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Changes in Corneal Astigmatism Following Pterygium Removal

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Abstract: ***Aims:*** *To investigate the effect of different types of pterygium excision surgery on post operative corneal stigmatism.* ***Setting and Design:*** *-Prospective comparative analysis.* ***Materials and Methods:*** *240 eyes were considered for pterygium excision. Following pterygiumexcision, these patients underwent 5 different types of surgeries: Conjunctival autograft with sutures (CAG-s) or fibrin glue (CAG-g), conjunctival rotational flap (CRF), or amniotic membrane transplantation with either suture (AMT-s) or with glue (AMT-g). The preoperative and postoperative keratometric measurements were taken using an automated kerato refractometer.* ***Statistical Analysis:*** *The changes in Best Corrected Visual Acuity and astigmatic degree were evaluated using Wilcoxon signed rank test. The difference in a stigmatic values between groups was calculated using one way analysis of variance (ANOVA).* ***Results:*** *The most commonly performed procedure was CAG-s (N = 115), followed by CAG-g (N = 53), CRF (N = 47), AMT-s (N = 15), and AMT-g (N=10). Following surgery, astigmatic values decreased from 3.47 ± 2.50 D to 1.29 ± 1.07 D (P < 0.001, paired t test). The change in astigmatism was significantly related to the preoperative size of the pterygium (ρ = 3.464, P = 0.005). The postoperative astigmatism correlated with preoperative astigmatism (ρ = 0.351, P < 0.001, Spearman correlation analysis). The changes in astigmatic values were not related to the method of surgery (P=0.055, ANOVA).* ***Conclusion:*** *High corneal astigmatism occurs due to pterygium, which decreases following excision. According to our study, the type of grafting or the use of suture or glue to fixate the graft does not have a significant effect on the change in astigmatism degree.*

Keywords: pterygium excision, postoperative corneal astigmatism, Conjunctival autograft with sutures, fibrin glue, conjunctival rotational flap, amniotic membrane transplantation with either suture or glue

1. Introduction

Pterygium is a fleshy, fibrovascular growth of conjunctival connective tissue over cornea resulting in decrease in visual acuity secondary to astigmatism, blockage of the optical axis and cosmetical unacceptability. It can cause flattening of the corneatotheleadingapex[1].

Several different surgeries are being performed to decrease the high recurrence of bare sclera technique, such as conjunctival autografting and amniotic membrane grafting[2–4]. Recently, fibrin glue has been recommended to secure the graft[5–6].

In our study, the aim was to investigate the effect of the type of surgery on the change in a stigmatism following pterygium excision.

2. Materials and Methods

In this prospective study, the data of 240 eyes that underwent pterygium excision by one surgeon, completed 3 months follow-up and showed no sign of recurrence were investigated. Patients with complaints of decrease in visual acuity, foreign body sensation and hyperemia due to pterygium were taken up for surgery. History of ocular trauma, ocular surgery, and presence of corneal abnormalities such as scarring, degeneration that might affect the astigmatic value were taken as exclusion criteria.

There were127 male and 113 female patients with a mean age of 57.5± 12.1 years (range 27 to 86 years). All the patients underwent comprehensive ophthalmic examination. The preoperative and postoperative best corrected visual acuity (BCVA) and keratometric values were noted. The BCVA values were obtained on a Snellen scale and then converted into logarithm of the minimum angle of resolution (logMar) values.

Preoperative horizontal length of pterygium was measured by focusing the slit on the pterygium and using ruler of the slit incorporated in the slit-lamp from limbus to the advancing edge of pterygium.

Automated kerato refractometer was used to obtain keratometric values.

Pterygium excision was performed as follows: Lidocaine HCL 40 mg/2ml + epinephrine 0.025 mg/ml was injected under the conjunctiva into the body of the pterygium. Following removal of the body, the head was lifted of the cornea. The abnormal scar tissue on the cornea was removed. A moderate amount of Tenon's capsule was removed from each patient.

Following removal of the pterygium, patients underwent 5 different types of surgeries: Conjunctival autograft with sutures (CAG-s) or fibrin glue (CAG-g), conjunctival rotational flap (CRF), or amniotic membrane transplantation with either suture (AMT-s) or with glue (AMT-g).

In conjunctival autografting, an oversized graft for 1 mm of length and width relative to the scleral bed was harvested from the superotemporal limbus. A Tenon-free graft was obtained which was subsequently moved to the nasal area. In CAG-s group, interrupted Vicryl 8-0 sutures were used to attach the graft. In the CAG-g group, fibrin glue was used to attach to the conjunctival edges and episclera. For CRF, a Tenon-free flaporiginating from the inferior bulbar conjunctiva with a hinge at the inferonasal border of the bare sclera was prepared and rotated to cover the bare sclera with interrupted8/0 Vicryl sutures.

For AMT, the membrane was taken out of the preservation medium and cut to the proper size to cover the defect area[7].

The membrane was spread over the denuded area so that the epithelial/basement membrane surface would be on top, and it was sutured to the surrounding conjunctiva and episclera by using interrupted 8-0 Vicryl sutures in AMT-s group. On the other hand, in the AMT-g group, fibrin glue was used to attach the amniotic membrane[8]. The eye was covered with an eye pad after administration of topical antibiotic ointment (moxifloxacin). Following surgery, topical antibiotic (moxifloxacin 0.3%, 4 times a day) and steroid (dexamethasone 0.1%, 4 times a day) drops were given, and were taperedover1 month period. Sutures were removed at2 weeks.

The overall changes in BCVA and astigmatic degree were evaluated using Wilcoxon signed rank test. The difference in astigmatic values between groups was calculated using one way analysis of variance (ANOVA). Difference with significance of < 0.05 was accepted as statistically significant.

3. Results

The most commonly performed procedure was CAG-s (N = 115) followed by CAG-g (N = 53), CRF (N = 47), AMT-s (N = 15), and AMT-g (N = 10). The horizontal length of the pterygium changed between2 and 7mm (mean ±SD3.78±1.11mm).

The mean preoperative logMar values were 0.37 ± 0.64 (range 0.00-3.00). Following surgery, the logMar values decreased to 0.12 ± 0.24 (range 0.00 to 2.00). This postoperative decrease was significant (P <0.001, Wilcoxon signed rank test).

Preoperatively, the mean astigmatic value was 3.47 ± 2.50 D (range 0.00D-12.50D). After surgery, the mean astigmaticvaluesdecreasedto1.29 ± 1.07 D (range 0.00 D-5.50 D). The mean difference between pre-and post operative astigmatic values was 2.18 ± 2.34 D, and this decrease was statistically significant (P<0.001, pairedt test).

The distribution of pterygium sizes according to the surgery groups is shown in Fig.1. The mean ± SD pterygium size according to the surgery type was as followed: 3.83 ± 1.16 mm in CAG-s, 3.72 ± 1.21 mm in CAG-g, 3.74±1.07 mm in CRF, 3.60±0.63 mm in AMT-s, and4.00± 0.81 mm in AMT-g, and there was no difference between groups for pterygium sizes (P>0.05).

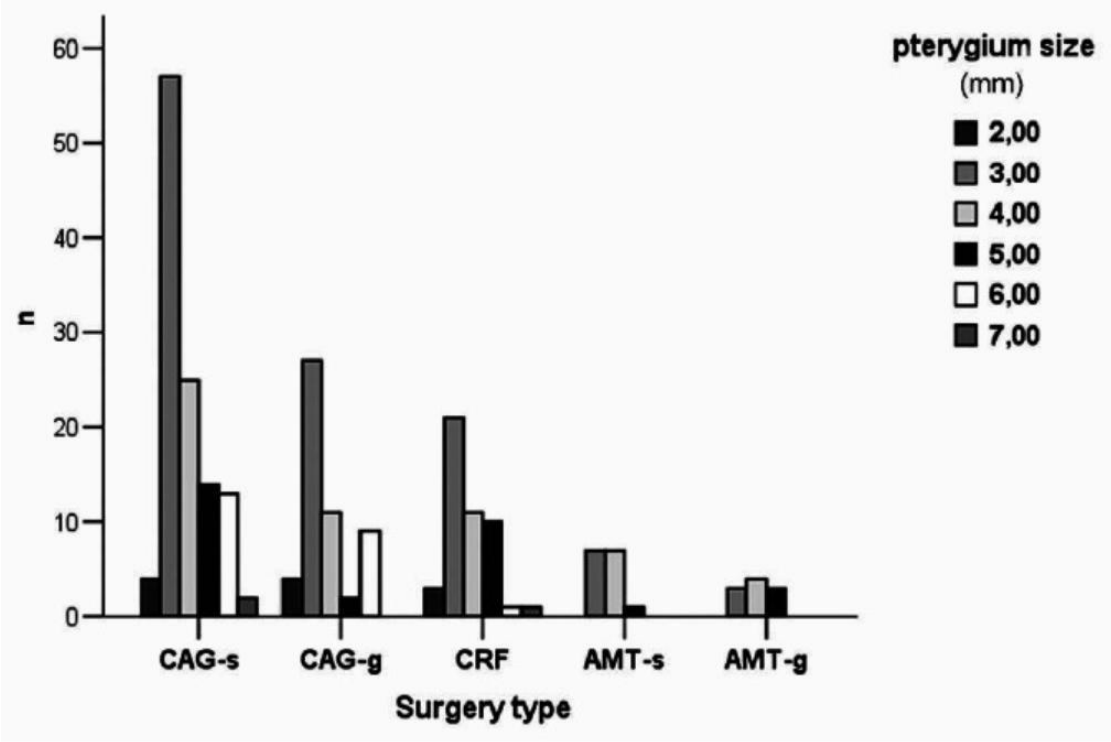

Figure 1: Simple bar chart showing the distribution of pterygium sizes according to the surgery type performed. (N:-Number of patients; CAG-s:-Conjunctival autografting with sutures; CAG-g:-Conjunctival autografting with fibrin glue; CRF:-Conjunctival rotational flap; AMT-s:-Amniotic membrane transplantation with sutures; AMT-g:-Amniotic membrane transplantation with fibrin glue.)

The changes in astigmatism values according to the pterygium size are shown in Fig.2. The astigmatic changes were significantly different according to the preoperative size of the pterygium (F=3.464, P=0.005, *One way ANOVA*). The Post Hoc test revealed that this difference was mainly due to differences between the pterygium with sizes of 2 mm, 5 mm as well as 6 mm (P = 0.009 and P = 0.017, *Tukey HSD*). There was a positive correlation between the preoperative size of the pterygium and the change in astigmatism degree (ρ = 0.224, P < 0.001, *Spearman correlation analysis*). Also, the change in astigmatism was significantly correlated with preoperative astigmatic values (ρ=0.780, P< 0.001, *Spearman correlation analysis*).

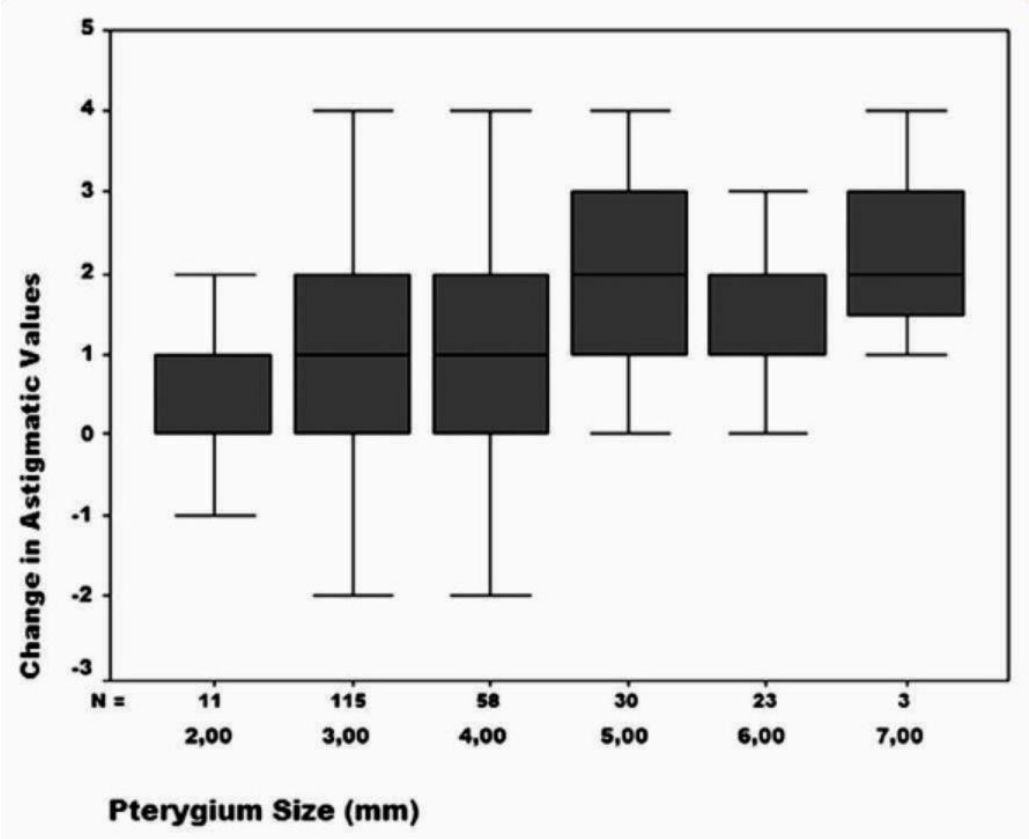

Figure2:-Whisker plot showing changes in astigmatic values (D-dioptre) in accordance with the horizontal size of the pterygium. (N:-Number of patients)

The postoperative astigmatism correlated positively with preoperative astigmatism ($\rho = 0.351$, $P < 0.001$, Spearman correlation analysis). On the other hand, the postoperative astigmatic values were negatively correlated with the change in astigmatism ($\rho = -0.262$, $P < 0.001$, Spearman correlation analysis).

The changes in astigmatic values were not related to the method of surgery ($P = 0.055$, ANOVA) (Figure 3). The correlation between the surgery type and change in a stigmatism was not statistically significant ($\rho = -0.116$, $P = 0.072$, Spearman correlation analysis).

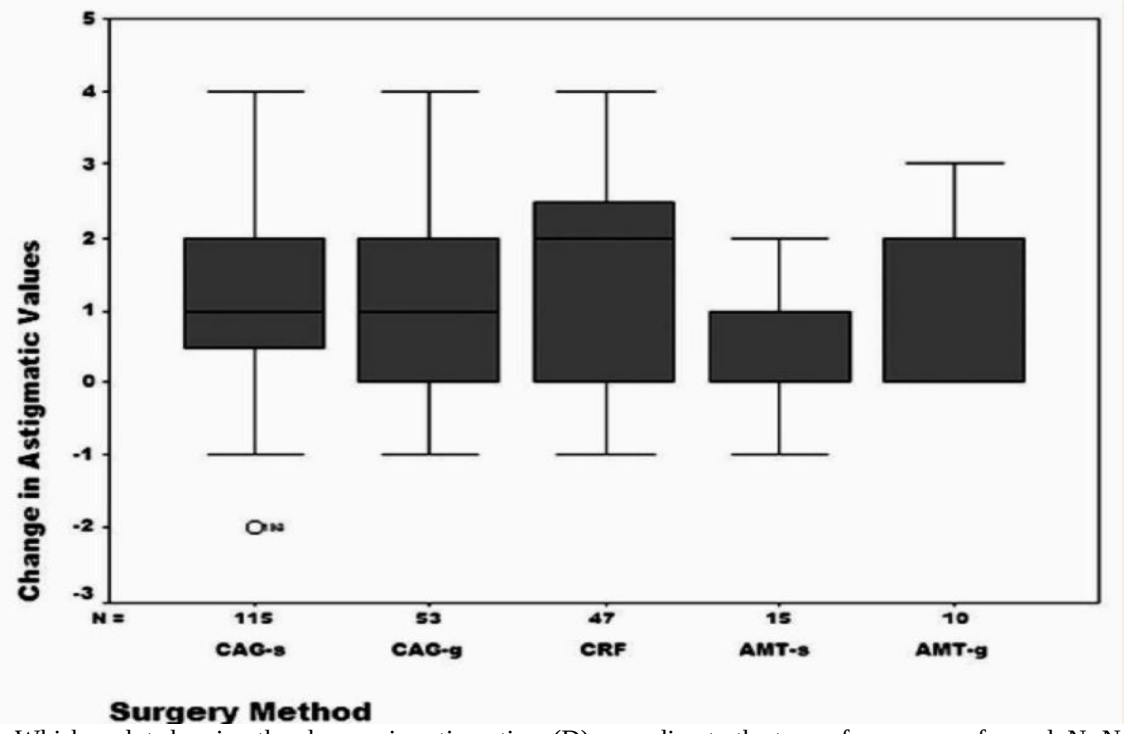

Figure 3: Whisker plot showing the changes in astigmatism (D) according to the type of surgery performed. N=Number of patients

4. Discussion

Pterygium can cause flattening of the cornea to the leading apex[1]. An induced astigmatism was explained by several mechanisms: Pooling of the tear film at the leading edge of the pterygium, and mechanical traction exerted by the pterygium on the cornea[9].

In present study, we found that the degree of astigmatism decreased significantly following excision, and this decrease was related to the size of the pterygium[10]. The size was affecting the change in astigmatism as well as postoperative degree of astigmatism. We also found that the change in astigmatic degree was positively correlated with the change invisual acuity. On the other hand, the type of grafting as CAG, CRF or AMT or the use of suture or glue to fixate the graft does not have a significant effect on the change in astigmatism degree.

The refractive components were demonstrated to stabilize at 1 month following pterygium excision[10]. But in present study, we included the 3rd month post operative results to make sure that refraction was stabilized.

An increase in visual acuity is expected following pterygium excision[11–12]. It was reported that BCVA increased from 0.53 to 0.68[9]. Accordingly, we observed a decrease in log Mar values from 0.38 to 0.13. In a similar study, the logMAR values decreased significantly from 0.41 to 0.24 in 27eyes[13] (P=0.000).

Lin and Stern found a significant correlation between the size of pterygium and corneal astigmatism[1]. It was also suggested that pterygium extending more than 45% of corneal diameter results in increasing degrees of astigmatism[14]. Mohammad-Salih and co-workers studied the pterygium extension, width, and total area and investigated their relationship with corneal astigmatism. Among the 3, an extension had the strongest and the most significant correlation with the astigmatism[17] (ρ =0.462, P<0.001, *Pearson correlation analysis*). The authors reported that pterygium with larger than 2.2 mm extension might contribute to corneal astigmatism>2 D.

Kampitak concluded that the amount of induced corneal astigmatism and timing for pterygium excision are related to the pterygium size, and reported that 2.25 mm pterygium resulted in astigmatism of 2 D, and should be considered in the limits of surgery[16]. Accordingly, Seitz *et al*. concluded that with the size of pterygium from 2.5 mm, the preoperative astigmatism increases, therefore, the authors believed that the surgery should be performed before it reaches beyond this point[17]. In present study, we compared the size of the pterygium with the change in astigmatism and found a significant correlation (P <0.001).

In a prospective study, the video keratographic changes of 55 eyes were evaluated and found that pterygium surgery significantly reduced refractive astigmatism from 3.12 to 2.51 (P = 0.05) [10–13]. We also found that corneal astigmatism decreased from 3.47 D to 1.29 D. The mean difference in corneal astigmatism change was 2.18 ± 2.34 D, and this decrease was statistically significant (P < 0.001). Surgical removal of pterygium can improve the changes; however, in eyes with advanced pterygium, corneal distortion does not normalize completely and irregular changes may persist if the lesion has reached the paracentral cornea[18].

Some other factors, like changes in corneal stroma and Bowman's layer, are suggested to be responsible for these persistent refractive changes ineyesafterpterygiumsurgery[19].

We found a significant correlation between the pre-and postoperative astigmatic values (ρ = 0.351, P < 0.001). Contrary to our results, some studies show no correlation between these 2 parameters[11]. This contradiction might be related to the larger number of patients included, and the larger horizontal pterygium sizes in present study. Similar to our results, Wu et al. found a significant correlation between the differences in refractive cylindrical power before and after surgery[13].

Frau and co-workers noticed that following surgery, corneal astigmatism exceeded more than 3 D in 7 patients and did not change dramatically in the rest of their 109 eyes with corneo-conjunctival autografting[20].

Yilmaz *et al*. compared the astigmatic changes following different types of surgeries including conjunctival autografting, limbal-conjunctival autograft, bare sclera and bare sclera with mitomycin[21]. The authors found a statistical difference between groups for mean topographical astigmatism and surgically-induced astigmatism (P = 0.033 and 0.030, respectively). In that study, the mean difference was between the baresclera and graft techniques where postoperative astigmatism was smaller in the former. In present study, we found no difference in post operative astigmatic changes between different surgical techniques.

In conclusion, pterygium results in high corneal astigmatism, which increases with the increase in horizontal length, and decreases to an acceptable level following excision. We found a significant correlation between the preoperative and postoperative astigmatic values as well as the changes in astigmatism with surgery. According to our study, the type of grafting as CAG, CRF or AMT or the use of suture or glue to fixate the graft does not have a significant effect on the change in astigmatism degree.

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