ECRONICON OPEN ACCESS

EC OPHTHALMOLOGY
Case Series

A Case Series on Patients Having Preoperative Non-with-the-Rule Corneal Astigmatism and Showing Failure of Visual Improvement After Pterygium Excision

Fathy Fawzy Morkos[1], Maged Maher Roshdy[1,2], Mona Fathy[1], Tamer Abdelfattah Badran[2] and Rania Serag Elkitkat[1,2,3]*

[1]*Watany Eye Hospital, Cairo, Egypt*

[2]*Ophthalmology Department, Faculty of Medicine, Ain Shams University, Cairo, Egypt*

[3]*Ophthalmology Department, Faculty of Medicine, MTI University, Cairo, Egypt*

***Corresponding Author:** Rania Serag Elkitkat, Watany Eye Hospital and Ophthalmology Department, Faculty of Medicine, Ain Shams University and Ophthalmology Department, Faculty of Medicine, MTI University, Cairo, Egypt.

Received: May 17, 2023; **Published:** May 31, 2023

Abstract

Purpose: To report on failure of visual improvement following pterygium excision in a cohort having preoperative non-with-the-rule (non-WTR) corneal astigmatism.

Patients and Methods: This is a retrospective case series study that was conducted at Watany Eye Hospital, Cairo, Egypt, on patients having preoperative non-WTR corneal astigmatism. Visual and refractive changes after surgery were reported. Relevant data were retrieved from the captured pre-and postoperative Pentacam HR imaging, including changes in topographic corneal astigmatism and pterygium encroachment on the visual axis.

Results: The percentage of non-WTR cases during a period of 29 months was 9.45% (7 out of 74 cases). The preoperative Pentacam flat meridian deviation from the horizontal (180^0) axis had a median of 60^0. The median pterygium extent was 210 µm before the visual axis. The seven patients had statistically insignificant differences in Corrected Distance Visual Acuity "CDVA", Pentacam corneal astigmatism, and mean keratometry "Km" between the pre-and postoperative values (six months after pterygium excision) (P-value = 0.125, 0.578, and 0.813 respectively).

Conclusion: Pterygia usually induce flattening of the horizontal corneal meridian causing WTR astigmatism. The sparse entity of patients having preoperative non-WRT corneal astigmatism has a less favorable visual prognosis following pterygium excision. Ophthalmologists should discuss with such patients the unfavorable visual and refractive outcomes and would rather defer from performing surgeries in such an entity of patients.

Keywords: *Pterygium; Pterygium Excision; Non-with-the-Rule Astigmatism; Corneal Astigmatism; Outcome of Pterygium Surgery*

Introduction

Pterygium is a fibrovascular proliferative disorder where the bulbar conjunctival tissue encroaches over the limbus onto the clear cornea [1]. It is more encountered among the inhabitants of sunny environments, mostly representing a local response to chronic dryness

and overexposure to ultraviolet rays [2,3]. The most common indications for surgical removal of pterygium include visual impairment (by induced corneal astigmatism or by direct encroachment over the visual axis), induction of intolerable inflammatory symptoms, and/or cosmetic disfigurement [4,5].

The advancing edge of the pterygium can cause significant changes in the corneal curvature, and hence in the refraction, before reaching the optical zone [6]. For decades, studies have addressed pterygium-induced changes in corneal astigmatism and reported significant flattening in the horizontal meridian and consequent with the rule (WTR) corneal astigmatism [7,8]. This can be logically explained by the pterygium-induced tension on the corneal horizontal meridian. Furthermore, a tear meniscus develops between the corneal apex and the head of the pterygium, causing a localized flattening of the horizontal corneal meridian or hemi-meridian on the side of the pterygium and adds to the pterygium-induced WTR corneal astigmatism [4,5,9-12].

In previous studies, the choice of suitable candidates for pterygium excision has always been related to the pterygium size and related parameters [1-4]. In our clinical practice, we noticed that there is some variability in postoperative patients' visual satisfaction despite uneventful pterygium removal in all cases. As per the Watany Eye Hospital (WEH) protocol, patients who are scheduled for pterygium surgery go through both subjective refraction and Pentacam examination before pterygium excision surgery. On checking the patients' electronic medical records, we deduced that all the patients who had poorer visual prognosis, despite uneventful surgery, had preoperative non-WTR corneal astigmatism.

In this study, we navigated through the visual and refractive outcomes of pterygium excision in patients having non-WTR corneal astigmatism, to confirm the existence of a relation between pterygium surgery outcome and corneal astigmatic axis.

Materials and Methods

This is a retrospective case series of patients who had non-WTR topographic corneal astigmatism and underwent pterygium excision at WEH, Cairo, Egypt, in the period from September 2018 to January 2022. The study adhered to the tenets of the Declaration of Helsinki and was approved by the Institutional Review Board (IRB) of the Watany Research and Development Center (the registration code is COR-2019-01), where the IRB granted a waiver of informed consents from the participants owing to the retrospective nature.

The electronic medical records of the WEH were explored to detect both subjective refraction and relevant Pentacam parameters before and six months after pterygium excision. The visual acuity testing was documented as Snellen scoring, then converted to LogMAR notation for statistical purposes. Preoperative pterygium size (distance between the leading edge of the pterygium and the corneal apex), keratometric parameters, and corneal astigmatic axis were obtained from the preoperative captured scans of Pentacam HR (Allegro Oculyzer II, WaveLight, Erlangen, Germany). The postoperative Pentacam scans were used to assess the changes in both keratometric values and corneal astigmatic axis.

We included primary significant pterygia extending to more than 45% of the corneal radius and/or within 3.2 mm of the visual axis [9,10] while patients with any previous refractive surgery or ocular pathology that affected the patients' visual acuity (mainly significant corneal opacities or scars other than those related to the pterygium and affecting the Pentacam topometric indices, cataract, glaucoma, uveitis, or retinal pathologies) were excluded.

The percentage of cases having preoperative non-WTR corneal astigmatism was determined, and their visual and refractive outcomes were studied.

All surgeries were performed by the same experienced surgeon (F.F.M.) using the same technique. Peribulbar anesthesia using lidocaine/bupivacaine combination was used. The surgery started with the elevation of the free edge of the pterygium using two McPherson forceps, followed by avulsion of the pterygium head. Any residual tissues were then carefully dissected from the cornea using a crescent blade. An ophthalmic burr was used afterwards for meticulous smoothing of the corneal surface, followed by complete pterygium removal. A conjunctival autograft from the upper temporal quadrant was then prepared and cut as per the required dimensions for covering the bare sclera and was fixed in place using fibrin glue.

Statistical analysis

Data analysis was performed using MedCalc Statistical Software version 20.106 (MedCalc Software Ltd, Ostend, Belgium). The D'Agostino-Pearson test was used to assess normality. Quantitative data were presented as median and interquartile range (IQR), as data was not normally distributed. Comparison between the preoperative and postoperative parameters were performed using the Wilcoxon test. The Mann-Whitney test was used to compare parameters between the two groups. P-values < 0.05 were considered statistically significant.

Results and Discussion

The number of patients who performed pterygium excision during a period of 29 months was 74 patients, seven of them had preoperative non-WTR topographic corneal astigmatism, representing 9.45% of the patients. Regarding this non-WTR cohort, there was a male predominance of 85.7%. The median patients' age was 59 years (IQR 53.25 - 63.25 years). The preoperative Pentacam flat meridian deviation from the horizontal (180°) axis had a median of 60° (41.75 - 71.75). The median pterygium extent (distance from the visual axis) was -210 (-295 to 775) µm (positive value means crossing the visual axis). Table 1 shows the individual visual and topographic data of the seven non-WTR patients included in the study.

		Preoperative Data						Postoperative Data			
Age	**Sex**	**CDVA[a]**	**K1[b]**	**K2[c]**	**Flat Meridian**	**Pterygium Extent**	**Pterygium Thickness**	**CDVA**	**K1**	**K2**	**Flat Meridian**
52	M	0.3	44	44.2	140	-310	320	0.4	42.9	44.1	180
70	M	0.22	44.2	44.4	75	220	450	0.22	40.1	44.1	10
57	M	0.4	45.9	47.9	80	-300	70	0.7	46.1	47.8	80
64	M	0.15	44.8	45.9	40	-280	150	0.3	44.5	44.7	130
61	M	0.22	43	43.8	133.5	1130	610	0.22	43.3	43.7	107.6
48	F	0.4	44.2	44.6	61.6	960	540	0.3	44.6	46	124.4
59	M	0.3	46	47	60	-210	230	0.52	46.4	47.2	130

Table 1: *The individual visual and topographic data of each of the seven non-WTR patients.*

a- CDVA: Corrected Distance Visual Acuity, b- K1: Corneal Flattest Meridian, c- K2: Corneal Steepest Meridian.

The study results declared that the non-WTR cohort of patients showed statistically insignificant differences in Corrected Distance Visual Acuity "CDVA", Pentacam corneal astigmatism, and mean keratometry "Km" between the pre-and postoperative values (P-value = 0.125, 0.578, and 0.813, respectively) (Table 2).

The present study focused on the presumed optical effect of pterygia to induce preoperative WTR corneal astigmatism and aimed to evaluate the impact of preoperative non-WTR corneal astigmatism on the visual and refractive outcomes of pterygium surgery. This

	Preoperative	Postoperative	Wilcoxon test P-value*
CDVA[a]	0.3 (0.22 - 0.375)	0.3 (0.24 - 0.49)	0.125
Pentacam astigmatism	0.8 (0.25 -1.075)	1.2 (0.5 - 1.625)	0.578
Km[b]	44.4 (44.15 - 46.213)	44.6 (43.5 - 46.425)	0.813

Table 2: *The pre-and postoperative visual and topographic parameters of the studied cohort.*

a- CDVA: Corrected Distance Visual Acuity, b- Km: Mean Keratometric Value.

**P-value is considered statistically significant if < 0.05.*

case series showed no improvement in postoperative visual outcomes and a slight increase in the postoperative corneal astigmatism in a cohort of seven patients who had preoperative non-WTR corneal astigmatism.

In all our chosen pterygium candidates, the pterygium was extending to more than 45% of the corneal radius and/or within 3.2 mm of the visual axis. As stated in the literature, these are the main parametric criteria that are expected to produce significant corneal astigmatism [9,10].

In many published reports [6-12] there were significant improvements in patients' subjective refraction and re-steepening of the horizontal corneal meridian following pterygium excision. To the authors' knowledge, none of the previous studies analyzed the visual and refractive improvements in relation to the preoperative corneal astigmatic axis.

From an optical point of view, it can be assumed that excising pterygia in patients having non-WTR corneal astigmatism may worsen the refractive and visual outcomes, as pterygium excision will remove its flattening effect on the horizontal meridian and hence may increase the non-WTR corneal astigmatism postoperatively. This was partially validated by our study results, where patients who had non-WTR corneal astigmatism did not show postoperative visual improvement and showed a slight (insignificant) increase in corneal astigmatism.

Owing to the small number of recruited patients in this case series, we recommend further studies on larger cohorts, which may even show a visual deterioration in those cases after pterygium removal. However, the small percentage of non-WTR patients (9.45%) elucidates that such cases are sparsely found. Since we excluded any patients having significant corneal opacities, all recruited non-WTR patients in the present study mostly had a significant non-WTR corneal astigmatism before developing the pterygium and its effect was only diminished by the pterygium existence. Another possibility is that the mechanism of inducing corneal pathology differs among pterygia, causing WTR astigmatism in most cases and the reverse in the remaining smaller cohort. This needs to be investigated in a future longitudinal study. It is also noteworthy that evaluating the preoperative corneal astigmatism while having pterygia may induce some fallacies in the corneal astigmatic axis calculation, and partial covering of the pupillary area by some pterygia that crossed the visual axis may also give some inaccurate calculations.

Conclusion

In conclusion, this study showed that surgical removal of pterygium in a cornea having non-WTR corneal astigmatism may result in patients' dissatisfaction postoperatively due to unimproved vision. Hence, patients having non-WTR corneal astigmatism should be preoperatively counseled regarding the expected visual prognosis, and surgeons would rather defer from performing pterygium excision in such candidates.

Conflict of Interest

None to be declared for all the authors.

Bibliography

1. Bahar I., *et al*. "Effect of pterygium surgery on corneal topography: a prospective study". *Cornea* 23.2 (2004): 113-117.
2. Kampitak K. "The effect of pterygium on corneal astigmatism". *Journal of the Medical Association of Thailand* 86.1 (2003): 16-23.
3. Liu L., *et al*. "Geographical prevalence and risk factors for pterygium: a systematic review and meta-analysis". *BMJ Open* 3.11 (2013): e003787.
4. Altan-Yaycioglu R., *et al*. "Astigmatic changes following pterygium removal: comparison of 5 different methods". *Indian Journal of Ophthalmology* 61.3 (2013): 104-108.
5. Levinger E., *et al*. "Posterior Corneal Surface Changes After Pterygium Excision Surgery". *Cornea* 39.7 (2020): 823-826.
6. Tomidokoro A., *et al*. "Effects of pterygium on corneal spherical power and astigmatism". *Ophthalmology* 107.8 (2000): 1568-1571.
7. Bahar I., *et al*. "Effect of pterygium surgery on corneal topography: a prospective study". *Cornea* 23.2 (2004): 113-117.
8. Ono T., *et al*. "Long-term changes and effect of pterygium size on corneal topographic irregularity after recurrent pterygium surgery". *Scientific Reports* 10.1 (2020): 8398.
9. Yagmur M., *et al*. "Visual acuity and corneal topographic changes related with pterygium surgery". *Journal of Refractive Surgery* 21.2 (2005): 166-170.
10. Zheleva V and Voynov L. "Comparative study of astigmatic changes following pterygium excision with conjunctival autograft transplantation". *Biotechnology and Biotechnological Equipment* 32.2 (2018): 433-436.
11. Koç M., *et al*. "The Effect of Pterygium and Pterygium Surgery on Corneal Biomechanics". *Seminars in Ophthalmology* 33.4 (2018): 449-453.
12. Seitz B., *et al*. "Impact of pterygium size on corneal topography and visual acuity - a prospective clinical cross-sectional study". *Klinische Monatsblätter für Augenheilkunde* 218.9 (2001): 609-615.

Volume 14 Issue 6 June 2023