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Comparison of Outcome of Corneal Astigmatism following Pterygium Excision Using Different Techniques

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ABSTRACT

Background: Pterygium significantly affects visual acuity owing to induced astigmatism and direct involvement of the visual axis. Astigmatism is mainly due to the pooling of the tear film and mechanical pull exerted by the pterygium on the cornea.

Methods: 75 cases with grade 2 primary nasal pterygium were preoperatively evaluated for visual acuity, autorefraction, and keratometry to evaluate astigmatism. The patients then underwent pterygium excision using different techniques: sutureless conjunctival autografting, conjunctival autografting with glue, conjunctival autografting with suture, and the bare sclera technique. Post-operatively, the patients were followed up on days 7, 1, and 6 months. Autorefraction and keratometry were performed again to evaluate postoperative changes in corneal astigmatism. ANOVA test was used to compare the variables and a probability level of 0.05 was considered statistically significant.

Results: The mean age of the participants was 41.3±5.4 years. The pre-operative means visual acuity of 0.89±0.56 significantly reduced to 0.32±0.12 ($p<0.05$) 6 months after surgery. 6 months after surgery the corneal astigmatism reduced from 1.81±0.61 D to 0.43±0.27 D, ($p<0.05$). Sutureless conjunctival autograft, conjunctival autograft with glue, and conjunctival autograft with suture group exhibited a decrease in astigmatism to 0.43±0.27 D, 0.63±0.30 D, and 0.59±0.39 D, respectively. The bare sclera technique did not show a significant decrease in astigmatism.

Conclusion: Pterygium excision decreases corneal astigmatism, and sutureless conjunctival autografting is a better technique for surface reconstruction than conjunctival autografting with glue or suture.

Key-words: Astigmatism, Autografting, Bare sclera, Pterygium, Visual acuity

INTRODUCTION

Pterygium is a degenerative condition of the subconjunctival tissue of the eye characterized by fibrovascular wing-shaped granulation tissue that subsequently infiltrates the cornea [1]. It destroys the Bowman's membrane and superficial layer of stroma [2].

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The prevalence of pterygium in India is around 14% [3]. The underlying etiology mainly lies in limbal stem cell disturbance due to increased exposure to UV light, which also explains the increased prevalence in hot, dry climates and people residing in equatorial regions [4,5]. Recently, the activation of matrix metalloproteinase by UV rays has also been studied as a trigger for pterygium occurrence [6].

Pterygium is mostly asymptomatic but can cause refractive changes and a decrease in visual acuity due to astigmatism, progressive encroachment over the pupillary axis, and restriction of the medial rectus muscle [7]. The various theories that explain irregular-induced

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astigmatism are the pooling of tear film, involvement of the visual axis, and mechanical traction on the cornea, leading to its flattening [8,9]. Studies have reported a decrease in induced astigmatism after pterygium excision [10].

In this study, we compared pre-and post-operative changes in corneal astigmatism after pterygium excision using different surgical techniques: bare sclera, sutureless conjunctival autografting, conjunctival autografting with suture, and conjunctival autografting with glue.

MATERIALS AND METHODS

Place of study- This prospective interventional study was conducted at the Department of Ophthalmology, AGMC, and GBP Hospital from January 2023 to June 2024.

Inclusion criteria- The patients with grade 2 [11] (Midway between limbus and pupil) primary nasal pterygium requiring surgery presenting in the outpatient department of our center were included in the study.

Exclusion criteria- Patients with a double pterygium or any pre-existing ocular conditions, such as cataracts or glaucoma, were excluded from the study. Written informed consent was obtained from all the patients.

Research Design- Routine ophthalmic examination, including visual acuity, anterior and posterior segment examination, autorefraction (Topcon RM-800, Topcon Co., Japan), manual keratometry (Super KMS-6 Kerato meter, Appasamy Associates, India), retinoscopy, and slit-lamp examination ((Topcon SL-7F, Topcon Co., Japan), was performed for all patients. Consenting participants underwent pterygium excision surgery under local anesthesia (peribulbar block). After the removal of the pterygium body, the head and fibrovascular tissue under the conjunctiva were dissected and removed using a surgical blade, with residual tissue scraping performed with a crescent knife. Mitomycin C was applied to all patients to decrease recurrence. The patients were divided into four study groups as follows:

Group 1: Sutureless conjunctival autograft (CAG) technique. After excision, an autograft taken from the superotemporal conjunctiva was placed over the bare sclera in the correct anatomical orientation for surface reconstruction.

Group 2: Sutured conjunctival autograft (CAG-s) technique. After excision, the autograft obtained from the superotemporal conjunctiva was fixed with a 10-0 nylon suture in the nasal bare sclera.

Group 3: Glued conjunctival autograft (CAG-g) technique. After excision, the autograft obtained from the superotemporal conjunctiva was fixed with fibrin glue (ReliSeal®, Reliance Life Sciences) in the nasal bare sclera.

Group 4: Bare sclera (BS) technique. The excised area was left bare, without grafting.

After surgery, the patients were followed up for ophthalmic examination on post-operative days 7, 1 and 6 months. At each visit, visual acuity was measured in the logarithm of the minimal angle of resolution (logMAR) along with refraction and keratometry. Corneal astigmatism was derived from keratometric values. The 6-month results were considered the outcomes to ensure that refraction was stabilized and was compared to the pre-operative results.

Statistical Analysis- Statistical analyses were performed using SPSS for Windows (version 28.0.1; SPSS Inc., Chicago, IL, USA). Pre- and post-visual acuity and astigmatic values are reported as mean±standard deviation. The ANOVA test was used to compare the variables because the study involved more than two groups and the variables were continuous. The statistical significance was set at a probability level of 0.05.

Ethical approval- The study was approved by the Institutional Ethical Committee.

RESULTS

In this study, 75 patients were selected for pterygium excision, and convenience sampling was performed to divide the patients into 4 groups. There were 33 patients in group 1 (CAG), 23 in group 2 (CAG-s), 14 in group 3 (CAG-g), and 4 in group 4 (BS). The mean age of the participants was 41.3±5.4 years (median 42 years), ranging from 25 to 55 years. Of the 75 patients, 51 were male (68%) and 24 were female (32%). The pre-and post-operative mean best-corrected visual acuity (BCVA) in logMAR were compared on days 7, 1 month and 6 months. The pre-operative mean BCVA of 0.89±0.56 significantly reduced to 0.32±0.12 ($p<0.05$) 6 months after surgery (Table 1).

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Table 1: Comparison of pre-and post-operative best corrected visual acuity (in logMAR)

Timeline	Mean	Standard deviation	p-value
Preop	0.89	0.56	
Post op day 7	0.79	0.51	0.03
Post op 1 month	0.46	0.28	0.002
Post op 6 months	0.32	0.12	0.001

Pre-and post-operative corneal astigmatism was also compared on days 7, 1 month and 6 months. Changes in corneal astigmatism were statistically significant at all three post-operative visits. The pre-operative corneal astigmatism of 1.81±0.61 D was reduced to 0.43±0.27 D 6 months after surgery ($p<0.05$) (Table 2).

Table 2: Comparison of pre-and post-operative corneal astigmatism (in diopters)

Timeline	Mean (in D)	Standard deviation	P value
Preop	1.81	0.61	
Post op day 7	1.01	0.51	0.001
Post op 1 month	0.64	0.31	0.02
Post op 6 months	0.43	0.27	0.01

Post-operative astigmatism at 6 months decreased significantly in only 3 surgical groups. Group 4 (BS) showed no statistically significant change in post-operative astigmatism. The pre-operative mean corneal astigmatism of 1.81±0.61 D, 1.21±0.59 D, 1.51±0.47 D and 1.29±0.61 D of the group 1 (CAG), 2 (CAG-s), 3 (CAG-g) and 4 (BS) was reduced to post-operative corneal astigmatism of 0.43± 0.27 D ($p<0.05$), 0.59±0.39 D ($p<0.05$), 0.63±0.30 D ($p<0.05$) and 0.92±0.57 D ($p > 0.05$), respectively after 6 months (Table 3).

Table 3: Comparison of pre- and post-operative corneal astigmatism using four techniques of pterygium excision.

Surgical Approach	Corneal astigmatism (mean, SD)				p-value
	Pre-Op	Post-Op Day 7	Post-Op 1 month	Post-Op 6 months	
Group 1 (CAG)	1.81±0.61	1.61±0.40	1.03±0.41	0.43± 0.27	0.001
Group 2 (CAG-s)	1.21±0.59	1.01±0.51	0.66±0.38	0.59±0.39	0.049
Group 3 (CAG-g)	1.51±0.47	1.14±0.45	0.64±0.31	0.63±0.30	0.003
Group 4 (BS)	1.29±0.61	1.22±0.45	0.85±0.35	0.92±0.57	0.073

The astigmatic decrease was greater in pterygium excision with conjunctival autograft (group 1) followed by conjunctival autografting with glue (group 3) and then with conjunctival autografting with suture (group 2) as shown in Fig. 1 and 2.

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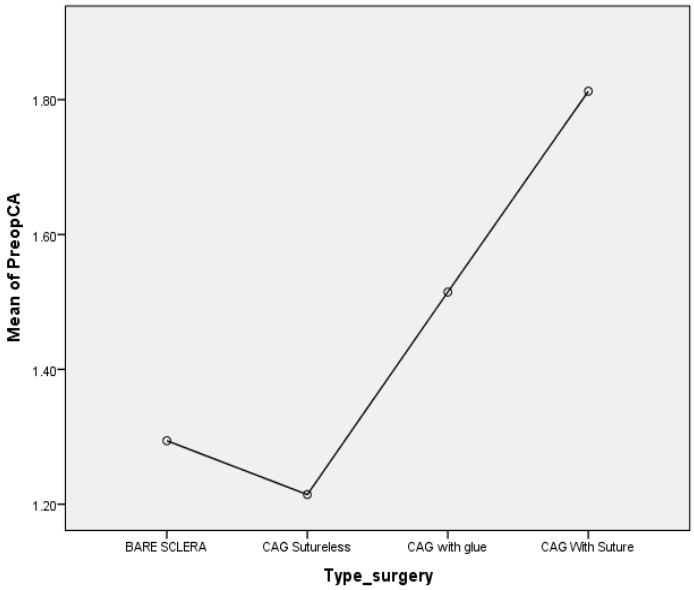

Fig. 1: Pre-operative corneal astigmatism

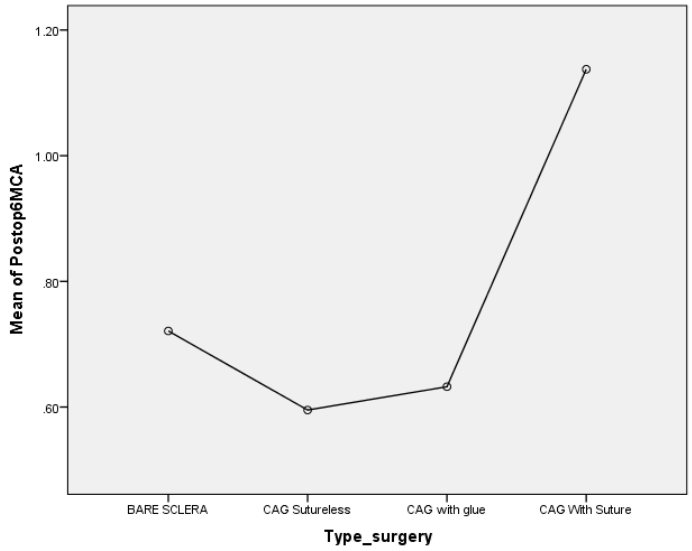

Fig. 2: Post-operative corneal astigmatism

DISCUSSION

Pterygium induces astigmatism and encroaches on the cornea, thus involving the visual axis, which leads to visual impairment. In this study, we compared the pre- and post-operative changes in corneal astigmatism after pterygium excision as well as astigmatic changes after excision using different surgical techniques.

Pterygium excision leads to improved visual acuity due to mass excision and decreased astigmatism [12]. Studies by Garg *et al.* [13] and Mohite *et al.* [14] observed that there were significant improvements in visual acuity from pre-operative 0.56±0.49 to post-operative 0.32±0.29 (p<0.0001) and pre-operative 0.424±0.30 to post-operative 0.587±0.267 (p<0.001) respectively. Our study also showed a similar improvement in visual acuity from 0.86±0.56 to 0.32±0.12 (p=0.01), which was significant 6 months after surgery.

Several studies have demonstrated a reduction in the induced astigmatism after pterygium excision. A study by Mohite *et al.* [14] had a significant reduction in mean keratometric astigmatism from 3.046±1.20 D to 1.486±0.63 D after pterygium surgery (p<0.001). Another study by Hasija A also showed significant improvement in pre-operative Astigmatism of 2.19±0.87 D to 0.19±0.13 D at the end of 4 months (p<0.0001) [15]. Our study had a reduction in astigmatism from pre-operative 1.81±0.61 D to 0.43±0.27 D post-operatively with p=0.01, thus showing a significant astigmatic decrease at 6 months which can be explained by improved corneal regularity and symmetry after excision.

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We also compared the changes in corneal astigmatism after pterygium excision using the most commonly performed techniques: sutureless conjunctival autograft (CAG), sutured conjunctival autograft (CAG-s) technique, glued conjunctival autograft (CAG-g), and bare sclera (BS) technique. There was a significant astigmatic decrease in pterygium excision with conjunctival autograft (group 1) followed by conjunctival autografting with glue (group 3) and then with conjunctival autografting with suture (group 2). However, group 4, which underwent the bare sclera technique, did not show a significant decrease in astigmatism.

A similar study by Garg P also compared the changes in corneal astigmatism after different techniques for pterygium surgery, like bare sclera (group 1), conjunctival autograft (group 2), and amniotic membrane graft (group 3) with a significant change in astigmatism in all 3 groups. They also showed a significant difference in astigmatic changes between the bare sclera technique and the conjunctival autograft technique (p=0.035) [13].

However, a study by Altan-yaycioglu *et al.* concluded that the type of grafting such as CAG or the use of suture or glue to fixate the graft does not have a significant effect on the degree of astigmatism [16]. The more significant changes in astigmatism with conjunctival autograft techniques can be due to better tissue healing and less granulation compared to the bare sclera technique.

CONCLUSIONS

Pterygium is commonly observed in ophthalmology OPD, with patients presenting with a decrease in visual acuity due to astigmatism, which can be significantly reduced by surgical excision. The amount of reduction in astigmatism also depends on the technique used for pterygium excision, where we suggest the use of a sutureless conjunctival autograft or conjunctival autografting with glue as a better technique that also decreases astigmatism and has better patient comfort due to reduced discomfort by sutures.

Further prospective studies with astigmatic and topographic measurements and a larger sample size would help better evaluate this topic in detail.

CONTRIBUTION OF AUTHORS

Research concept- Dr Phani Kumar Sarkar
Research design- Dr Saloni Goyal
Supervision- Dr Rathindra Das
Materials- Dr Sulata Reang
Data collection- Dr Sulata Reang
Data analysis and interpretation- Dr Saloni Goyal
Literature search- Dr Sulata Reang
Writing article- Dr Sulata Reang
Critical review- Dr Rathindra Das
Article editing- Dr Saloni Goyal
Final approval- Dr Phani Kumar Sarkar

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