Article Two

Effect of pterygium excision on corneal astigmatism at University Teaching Hospitals, Eye Hospital, Lusaka, Zambia

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Abstract

Introduction: A pterygium is a fibrovascular growth that extends from the conjunctiva to the cornea. It causes tractional forces which result in a flattened cornea, typically causing astigmatism. The study objective was to evaluate the effect of pterygium excision on corneal astigmatism.

Methodology: This was a prospective single arm cohort study which was conducted at the University Teaching Hospital from May 2024 to March 2025. A total of 46 participants were recruited yielding 48 eyes with primary pterygium. Adult pterygium patients ≥18 years were evaluated before surgery and at 2 and 6 weeks postoperatively for best corrected visual acuity, keratometry, and refractive astigmatism.

Results: Of the 48 eyes recruited, one eye was excluded due to loss to follow, hence 47 eyes were analysed. The mean age of the participants was 47.85 years, with the oldest and youngest participants aged 74 and 24 years, respectively. The results revealed best corrected visual acuity (BCVA) improved from 0.27±0.25 before surgery to 0.19±0.15 ($p<0.001$) and 0.14±0.12 ($p<0.001$) at 2- and 6-weeks post-surgery, respectively. The mean corneal astigmatism was 2.62±2.75D preoperatively. The mean corneal astigmatism at 2 and 6 weeks was 0.47±1.10 and 0.01±0.50D at 6 weeks post-operation. Significant differences in BCVA and astigmatism were maintained even between the 2 and 6 week post-operatively.

Conclusion: Pterygium excision with autograft leads to a significant reduction in astigmatism and improvement in BCVA. Stability in BCVA and astigmatism was not established by week 2 postoperative follow up, highlighting the need for further follow-up assessments.

Key words: Best Corrected Visual Acuity, Keratometry readings

Background

A pterygium is a common fibrovascular degenerative condition whereby the fibrovascular connective tissue of bulbar conjunctiva grows over the cornea in a wing-like shape (1). The term comes from the Greek word pteros, meaning "butterfly wing" (2). The prevalence of pterygium globally is 12%, according to the 2018 meta-analysis, which looked at 68 articles (3). There is an increase in the prevalence of pterygium noted near the equator and the development of pterygium has been closely associated with exposure to ultraviolet light (4).

Pterygium causes flattening of the cornea horizontally towards its' apex, leading to tear pooling, which worsens the induced astigmatism (5). The severity of pterygium and its impact on vision depends on how much it affects the visual quality (6). Surgical excision combined with conjunctival autografting is considered the definitive treatment for pterygium due to its lower recurrence risk, ; alternative approaches like the bare sclera technique are associated with significantly higher rates of recurrence (7, 8)

The improvement in pterygium-induced astigmatism occurs immediately after excision, and it is also noted that corneal topography becomes steeper (6). Studies have shown that it takes about one to three months for

corneal astigmatism and refractive power to stabilize post excision and autograft (9) While other studies have shown that corneal topography stability is achieved within one-to-two-month post-excision and autograft (9-10) showed that postoperative keratometry readings stabilized within 2 months post pterygium excision and no significant change was observed at 4 months postoperative. There is no consensus on the time to corneal astigmatism stability post pterygium excision. Astigmatism as an indication for pterygium excision is uncommonly used by many ophthalmologists world over (11) and Zambian ophthalmologist are no exception. This study evaluated the effect of pterygium excision on corneal astigmatism at University Teaching Hospitals- Eye Hospital (UTHs-EH). Specifically, the study compared the corneal astigmatism before and after pterygium excision; determined the difference in cornea astigmatism after pterygium excision at two and six weeks; and compared the visual acuity before and after pterygium excision.

Materials and Methods

Study Design and Site

This prospective, single-arm cohort study was conducted at the University Teaching Hospitals-Eye Hospital in Lusaka. Because all participants received the same intervention, a single-arm design was employed.

Study population and Sampling Method

The study population consisted of 46 patients scheduled for pterygium surgery, yielding a sample size of 48 eyes selected via consecutive sampling; for individuals with bilateral presentation, each eye was evaluated independently.

Eligibility criteria

Eligible participants included adults aged 18 and older with primary pterygium. Conversely, individuals with recurrent pterygium, a history of ocular trauma, or prior ocular surgeries were excluded.

Intervention and follow-up

Under local anesthesia administered in the subconjunctiva, the pterygium with the Tenon capsule was excised from the cornea and scleral bed. An autologous conjunctival graft was harvested from the superiotemporal bulbar conjunctiva to replace the conjunctival defect created by the pterygium removal. The researcher performed the pterygium surgeries. The participants were given oral ciprofloxacin and paracetamol postoperatively to take for 5 days. They also began to use a steroid antibiotic eyedrop such as dexamethasone chloramphenicol on day one post-operation for a period of 4 weeks.

At each visit, the participants underwent visual assessments, BCVA, autorefraction, and slit lamp examination.

Data Collection and Management

Semi-structured questionnaire was administered and baseline data was collected from all the participants, which included slit-lamp examination and fundoscopy, uncorrected and best-corrected visual acuity assessments and autorefraction RK-800 model. The pterygium length from the limbus onto the cornea was measured and graded from I-3 as outlined by Sarkar and Tripathy (6) with grade 1, less than 2mm, grade 2, 2-4mm and grade 3, greater than 4mm.

Data Analysis

All the data obtained at each visit were recorded on the patients' information sheet and transferred to Microsoft Excel and later exported to Statical Package for the Social Sciences (SPSS) version 27 for analysis. Repeated measures Analysis of Variance (ANOVA) was used to assess for significance of the change in the means before and after surgery. Post hoc paired t -test was used to assess the significant pairs after ANOVA was found significant.

Ethical Consideration

Written informed consent was obtained from the participants. The study was reviewed and formally approved by the University of Zambia Biomedical Research Ethics Committee (Ref: 4621-2023) and the National Health Research Authority (Ref: NHRA1104/07/04/2024). Accordingly, this research was conducted in strict adherence to the ethical principles outlined in the 1964 Declaration of Helsinki and its later amendments

Results

Characteristics of participants undergoing pterygium excision

Of the 46 participants included in the study, 37 were females representing 79 % of total participants and the mean age of the participants was 47.85 years, with the oldest and youngest participants aged 74 and 24 years,

A total of 48 eyes were recruited within the study period and one eye was excluded at final data analysis due to missing data post-operatively. Majority of the eyes had grade 2 pterygium (78%) with a mean length of extension from the limbus into the cornea of 3.35 ±1.16 mm (19%) (Table 1).

Table1: *Baseline characteristics and measurements of participants undergoing pterygium excision at University Teaching Hospitals -,Eye Hospital, Lusaka, Zambia in 2024 (N=47)*

Characteristic	n (%)
Sex	
Male	10 (21.3)
Female	37 (78.7)
Pterygium grade	
Grade 2	37 (78)
Grade 3	10 (21)
Age	
Mean	47.85 years
Standard deviation	10.63
Length	
Mean	3.35mm
Standard deviation	1.04
Pre-op Best Corrected Visual Acuity (LogMAR)	
Mean	0.27
Standard deviation	0.25
Pre-op refractive cylinder	
Mean	-2.97D
Standard deviation	2.71D
Pre-op Astigmatism	
Mean	2.67D
Standard deviation	2.75D

Best Corrected visual acuity

Best corrected visual acuity (BCVA) was assessed with a Snellen chart and subsequently converted to logMAR values for statistical analysis. The mean pre-operative best corrected visual acuity was 0.27± 0.24 logMAR. The BCVA improved post-op to 0.19±0.15 and 0.14±0.12 at 2 and 6 weeks respectively, which was statistically significant (p-value = 0.001). There was a statistically significant difference between BCVA at 2 and 6 weeks postoperatively (p- value= 0.006).

Table 2: Change in Best Corrected Visual Acuity for the participants undergoing pterygium excision

Mean Best Corrected Visual Acuity (± SD)			Repeated Measures ANOVA p-values		
Pre-operation baseline	2 weeks post operation	6 weeks post operation	Baseline vs 2 weeks	Baseline vs 6 weeks	2 vs 6 weeks
0.27±0.25	0.19±0.15	0.14±0.12	<0.001	<0.001	0.006

Corneal astigmatism

Table 3 illustrates a significant reduction in cornea astigmatism after pterygium excision from a mean of 2.62±2.75D to 0.01±0.50D at 6 weeks post-surgery (p-value = 0.001). A significant difference in the mean astigmatism was also noted at 2 weeks post operation and at 6 weeks (p-value= 0.006).

Table 3: Change in astigmatism for participants undergoing pterygium excision at University Teaching Hospitals -,Eye Hospital, Lusaka, Zambia in 2024 (N=47)

Mean Cornea astigmatism			Repeated Measures ANOVA p-value		
Pre-operation	2 weeks post operation	6 weeks post operation	Baseline vs 2 weeks	Baseline* vs 6 weeks	2 vs 6 weeks
2.62±2.75	0.47±1.10	0.01±0.50	<0.001	<0.001	0.006

ANOVA: Analysis of Variance.
Pre-op: Pre operation (pre operative).
Post-op: Post operation (post operative).
SD: Standard deviation.
N: Number of participants.
vs: Versus (comparison).

Association of astigmatism and pterygium length among participants undergoing pterygium excision

Table 4 shows the mean change in astigmatism in relation to pterygium length. There was no statistical difference in mean astigmatism between pterygium length of 2mm or less compared to those greater than 2mm at all-time points in this study (p-values > 0.05).

Table 4: Association of astigmatism and pterygium length for participants undergoing pterygium excision at University Teaching Hospitals,Eye Hospital, Lusaka, Zambia in 2024 (N=47)

Operation stage		Mean Astigmatism (Diopter)		
		≤2mm	>2mm	p-value
Pre-operation	baseline	-1.86	-2.75	0.43
Post operation	2 weeks	-0.29	-0.51	0.63
	6 weeks	-0.18	0.019	0.33

mm – millimetre

Discussion

This study looked at the change in astigmatism and the BCVA before and after pterygium excision and autograft surgery. Stability in astigmatism was assessed by comparing the two-week and six-week post-surgery time intervals. The mean BCVA at pre-op was 0.27±0.25, which later improved to 0.14±0.12 post-operation. A statistically significant mean change in astigmatism post-operation was noticed at both two-week and six-week post-operation.

The demographic features of the participants are comparable with studies done in other African countries. The mean age for the participants in this study was 48 years which is similar to the studies done by Kumah et al (13) and Amoah, K, et al. (6) whose mean age was 41 and 47 years, respectively. In this study, there were more female participants than male participants which could be due to the great concern and awareness of cosmesis issues among women (13). In contrast, a study done in Kano Nigeria by Lwan et al., (7) had a population of male patients almost twice that of females which was similar to the findings by Zheleva and Voynov's (16).

The improvement in the mean BCVA postoperatively observed in this study are comparable to the finding in a study done by Shastry et al., (15), in which the mean BCVA in LogMAR at baseline was 0.22 ± 0.16, whereas that at 12th week post-surgery was 0.11 ± 0.09 and the improvement was statistically significant. Zheleva and Voynov's (16) study from Bulgaria revealed that the mean uncorrected visual acuity before surgery improved significantly as well as the BCVA following pterygium. The study by Misra, et al. (16), showed that both unaided and BCVA showed significant improvement at one month after surgery, and that this level persisted at three months. These findings implied that one month following surgery, visual acuity stabilized. In the current study there was a significant change in the BCVA between 2- and 6-weeks post operation showing that there is still ongoing change in astigmatism beyond two weeks.

Pterygium induces with-rule the corneal astigmatism in the majority of the cases (18). The pterygium induced corneal astigmatism is also attributed to the size of the pterygium and the pooling of tears (17-18). There was significant improvement in corneal astigmatism after pterygium excision. These finding are similar to the reduction what was also observed in a Ghanaian study among cooks at a school (14). In their study, the corneal astigmatism decreased from a baseline of 1.26D to 0.84D after surgery with a P value <0.001. The corneal astigmatism at 2 weeks and 6 weeks post-surgery was statistically significant in the current study, implying that corneal astigmatism stability was not achieved at 2 weeks post-surgery. Conversely, a Ghanaian study by Amoah et al. (6) reported that corneal astigmatism stabilized by week six.. Our findings confirm that corneal

remodelling and subsequent astigmatic shifts continue actively beyond the immediate two-week postoperative period.

In a study by Kam, et al., (19), corneal astigmatism stability post pterygium excision was observed at one week after surgery. The current study astigmatism stability was not achieved at 2 weeks post-surgery. Other studies revealed that cornea astigmatism was achieved at one month and at 3 months post-surgery (9-18). These findings show that there is no consensus in literature concerning the time to when cornea astigmatism stability is achieved post pterygium surgery.

The current study showed significant improvement in astigmatism and best corrected visual acuity after excision of the pterygium. It has been shown that, after pterygium surgery, interventions like prescription glasses, intraocular lens measurements, or laser keratometric procedures may lead to residual refractive error and a poor visual outcome before keratometric stability is achieved (7). Hence, patients presenting with pterygium and seeking refractive correction procedures such as spectacle prescription and cataract surgery could be advised to undergo pterygium excision for that optimal visual outcome of the refractive procedure thereafter.

In the current study the relationship of pterygium size and astigmatism was explored at different time points. There was no significant difference in mean astigmatism between pterygium less than or equal to 2mm in length compared to pterygium with greater than 2mm. However, the mean astigmatism (1.86D) for pterygia with less than or equal to 2mm was lower than that of pterygia greater than 2mm (2.75D). In contrast studies have found astigmatism to be significantly different in pterygia of less than 2mm compared to those greater than 2mm (16).

Study limitations

Significant improvement in corneal astigmatism and visual acuity was observed in the study. However, the lack of follow-up to assess the recurrence rate of pterygium and overall change in astigmatism in the long term limits the extrapolation of the study. A four-week and or more than six-week post-operation assessment would also have improved the ability to identify when astigmatism stabilizes.

Policy and practice implication

Eye care policies should promote timely surgical management of visually significant pterygia to reduce refractive errors and improve visual outcomes because pterygium excision significantly reduces corneal astigmatism. Therefore, clinicians should consider pterygium excision as an effective intervention for reducing corneal astigmatism and improving vision.

Significant improvement in best-corrected visual acuity occurred after pterygium excision. Therefore, policies should support access to pterygium surgery as part of visual rehabilitation services. Eye care providers should include the potential visual benefits of surgery in patient counseling.

Conclusion

Results of this study show that Pterygium excision with autograft leads to a significant reduction in astigmatism and improvement in BCVA. This shows that pterygium excision has a beneficial effect on reducing corneal astigmatism, thereby enhancing visual acuity and corneal astigmatism. The study findings, can be helpful in maximising the outcome of procedures that aim at enhancing vision such as cataract surgery and refraction in those with concomitant pterygium by first advocating for pterygium excision. Eye health professionals should incorporate pterygium assessment and management before elective refractive procedures. These results contribute to the growing body of evidence supporting the efficacy of pterygium surgery in improving ocular health outcomes.

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Competing interest

The authors declare no competing interests exist.

Consent

Written informed consent was obtained from all participants according to the international standards.

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