https://doi.org/10.15218/zjms.2018.019

The relation between pterygium size and refractive astigmatism among a group of patients in Erbil city

Received: 30/6/2016 Accepted: 16/1/2017

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Abstract

Background and objective: A pterygium is a triangular fibrovascular subepithelial ingrowth of degenerative bulbar conjunctival tissue over the limbus onto the cornea. Excision is indicated if the pterygium approaches the visual axis, causing loss of vision from irregular astigmatism or in cases of considerable irritation. This study aimed to determine the percentage of astigmatism in patients presented with pterygium and measure the effect of size (width and height) of pterygium on a degree of astigmatism and indication of early surgery.

Methods: A hospital based cross-sectional study using non-probability convenience sampling was conducted in the ophthalmology department of Rizgary and Erbil teaching hospital in Erbil city from June 2015 to February 2016**.** Ninety-six eyes of eighty patients with pterygium were included in this study.

Results: The mean age ± SD of the 80 patients included in the study was 37.5 ± 9.62 years ranging from 22-58 years. There were 45 male and 35 female patients. Two-thirds of eyes (72.6%) had with-the-rule astigmatism while 12.6 % of eyes had against-the-rule astigmatism. A highly significant strong correlation was seen between a fraction of corneal area encroached by pterygium with induced astigmatism (r = 0.727, *P* <0.001). A highly significant strong correlation was found between the area of pterygium and corneal astigmatism in a case of severe pterygium (pterygium encroaching > 4 mm area on the cornea) (r = 0.802, *P* <0.001).

Conclusion: Pterygium size has a significant correlation to the amount of induced astigmatism. The correlation is stronger in the pterygia of severe degree (>4 mm) as in this group they are encroaching on the visual axis.

Keywords: Pterygium; Size; Refractive astigmatism; Erbil.

Introduction

A pterygium is a triangular fibrovascular subepithelial in growth of degenerative bulbar conjunctival tissue over the limbus onto the cornea. It typically develops in patients who have been living in hot climates; it may represent a response to ultraviolet exposure and possibly to other factors such as chronic surface dryness.[1] The histopathology of it shows elastotic degeneration of the stromal collagen with subepithelial fibrovascular tissue.[2] Due to sunlight exposure, pterygium is regarded as a public health problem in rural areas. Independent factors in the incidence of pterygium such as older age, male and the history of outdoor activities indicate the multi-factorial causes of pterygium.[3] The prevalence of pterygia increases steadily with proximity to the equator. Regular and irregular astigmatism occurs in proportion to its size. A pigmented iron line *(Stockerline)* may be seen at the central anterior edge of the pterygium on the cornea when longstanding and stable. Excision is indicated if the pterygium approaches the visual axis, causing loss of vision from irregular astigmatism or in cases of considerable irritation.[2] The type of

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https://doi.org/10.15218/zjms.2018.019

astigmatism that pterygium causes in the majority of cases is with the rule.[4] However, pterygium also causes against the rule and oblique astigmatism.[5] Astigmatism may occur either due to traction generated by the pterygium, pulling on and distorting the corneal curvature, or by tears pooling in advance of the pterygium, or both.[6] There is a strong correlation between the horizontal extent of pterygium encroachment and astigmatic change following surgery.[7] As the size of pterygium increases, the amount of induced astigmatism increases in direct proportion.[8] Astigmatism seen in the patients with pterygium represents both naturally occurring astigmatism and induced astigmatism. It may be incorrect to identify entire astigmatism as induced.[9] Cornea must persist transparent to refract light appropriately. Astigmatism is a condition in which the irregular curvature of the cornea blurs and distorts both distant and near vision.[10]Astigmatism can be measured by keratometry, corneal topography, and refraction.[11] Normally the central 4 mm of the corneal surface is spherical but progressively flattens towards the periphery. Keratometry can measure the average curvature of the central 3 mm along its two principal meridians.[12] The successful pterygium excision surgery reduces the pterygium induced refractive astigmatism and improves the visual acuity either by reducing astigmatism or by removal of the pterygium from the visual axis.[9] Conducting this study is important because it fills the knowledge gap in identifying the relationship between the pterygium size and induced astigmatism changes and to determine whether astigmatism induced by pterygia is an indication for surgery. This study aimed to determine the percentage of astigmatism in patients presented with pterygium and measure the effect of size (width and height) of pterygium on a degree of astigmatism.

Methods

Design of the study: Hospital based prospective cross-sectional study

Setting: The study was conducted in the ophthalmology department of Rizgary and Erbil teaching hospital in Erbil city**.**

Time and duration: The study was conducted in eight months from June 2015 to Feb 2016.

Participants: Ninety-six eyes of eighty patients with pterygium were included in this study.

Exclusion criteria: Eyes with recurrent pterygium, atypical on horizontal/non-nasal pterygia, pseudo pterygia, eyes with astigmatism apart from corneal causes, patients having pterygia but with history of diabetes mellitus, hypertension, corneal diseases, eye trauma or previous intraocular surgery, contact lens wearers, having evidence of current intraocular inflammation on slit-lamp examination were excluded from the study.

Sample size estimation: the sample size was calculated using Epi-info computer program, the rate of patients presented with pterygium is estimated to be 50%, with the desired precision of 10% and 95% confidence level. Accordingly, the estimated sample size was 96.

Sampling method: Non-probability convenience sampling from the out-patient departments

Instruments and equipment

The corneal diameter of each involved eye was measured in millimeters from the limbus to the limbus (horizontal length) by Topcon slit-lamp microscope PS- 66E light beam. A standardized photograph was taken for the patient's affected eye by using Samsung (Galaxy S4) smartphone camera. The pterygium dimensions (Figure 1), including the width, height, and corneal area encroached in millimeter was calculated from the photographs using image J (version 1.48V) software program using a special computer software program. Based on this size, pterygium is classified into three types as:

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Type 1 - Pterygium encroaching < 2 mm area on the cornea, i.e., crossing limbal margin but not reaching the pupillary margin
Type 2 - Pterygium encroaching 2-4 mm area on the cornea, i.e., reaching up to pupillary margin but not crossing it
Type 3 – Pterygium encroaching > 4 mm area on the cornea, i.e., crossing pupillary margin and coming in the visual axis
Corneal astigmatism in diopters and keratometry readings (to exclude astigmatism other than corneal cause) was measured with the help of Topcon Auto refractor/keratometer RM 8800.
Subjective refraction with best corrected visual acuity using (Snellen) chart test was used to estimate the degree of significant astigmatism subjectively.

Questionnaire design

The questionnaire was designed by the researcher through a review of relevant literature. It was reviewed by the supervisor of the research. It consisted of some demographic data, including age, sex, occupation, address, and ethnicity, and the duration of pterygium.

Statistical analysis and data management

The data were entered and analyzed using the statistical package for the social sciences computer program (version 20). Descriptive statistics were used to calculate frequency; means and standard deviation. ANOVA test was used for comparison between the three groups of pterygium size and corneal astigmatism. Pearson correlation coefficient was used to calculate the p values. A *P* value of less than 0.05 was considered significant. Correlation of parameters of pterygium size with induced corneal astigmatism was measured using correlation coefficient test.

Ethical Considerations

The study was approved by the research ethics committee of the college of medicine of Hawler Medical University, and verbal informed consent was taken from each participant before being enrolled in the study.

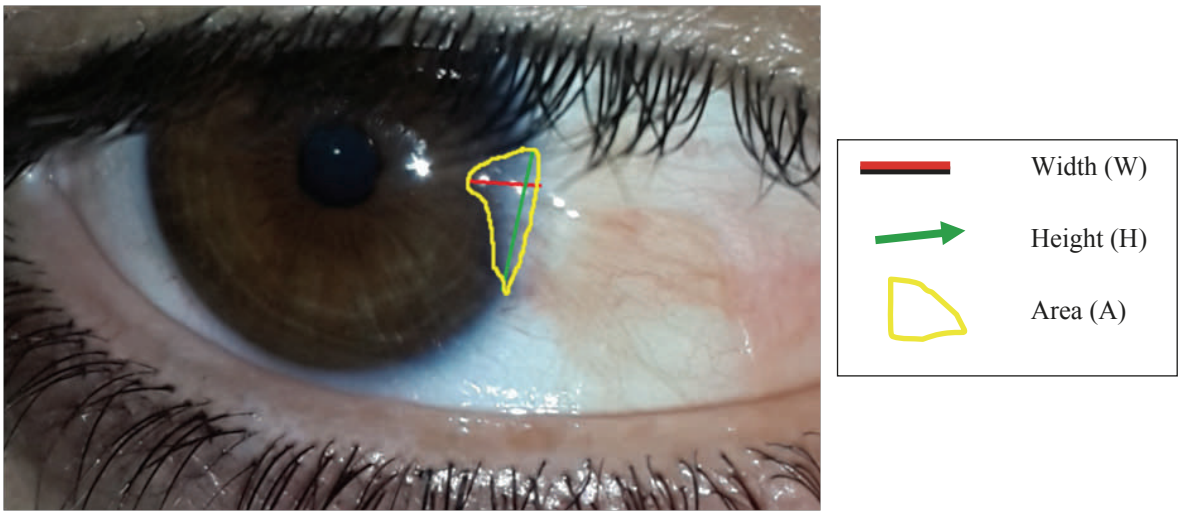

Figure 1: The parameter of pterygium size by Image J Program.

https://doi.org/10.15218/zjms.2018.019

Results

The mean age ± SD of the 80 patients included in the study was 37.5 ± 9.62 years ranging from 22-58 years. There were 45 male (56.25%) and 35 female (43.75%) patients as shown in Table 1. The male: female ratio was 1.28:1. Of 80 examined patients, 16 patients (20.0%) were in the age group of less than 30 years, 32 patients (40 %) in the 30-39 years age group, 17 patients (21.3%) in the 40-49 age group, and only 15 patients (18.8%) were more than 50 years old as shown in Table 1. The mean duration of the pterygium was 5.06 ± 4.8 years, ranging from 1-20years. Table 1 shows that more than half of the sample (44 out of 80) were living in urban settings and about half (58.7%) of the sample had an indoor occupation. Within the outdoor occupation, 13 patients were a casual worker, 11 of them were army forces while only 9 of them were drivers as shown in Table 1. Out of 96 eyes presented with pterygium; 95 of them (98.9%) had corneal astigmatism; of those 95 eyes, two-thirds of sample (72.6%) eyes had vertical steep axis (with-the-rule astigmatism) on keratometry while only 12 (12.6 %) eyes had horizontal steep axis (against-the-rule astigmatism) as shown in Table 2, all pterygia are typical.

Table 1: Distribution of the sample by age groups, Sex, Address and Occupation.

Variables		Frequency	Percent
Age groups	<30	16	20.0
	30 – 39	32	40.0
	40 – 49	17	21.3
	50 - 59	15	18.8
Sex	Female	35	44
	Male	45	56
Address	Urban	44	55
	Rural	36	45
Occupation	Housewife	32	40.0
	Office work	15	18.7
	Casual worker	13	16.3
	Army forces	11	13.8
	Driver	9	11.2
Total		80	100

Table 2: Distribution of sample by type of Astigmatism.

Astigmatism	Frequency	Percent
With the rule Astigmatism	69	72.6
Against the rule Astigmatism	12	12.6
Oblique Astigmatism	14	14.7
Total	95	100

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With increasing size of pterygium, there is an increase in the mean of corneal astigmatism which is shown by keratometry results (Table 3). *P* value indicates that the difference is statistically highly significant (< 0.001). A highly significant strong correlation of corneal astigmatism (flattening of horizontal axis) with dimensions of pterygium (r = 0.553 for height and r = 0.721 for the width of pterygium, *P* <0.001) was noted. Although there was a highly significant correlation between induced astigmatism with the area of pterygium, this was weak in cases of mild and moderate pterygium (< 4 mm). However, a highly significant strong correlation was found between the area of Pterygium and Corneal Astigmatism in case of severe pterygium (pterygium encroaching > 4 mm area on the cornea) (r = 0.802, *P* <0.001) as shown in Table 4.

Table 3: Mean and Standard deviation of corneal astigmatism among different groups of pterygium.

Groups	Number	Corneal astigmatism (Diopters) (mean ± SD)	*P* value
Group 1	26	-0.692 ± 0.544	
Group 2	33	-0.780 ± 0.507	<0.001
Group 3	37	-1.655 ± 1.567	

Table 4: Correlation between Area of Pterygium and Astigmatism.

Groups of Pterygium	Area of Pterygium and Corneal Astigmatism	
	Correlation coefficient	*P* value
Group 1	0.214	0.294
Group 2	0.019	0.917
Group 3	0.802	<0.001

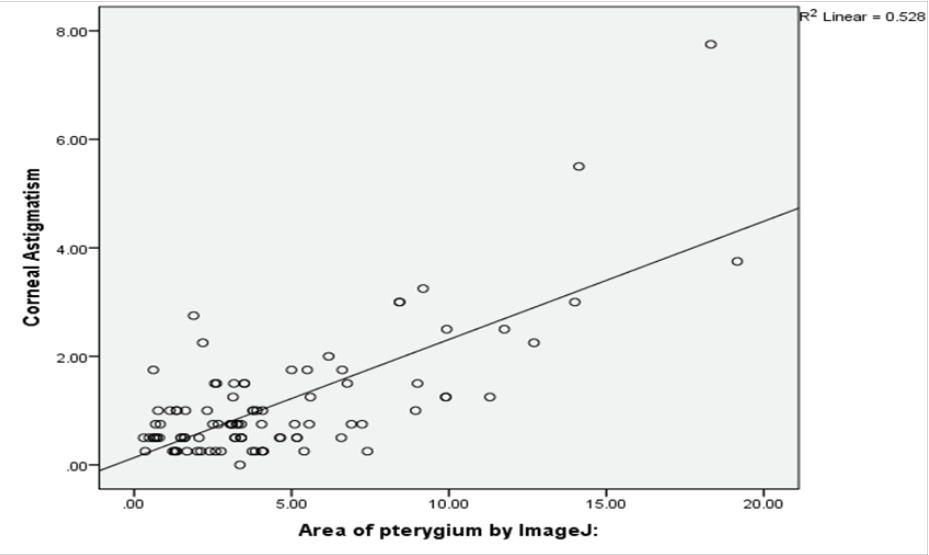

Figure 2: Correlation between induced astigmatism with an area of pterygium.

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Discussion

In this study, the mean age of 80 patients was 37.5 ± 9.62 years; this was close to mean age of a group of patients studied in India [13] in which mean age was 42.58 years ± 11.09. Because those patients having pterygia but with a history of diabetes mellitus and hypertension were excluded in this study, more than 80% of cases were below 50 years of age, this percentage was two folds more than the result of a study done in Iran[14], in which only 37 % of patients were below 50 years. This study shows that 56 % of patients were males and 44% were females, with a male: female ratio of 1.28: 1. This is adjacent to the result of a study done in India[13] which shows that more than half (51.5%) were males (48.5%) were females. Although the incidence of pterygium in rural residents is more than that in urban ones, in this study, we found that 45% of people were living in rural areas and 55 % were urban residents the reason is that there is no clear identification of rural and urban addresses of Erbil governorate. In this study, the percentage of pterygium in the patients based on occupation, outdoor workers (41.3%) and housewives (40%) had the highest percentage of patients suffering from pterygium; and its reason could be due to more exposure to heat and sun rays. In most preceding studies, similar results have been obtained.[14] In this study the duration of the pterygium was ranging from 1-20 years, this result is close to the previous study done in India.[15] Once pterygia reach a critical size, they induce visually significant central with-the-rule astigmatic changes that may not be apparent by subjective refraction.[16] In this study, more than two-thirds of the eyes (72.6%) had with the rule astigmatism; 14% had oblique astigmatism, and 12.6% had against the rule astigmatism, which agrees with the results of studies done in Malaysia[17] and Pakistan,[18] while it is to some extent differ from the results of two studies done in Iraq[19] and India.[13] In this study there is a statistically significant correlation between the area of pterygium and induced corneal astigmatism, this result is in accordance with two other previous studies.[20,21] The width of pterygium on the cornea and its total area have the strongest correlation with the induced astigmatism than the height of the pterygium, this result goes with a study done in Malaysia.[17] In this study, we found a direct relationship between keratometric astigmatism and area of pterygium, with a weak correlation in cases of mild and moderate pterygium (< 4 mm), as the correlation coefficient was 0.214 (P = 0.294) and 0.019 (P = 0.917) in group 1 and 2 respectively. Therefore, the amount of induced keratometric astigmatism in Group 1 and 2 correlated minimally with the area of pterygium. The correlation was strong in severe pterygium (Group 3) with a correlation coefficient of 0.802 (P <0.001). These results were opposed the findings of a study done Pakistan[20] in which the correlation was strongest at the moderately severe pterygium (Group B) with a correlation coefficient of 0.752 (P = 0.01). This difference could be because of using keratometer to measure astigmatism in this study.

Conclusion

Pterygium size has a significant correlation to the amount of induced astigmatism. The correlation is stronger in severe pterygium (> 4 mm) as in this group the pterygium is encroaching on the visual axis. In the future studies, a case-control study must be investigated so that the impact of pterygiumon the type and amount of astigmatism can be declared more confidently. Using corneal topography for analysis of astigmatism and pterygium is required to assess the relation earlier. Early surgery is indicated before reaching grade three (Pterygium encroaching > 4 mm area on the cornea).

Competing interests

The authors declare that they have no competing interests.

https://doi.org/10.15218/zjms.2018.019

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