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CORNEAL REFRACTIVE CHANGES AFTER PTERYGIUM SURGERIES WITH DIFFERENT TECHNIQUES : A COMPARATIVE STUDY

Ophthalmology

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ABSTRACT

Aims and objectives: To evaluate refractive changes of the anterior and posterior corneal surfaces as well as best corrected visual acuity (BCVA) after different techniques of pterygium surgery using Pentacam and autorefractometer, as well as estimating the needed postoperative time for stability of the corneal refractive changes. Material and methods: prospective, interventional, randomized, comparative study has been conducted on 60 eyes of 60 patients, ages were between 34 and 56 years, divided randomly into 3 groups; group A included20 patients that were treated with pterygium excision with bare sclera technique plus MMC application for 3 minutes at site of excision.Group B: 20 patients that were treated with pterygium excision with conjunctivalautograft. Group C: 20 patients that were treated with pterygium excision with limbal/conjunctival auto graft. Postoperative assessment includedrefraction and pentacam on visits at 1, 3, and 6 months after surgery.

Results: In all groups, BCVA changes 6 months postoperatively, were statistically significant, while Spherical, and Cylindrical error changes were statistically insignificant. Average K and corneal thickness changes were statistically insignificant, while anterior corneal astigmatism changes were statistically insignificant in group A, and significant in groups B and C.

Conclusion: As pterygium causes reversible impairment of visual acuity either by mechanically-induced astigmatism or by encroachment on pupillary area obscuringvisualaxis,so,pterygium surgery can be considered as a refractive surgery. The mean postoperative refractive changes are nearly similar in all groups as regard BCVA, spherical power and keratometric astigmatism of the cornea. These changes were obtained during the first 3 months postoperative period.

KEYWORDS

pterygium, corneal astigmatism, keratometric power, limbal graft, dry eye, tear film

INTRODUCTION

Pterygium is an elevated, superficial, external ocular fibro vascular connective tissue overgrowth of bulbar conjunctiva mass and extends onto corneal surface.Pterygia can vary from a small atrophic quiescent lesion to a large aggressive, rapidly growing fibro vascular lesion that can distort the corneal topography, and in advanced cases they can obscure the optical center of the cornea. Pterygium is a very common degenerative condition seen in many countries. The main indications for pterygium surgery are visual impairment due to either astigmatism or direct invasion of the visual axis. Pterygium typically develops in patients who live in hot climates and may represent a response to chronic dryness and ultraviolet rays. Pterygium can cause complications including chronic irritation, decreased vision and disruption of pre corneal tears film.

Multiple different procedures have been advocated in treatment of pterygia. These procedures range from simple excision to sliding flap of conjunctiva with or without adjunctive external beta radiation therapy or use of external agent such as Mitomycin C. Several mechanisms have been suggested to explain the induced astigmatism by pterygium. The first mechanism includes pooling of the tear film at the leading edge of pterygium as the head of pterygium approach the apex of cornea a tear meniscus develops between the corneal apex and elevated pterygium causing an apparent flattening of normal corneal curvature. The second mechanism includes mechanical traction exerted by pterygium on the cornea**.** Successful pterygium surgery reduces pterygium induced refractive astigmatism and improves the visual acuity**.** With pentacam(CSO, Italy) topographic analysis of corneal front and back surface is based on the true evaluation measurement from one side of the cornea to other “limbus to limbus”. Pterygium was also graded depending on the extent of corneal involvement, Grade I-crossing the limbus, between limbus and a point midway between limbus and pupillary margin, Grade II-head of the pterygium present at a point midway between limbus and pupillary margin (nasal pupillary margin in case of nasal pterygium and temporal margin in case of temporal pterygium), Grade III-reaching up to pupillary margin and Grade IV-crossing pupillary margin. Progressive pterygia can lead to complications, such as astigmatism and increased higher order aberrations. These aberrations are decreased significantly at 2 weeks after surgery and remain relatively stable, yet they remain at levels higher than in normal eyes because of scarred Bowman's layer and superficial stroma**.** While in small G I pterygium, the reduction in astigmatism and aberrations 3 weeks after excision is very significant and very near to normal. The maximum number of patients of pterygium are seen in the age group of 20-60 years and there is no difference in male/female ratio. It's also thought that the size of pterygium depends on the duration of working hours in outfield. The pooled prevalence of pterygium was relatively high, especially for low latitude regions and the elderly. There were many modifiable risk factors associated with pterygium to which healthcare providers should pay more attention. Uneventful pterygium excision with conjunctivalautograft plus corneal polishing can significantly reduce most of the pterygium-induced higher-order aberrations. Moreover, the reduced postoperative aberrations continue to change beyond the early postoperative period even into the 1-year postoperative period. Therefore, any refractive procedures should be postponed at least 1 year after the pterygium surgery until corneal stability occurs.

MATERIALAND METHODS

Total sixty eyes of 60 patients with primary nasal pterygium were from those who attended the out-patient Department of Ophthalmology, SKMCH Muzaffarpur in the period between March 2019 to February 2020. Their ages were between 34 and 56 years old, they were divided into 3 groups;Group A: 20 patients treated with pterygium excision with bare sclera technique plus MitomycinC (MMC) application for 3 minutes at site of excision.Group B: 20 patients treated with pterygium excision with auto-conjunctivalgraft.Group C: 20 patients treated with pterygium excision with auto- limbal/conjunctival graft. Inclusion criteria included Patients with primary nasal pterygium. Exclusion criteria included Patients with any other ocular pathology, recurrent pterygium, Pseudo-pterygium, previous refractive or intraocular surgery.

All patients underwent pre-operative full ocular examination including slit lamp examination to determine grading of pterygium and anterior segment abnormalities, examination of extra-ocular muscle motility, visual acuity (un-aided and best corrected visual acuity (BCVA)using spectacles), refraction using auto-refractometer and cycloplegic refraction to accurately detect sphero-cylindrical errors, and corneal topography to detect corneal thickness and curvature before surgery using pentacam. Surgical procedureswere done with sub-conjunctival infiltration anaesthesia.Pterygium excision with bare sclera and MMC in group A, with auto conjunctival graft taken from the superior fornix conjunctiva of the same eye and fixed to conjunctiva surrounding this bare area with four corner superficial

(conjunctiva to conjunctiva) stiches using 8/0 virgin silk sutures in group B, while in group C, it was covered with auto limbal/ conjunctival graft taken from super otemporalli mbalconj unctival section of the same eye, including a very thin (40-50 microns) limbal and clear corneal graft (1 mm beyond limbus)using crescent knife dissector, the corneal/limbal part of the graft was fixed to limbus with circumferential 8/0 virgin silk sutures, and conjunctival part was fixed to neighboring conjunctiva as in group B.

Postoperativefollow up includes examination 1 week after surgery for assessment of grafts, signs of inflammation or necrosis of cornea or sclera, observing residualcorneal scarring, assessment of corneal re-epithelialization, and autorefraction. Then 1 month after surgery for removal of any remaining sutures, auto refraction and assessment of unaided and BCVA, slit lamp examination, and pentacamassessment to detect topographic changes of anterior and posterior surfaces of cornea after pterygiumexcision.Then 3 months after, and last visit 6 months after surgery, at both of them, delayed corneal refractive changes were assessed using both autorefractometer and pentacam, as well as visual acuity assessment using unaided and BCVA. All collected questionnaires were revised for completeness and consistency. Pre-coded data was entered on the computer using "Microsoft Office Excel Software" program (2010) for windows. The entered data then was transferred into the Statistical Package of Social Science Software program, version 21 (SPSS) to be analyzed statistically Data then was summarized using range, mean with standard deviation and Median for quantitative variables and frequency and percentage for qualitative ones. Comparison between the all groups was achieved using independent sample t-test or Mann Whitney test for quantitative variables and Chi square for qualitative comparisons. Graphs are used to illustrate information. ProbabilityP-value <0.05 was considered significant. (Sig) – P-value 0.01 was considered as highly significant. (HS) – P-value >0.05 was considered non-significant (NS).

RESULTS

In group A: This group consisted of 20 patients 16 males and 4 females with age ranging from 34 to 54 years, the pterygium was nasal in all cases 9 right and11left.

In group B:there were 20 patients; 13 males and 7 females with ages ranging from 34 to 48 years. The pterygium was nasal in all cases 16 right and 4 left.

In group C: there were 20 patients; 8 males and 12 females, with ages ranging from 36 to 56 years, the pterygium was nasal in all cases 13 right and 7 left.

Table (1): comparison of the 3 groups as regard BCVA, Spherical error and cylindrical error

	Group A			Group B			Group C		
	Pre operative	6 months postoperative	P value	Pre operative	6 months postoperative	P value	Pre operative	6 months postoperative	P value
BCVA Range Mean (+/-SD)	(0.5-08) 0.44±0.13	(0.8-1.0) 0.84±0.21	P=0.008	(0.3-0.7) 0.48±0.10	(0.7-1.0) 0.82±0.248	P=0.01	(0.2-07)	(0.8-1.0) 0.76±0.21	P=0.003
Sphere Range Mean (+/-SD)	-0.25 to +400 2.2±1.7r	+0.25 to +1.75 0.8±0.59	P=0.1	+0.75 to +4.00 1.95±1.40	+0.00 to +1.50 0.7+0.570	P=0.06	+075 to +3.75 2.125±1.73	0.75 to +1.75 1.2±0.41	P=0.235
Cylinder Range Mean (+/-SD)	-0.75 to -6.00 2.3±1.7	-0.25 to -2.25 0.85±0.80	P=0.1	-1.00 to -9.00 3.85±3.219	-0.50 to -2.75 1.4+1.039	P=0.08	-2.25 to -9.00 4.50±3.08	-1.00 to -2.75 2.2±1.19	P=0.042

In all groups, after 6 months postoperatively,BCVA changes were statistically significant, while Spherical, and Cylindrical error changes were statistically insignificant.

Table (2)comparison between the 3 groups as regard average keratometric power of the cornea, anterior astigmatism and corneal thickness

	Group A			Group B			Group C		
	Pre operative	1st month postoperative	P value	Pre operative	1st month postoperative	P value	Pre operative	1st month postoperative	P value
Average K Range Mean (+/-SD)	40.94-43.91 42.6±1.33	42.62-45.00 43.77±0.95	P=0.1496	40.67-46.65 43.72±2.50	43.08-47.56 45.11±1.65	P=0.3322	40.25-48.09 44.85±2.87	40.67-45.93 43.92±2.30	P=0.5869
Average Astigm Range Mean (+/-SD)	-0.54—6.00 2.59±2.18	-0.48–3.24 1.29±1.11	P=0.2721	-1.03-9.595.018±3.35	-0.48 -2.35 1.116±0.722	P=0.0335	-0.54-13.75 5.902±5.60	-0.85--5.14 2.19±1.77	P=0.0195
Thickness Range Mean (+/-SD)	488-571 526.8±35.08	492 -561 516±26.81	P=0.6194	458 - 577531.4±46.30	457 -573 518±44.16	P=0.8915	510 - 612552±37.21	505-560541.6±21.39	P=0.5960

In all groups, after 6 months postoperatively,Average K and corneal thickness changes were statistically insignificant, while anterior corneal astigmatism changes were statistically insignificant in group A, and significant in groups B and C, as shown in table 2,(figures 2 to 7). All included cases in this study were straight forward in surgical procedures and their follow up, while cases with any complications that could alter the corneal surface regularity were excluded from this study, this happened with 2 cases; one from group A, complicated with dellen formation due to excessive corneal dissection, the second case was from group B, complicated with recurrence of pterygium.

DISCUSSION

Pterygium causes impairment of vision either by mechanical traction on the cornea or mechanical interference with regularity of ocular surface as well as its tear film, or by direct invasion of the visual axis. As the head of pterygium approach the apex of the cornea, a tear meniscus develops between the corneal apex and elevated pterygium, causing apparent flattening of normal corneal curvature. Yasar et alpostulated that the pooling of tears at the pterygium apex plays an important role in corneal topographic changes.Besides, sub epithelial fibrosis beneath the head of the pterygium can cause localized flattening by a direct traction effect on the underlying stroma. The role of pooling of tears was supported in this study by significant postoperative changes in BCVA despite insignificant changes in Postoperative anterior corneal astigmatism and total refraction, whatever the technique of the pterygium surgery.

In the present study, the right eye was affected in 53.3% and the left eye was affected in 46.6 % which is different than reports of Seitz et al, who found that the left eye was affected in 62%of the patients while the right eye was affected in 38% and Yagmur et al, who found that the left eye was affected in 55% of the patients while the right eye was affected in 45%.And agree withCinal et al, who found that the left eye was affected in 33% of the patients while the right eye was affected in 67%. In the present study, the results after 6 months postoperatively were correction in the BCVA from (0.6-0.8) with mean of ±SD 0.44±0.13 to(0.8-1.0) with mean of ±SD 0.84±0.21, which is statistically significantand agree with Errais K et al, and Oltulu R et al,who found that BCVA was evaluated on 20 eyes with pterygium before and 3 months after successful excision and limbo-conjunctivalautograft surgery, BCVA was 0.73+/-0.20 preoperatively and 0.89+/-0.16 postoperatively. While Maheshwari, and Pavilack and Halpern, examined 85 eyes with primary pterygium after pterygium excision by limbalconjunctivalautograft technique and found that BCVA

improved from 0.4 preoperatively to 0.9 postoperatively in 24% of the patients. In this study, the mean changes of spherical error were from 2.2±1.7 SDpreoperatively, to 0.8±0.59 SD postoperatively.Also that of cylindrical error were from 2.3±1.7 SD preoperatively, to 0.85±0.80 SDpostoperatively, and both were statistically insignificant. The mean (average) keratometric power of the cornea changed from 42.6±1.33 SD to 43.77±0.95 SD, which was statistically insignificant. This agrees with Oltulu R et al, 21 eyes of 21 patients with primary pterygium before and 2 months after pterygium excision using conjunctiv alautograft technique,The mean refractive power was 42.59 ± 3.44 D preoperatively and 43.72 ± 2.07 D postoperatively.

Also, it agrees with Cinal et al, who examined 27 eyes with primary pterygiumunderwent pterygium surgery with using mitomycin C and found improvement in the spherical power of the cornea from 42.26±0.63D preoperatively to 43.69±0.88D postoperatively, (statistically insignificant). This disagreed with Errais K et al, and Errais K et al who evaluated 20 eyes with pterygium before and 3 months after successful excision and limbo-conjunctivalautograft surgery, Corneal spherical power was 41.65+/-3.29 D (mean +/- SD) preoperatively and 44.58+/-1.55 D postoperatively. But this agreedBahar I et al,54 patients (55 eyes) with primary pterygium before and after pterygium excision with graft as well as using intraoperative mitomycin C. BCVA was 0.5 preoperatively and 0.9 postoperatively. In present study, the refractive changes almost equal in the 3 methods as regard BCVA, spherical power of the cornea and keratometric astigmatism of the cornea. but the recurrence rate was high in bare sclera method so we should exclude it in our surgeries, while the recurrence rate was low in mitomycin C group but it carries many serious complications reported in many studies, such as secondary glaucoma,uveitis, scleromalacia and poor epithelial healing, so, it is also not safe method. also Cheng., et al,compared mitomycin C with graft and reported recurrence rate 15.9% with MMC and 1.9% with graft method. Statistically significant changes occured after surgeryas regard BCVA, astigmatism of the anterior corneal surface.It was noted that improvement of BCVA was greater than expected from changes in spherical and cylindrical errors. There was no significant change in corneal thickness but the cornea become steeper after surgery.So, from these results, it could be clearthat pterygium causes refractive changes on the anterior corneal surface causingreversible impairment of visual acuity either by mechanically-induced astigmatism or by encroachment on pupillary area obscuring visual axis. Pterygium surgery can be considered as a refractive surgery. The refractive state of the eye is better to be deferred for at least one month after pterygium excision to ensure valuable correction, and it continues to improve through the 1st 6 months after surgery.

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