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Case Series

Case series about physiological astigmatism and the impact of pterygium surgery

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ABSTRACT

Introduction: Pterygium is a benign conjunctival fibrovascular neoformation progressively encroaching on the cornea, it can cause corneal distortion and induce astigmatism, or aggravate pre-existing physiological astigmatism, which is defined as ≤ 0.50 D and not requiring optical correction. The radical treatment of pterygium is purely surgical, with conjunctivo-limbal grafting and conjunctival autografting emerging as the surgical techniques of choice. The main objective of the study was to investigate whether pterygium surgery does not worsen the preoperative physiological astigmatism.

Material and methods: This is a prospective cohort study conducted in the ophthalmology department of the Mohammed V Military Hospital in Rabat over a period of 12 months, including 43 stage II/III/IV pterygia that were operated on by conjunctival autograft by the same surgeon. First, we looked for an association between pterygium surgery and variations in astigmatism. For quantitative variables we used the Wilcoxon test. In a second step we split the file into two distinct groups according to the value of preoperative astigmatism≤ 0.5 D or >0.5 D in order to detect the impact of pterygium surgery on physiological astigmatism. Statistical analysis of the data was performed by comparing the distribution of these characteristics.

Results: The median astigmatism was 1 D (0.25; 2.50). 35% of our population had preoperative astigmatism ≤0.5 D. The Wilcoxon test showed that there was a statistically significant difference between preoperative and postoperative astigmatism (p = 0.001). The paired sample T-test showed no statistically significant difference between the preoperative and postoperative outcome in the physiological astigmatism population (p = 0.53).

Conclusion: Many studies have shown the benefits of pterygium excision on astigmatism, but few studies have specified the impact of this surgery on physiological astigmatism. Our study showed that pterygium surgery does not alter physiological astigmatism.

1. Introduction

Pterygium is a relatively common benign conjunctival fibrovascular lesion that progressively impinges on the cornea [1]. The term pterygium is derived from the Greek pteros, referring to its triangular butterfly "wing" appearance [2].

It is characterised by a migratory front of altered epithelial cells starting from the limbus, most often the nasal one, and moving towards the center of the cornea. This is accompanied by conjunctival metaplasia with the presence of mucus cells, while the underlying extracellular stromal matrix becomes the site of fibroblastic proliferation and neovascularisation with an influx of inflammatory cells [3].

Pterygium can cause corneal distortion and induce astigmatism [4]. This astigmatism can be caused either by the accumulation of tears in front of the pterygium or by the traction of the pterygium on the cornea, pulling and distorting it, or both [5]. The effect of the pterygium on the refraction of the cornea has been measured by refraction, keratometry and corneal topography [6]. The refraction may show an irregular astigmatism of varying power and axis depending on the direction of gaze.

The clinical presentation is dominated by dry eyes aggravated by surface congruence. Its treatment is initially symptomatic, using

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lubricants and anti-inflammatories; but its radical treatment is purely surgical.

Surgical techniques are diverse, with conjunctivo-limbal grafting and conjunctival autografting appearing as one of the surgical techniques of choice.

2. Material and methods

This is a single-center prospective study conducted at the ophthalmology department of the Mohammed V Military Hospital of Rabat over a 12-month period from January 2019 to February 2020.

The main objective of the study is to see if pterygium surgery does not worsen the preoperative physiological astigmatism. The inclusion criteria were patients with stage 1, 2, 3 and 4 pterygia only. We excluded all patients with recurrent pterygia and also pterygia associated with an inflammatory or infectious condition of the eye, and patients with allergic conjunctivitis during this period. The dependent variable was astigmatism. The main risk factor studied was the impact of pterygium surgery, the independent variables were socio-demographic.

A socio-demographic and clinical data collection form was used to support the work.

First, we explained to the patients the surgical technique and the main complications of the surgery, the treatment and the postoperative follow-up. We obtained the patients consent.

All patients were operated on according to the most popular Tagle technique by the same ophthalmic surgeon with 4 years of experience in our hospital.

The surgical operation is performed after obtaining the agreement of the anaesthetist and the completion of a minimal pre-anaesthetic check-up: electrocardiogram, blood count, ionogram, renal, hepatic, glycemic and coagulation check-up. In our patients these check-ups were without any particularity.

We started the operation by removing the corneal and conjunctival part of the pterygium. In the conjunctival part, we carefully avoided the sheath of the medial rectus muscle in order not to produce secondary fibrosis. We also removed the Tenon's capsule underlying the pterygium to avoid the risk of recurrence.

We proceeded with a selective cauterisation of the resection site and then measured the dimensions of the denuded area in order to harvest a conjunctival self-graft of identical size.

The graft is harvested from the superior-temporal bulbar conjunctiva of the same eye in all patients. We used 2% xylocaine to detach the conjunctiva from Tenon's capsule. With Castro's scissors, we gently isolated the free conjunctival graft without central perforation. The free graft was then placed on top of the cornea, epithelial side against the cornea, before transferring it to the nasal sclera.

We made a careful suture (two episcleral stitches at the internal extremities and two conjunctival stitches) with Vicryl 8/0 absorbable suture.

An eye drop treatment combining antibiotics and anti-inflammatory drugs was given systematically for a period of 15 days. Patients were reviewed at D1, D7, D30, 3 months and 6 months. We took the refraction before the operation and after 6 months postoperatively. We used the same auto refractometer during the study.

For data processing we prepared a data entry mask in SPSS version 20 and the data were entered with this software. The data collection sheets were numbered for verification purposes.

As far as data analysis is concerned, we first looked for an association between pterygium surgery and the value of astigmatism. We also did a statistical analysis of the demographic data by comparing the distribution of these characteristics. The comparison tests used were for categorical variables, the Yates Chi2 test and when the conditions for using Chi2 were not met, the Fisher exact probability calculation. ORs and their 95% confidence intervals were also calculated. For quantitative variables we used the Wilcoxon test.

In a second step we split the file into two distinct groups according to the value of the pre-operative astigmatism and sought to establish the impact of surgery on physiological astigmatism. The graphics were made on Microsoft EXCEL office 2007.

This work has been reported in line with the PROCESS 2020 criteria [7].

3. Results

Our series included 43 patients. The mean age was 45.6 years with a standard deviation of 12.35. The majority of patients were between 40 and 60 years of age. It shows the absence of the class of patients with an age below 20 years (Fig. 1).

The target population of our study is 65% male and 35% female (Fig. 2). All patients in our series had nasal pterygium. 35% of our population had a preoperative astigmatism of 0.5 D or less. The median astigmatism was 1 (0.25; 2.50). (Fig. 3).

Twelve patients had an astigmatism of 0.25 D; two patients had an astigmatism of 0.5 D and only one had an astigmatism of 0 D. The mean age was 43 ± 13.

The mean physiological preoperative astigmatism was 0.25 (Fig. 4). 47% of patients had worsening of their postoperative astigmatism compared to the preoperative astigmatism, 33% had stabilisation of the astigmatism; and 20% had a decrease of the postoperative astigmatism (Fig. 5).

In patients with a preoperative astigmatism of 0.25 D, 41.67% had no change in refraction, 16.66% had a reduction in their preoperative refraction and 41.67% had an increase in refraction.

For patients with 0.5 D refraction; 50% had an improvement in refraction compared to 50% for an increase in refraction (Fig. 6). Five patients had astigmatism beyond 0.5 D and ranged from 0.75 D to 1.75 D (Fig. 7).

Using the paired sample T-test there was no statistically significant difference between the preoperative and postoperative results. ($p = 0{,}53$).

The Wilcoxon test shows us that there is a statistically significant difference between preoperative astigmatism in general and post-operative astigmatism ($p = 0.001$).

By splitting the file into two groups (physiological astigmatism and astigmatism greater than 0.5), and applying the Wilcoxon test, there is a statistical difference between the two groups ($p = 0.01$).

In our series, irritative signs were the most frequent complication found in all patients, which subsided after 15 days postoperatively, followed by recurrence in two patients.

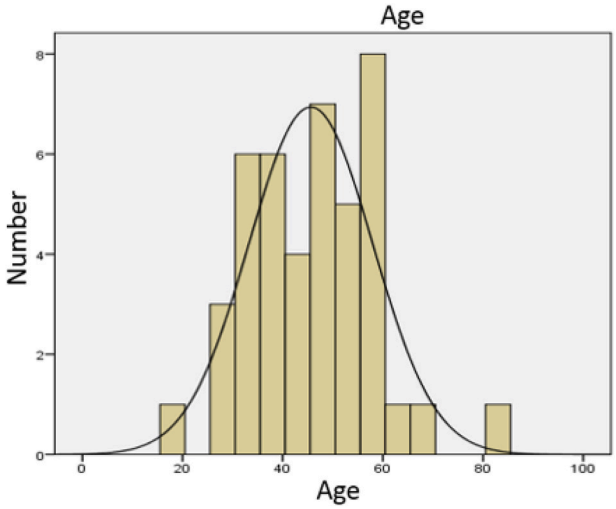

Fig. 1. Age distribution. Mean: 45.6; Standard deviation = 12.358; N = 43.

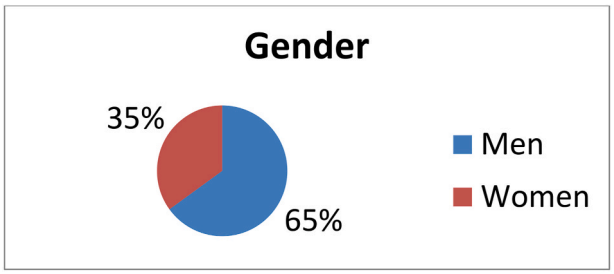

Fig. 2. Gender distribution.

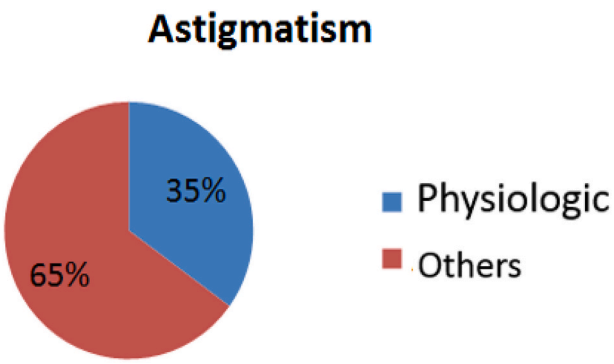

Fig. 3. Distribution according to the degree of astigmatism.

4. Discussion

The main objective was to investigate whether there is a value of preoperative astigmatism for which it is not desirable to perform a surgical cure of the pterygium.

Our study showed that, in the first instance, surgical treatment of pterygium generally improves postoperative astigmatism. Secondly, after dividing the sample into two groups according to the degree of preoperative astigmatism, we found that there was a statistically significant difference between the two groups but after univariate analysis, pterygium surgery was neither a protective nor a risk factor.

This was a study conducted in a center with a large number of patients with pterygium associated with other refractive surgical conditions that may alter preoperative astigmatism. Furthermore, a large number of patients associated with a multitude of surgeons could also have altered the statistical relationships between the degree of postoperative astigmatism and physiological astigmatism. Therefore, extrapolation of the results in general should be relative.

The majority of our patients were over 40 years of age, which is very similar to the results of Moukoury [8]. The average age of our patients was 45.6 years. This predominance of age could be explained on the one hand by the accumulation of UV irradiation in soldiers who had spent more than 10 years in desert areas and on the other hand by the refusal of surgery by certain patients, either because of fear of the risks of surgery, or because of false information about an almost constant recurrence, or when the pterygium is not functionally or aesthetically troublesome. It should be noted that we have not had any cases under the age of 20. The exceptional nature of pterygium before the age of 20 has been reported by most authors.

In our series, the male sex represents about 65% of the operated patients. These results are consistent with the majority of studies, few of which have mentioned a female predominance. However, the male dominance reported in our study is explained by the selection bias in consultation since the military workforce is dominated by men.

Moreover, men are more exposed to UV radiation through their outdoor activities than women. Recent physio-pathogenic data confirm the major role of UV radiation. According to Taylor, UVA and UVB radiation between 2900 and 3200 μm would intervene by denaturing the proteins of Bowman's membrane and the superficial stroma responsible for neo-vascular and fibroblastic proliferation from the limbus. Other risk factors may be added, in particular dust, wind and heat due to

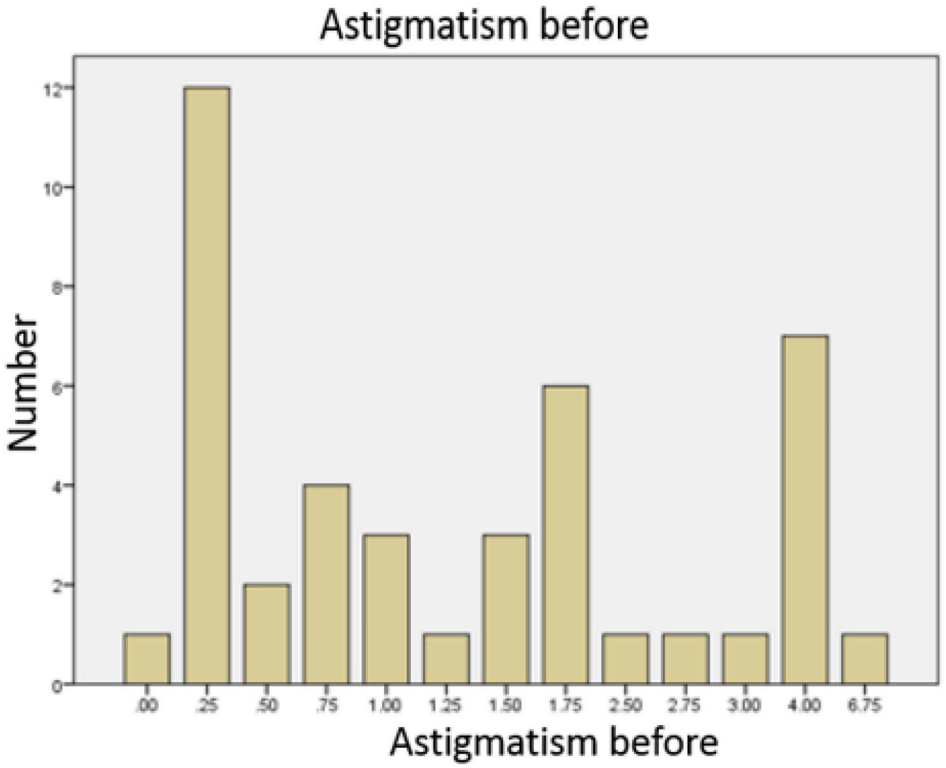

Fig. 4. Distribution according to the number of astigmatisms.

Astigmatism	Aggravation	Improvement	Stabilisation
Number	47%	20%	33%

Fig. 5. The evolution of astigmatism after pterygium surgery.

ASTIGMATISM VALUE	Aggravation	Improvement	Stabilisation
00	100%	0	0
0.25	41.67%	16.66%	41.67%
0.5	50%	50%	0

Fig. 6. Evolution of astigmatism according to its preoperative value.

	Astigmatism ≤ 0.5	Astigmatism ≥ 0.5
0	1	0
0.25	1	4
0.5	0	1

Fig. 7. Distribution of astigmatism.

surface irritation.

According to some authors, bilateral involvement is the rule. In fact, unilaterality is the rule in our series. Most often, it is bilateral and asymmetrical over time.

The literature emphasises the preferential location of the pterygium on the nasal side. The results of our series are in line with this fact since it is nasal in all patients. It is indeed the most exposed to solar radiation due to the absence of protection by the shadow of the nose and the orbital frame and perhaps also due to the focus of UV and IR radiation by the corneal dome at the level of the nasal limbus (Rizzuti's sign), which probably contributes to the actinic degeneration of the limbal stem cells responsible for maintaining the ocular surface.

This can also be explained by the fact that the temporal area is better protected during an external aggression by the blepharospasm it induces and by the cilia, which are more abundant there. In addition, the lacrimal current flowing through the lacrimal points will preferentially carry irritating or toxic particles and microbial flora towards the inner side.

Astigmatism is literally the absence of stigmatism affecting an optical system. It can be regular or irregular. Regular astigmatism corresponds to astigmatism that can be corrected with glasses, whereas irregular astigmatism corresponds to all high-degree optical aberrations that cannot be corrected with glasses. In the case of pterygium, it is rather an irregular astigmatism following the progressive retraction of the body of the pterygium which induces a traction responsible for a deformation of the cornea and consequently an astigmatism. Monitoring of corneal deformation is an excellent way to judge the evolution of a pterygium.

The low incidence of physiological astigmatism in our series is explained by the delay in consultation, which favours an increase in astigmatism by flattening of the cornea due to the slow progression of the pterygium. Moreover, the rejection of surgery by some patients, either for fear of the risks of surgery, or when the pterygium is not functionally or aesthetically disturbing, increases the astigmatism.

5. Conclusion

In our series, the patients were all operated on for a cure of the pterygium associated with a conjunctival autograft. This technique seems to us to have the advantage of restoring the most physiological ocular surface possible by providing limbal stem cells, at the heart of the physiopathology of this pathogenesis.

Pterygium surgery does improve pterygium-induced astigmatism but not to all degrees of preoperative astigmatism.

Ethical approval

Not related.

Sources of funding

Not available.

Author contribution

Corresponding author: YOUSSOUFOU SOULEY ABDOUL SALAM.

OUMAROU SAMBOU KHIDROU FADHLOULLAHI: wrote and reviewed the final paper.

NOUHOU DIORI ADAM: data analysis.

ERIGA LUCRECE JOANELLE: study concept.
AMZA ABDOU: data collection.

Registration of research studies

Not applicable here, this is a study of cases.

Guarantor

Youssoufou Souley Abdoul Salam.

Consent

Written informed consent was obtained from the patients for this publication of this study. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request".

Provenance and peer review

Not commissioned, externally peer-reviewed.

Declaration of competing interest

There Is Not Conflicts Of Interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.amsu.2022.104488.

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