade 4 pterygium. Our findings are in accordance with the findings of other workers [13,14].The preoperative mean astigmatism was 4.08+/-0.52. The amount of astigmatism varied with grade of pterygium. The preoperative mean astigmatism was 2+/-0.22 in grade I pterygium, 2.40+/-0.50D was noticed in grade 2, 3.37+/-0.59D in grade III pterygium and 8.56+/-0.79D in grade IV.

Lin and Stern [24] found a significant correlation between the pterygium size and corneal astigmatism; they reported pterygium to induce significant degrees of astigmatism once it exceeded >45% of the radius. With increase in grade of pterygium ,induced astigmatism is increased .The maximum degree of astigmatism was noted in grade IV and minimum was in grade I .There was statistically significant correlation between grade of pterygium and induced astigmatism (p-value<0.001).This calculation was done by ANOVA test.

The astigmatism decreased significantly following pterygium excision .The mean preoperative refractive cylinder decreased from 4.08+/-0.52D to 1.92+/-0.53D postoperatively (p<0.001) after 1 month follow up. Astigmatism was with the rule in all patients. Surgical removal of pterygium caused a significant reduction in refractive astigmatism. The mean preoperative refractive cylinder decreased from 2+/-0.22Dto 0.90+/-0.23D postoperatively (p=0.515) in grade I pterygium, from 2.40+/-0.50D to 1.14+/-0.41D in grade 2 (p<0.001) after 1 month follow up. In grade III pterygium refractive cylinder decreased from 3.37+/-0.59D to1.57+/-0.64D postoperatively (p<0.001) after 1 month follow up. The amount of astigmatism decreased significantly following pterygium excision in grade II and grade III (p<0.001) but in grade I the decrease in amount of astigmatism following pterygium surgery was not statistically significant (p=0.515).The amount of astigmatism seen in the patients with grade I pterygium (>2D) occurs not only due to pterygium induced refractive changes, but naturally occurring astigmatism was more responsible. This was noticed by the fact that in grade I the amount of astigmatism decrease following pterygium surgery was not statistically significant (0.5)

When primary pterygium increases in size (more than grade 1) it induces significant with the rule astigmatism. This significant astigmatism tend to increase with the increasing size of the lesion. Pterygium induced astigmatism decreased significantly following pterygium excision in grade II, grade III and grade IV.

Pterygium induced impaired visual acuity may be caused by an alteration in tear film or by mechanical effects of the lesion. Therefore, excision of the lesion may lead to reconstruction of the normal surface, and thus, improvement in the visual acuity [23]. Statistically improvement in BCVA in grade II, grade III and grade IV pterygium was due to reduction of astigmatism. Preoperative BCVA improved from 0.45+/-0.10 to 0.60+/-0.09.

Pterygium was seen to have a considerable effect on topographic indices in the present data. Flattening was seen in the horizontal meridian, which was associated with the astigmatism. The exact mechanism of flattening is not clear. It is thought to be caused by the formation of tear meniscus between the corneal apex and the elevated pterygium, causing an apparent flattening of the normal corneal curvature.

The topographic surface irregularity (SRI) and surface assymetry indices (SAI) significantly reduced in grade 2, grade 3 and grade 4 pterygium. This reduction in SRI and SAI was not statistically significant in grade 1 pterygium. The mean preoperative SRI and SAI 1.02+/-0.52 and 2.49+/-1.02 respectively reduced to 0.85+-0.32 and 1.10+/-0.09 respectively.

Our study was limited in that it was characterised by short term postoperative follow up period. We evaluated the corneal astigmatism and corneal topographic values in first postoperative month. It is possible that corneal topography changes with time after surgery. Therefore, further studies with longer follow up time are necessary

IV. Conclusion:

In summary, our study demonstrates that successful pterygium excision with auto conjunctival grafting reduces the corneal astigmatism and improves topographic irregularity. Corneal astigmatism and corneal topography values in patients with pterygium are useful indicators of the need for pterygium surgery or as indicators of surgical success.

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