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Original Research Article

EVALUATION OF POSTOPERATIVE OUTCOMES OF PTERYGIUM EXCISION WITH CONJUNCTIVAL AUTOGRAFT: A PROSPECTIVE CLINICAL STUDY

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ABSTRACT

Background: Pterygium is a common ocular surface disorder associated with visual impairment due to its encroachment on the cornea and induction of astigmatism. Surgical excision with conjunctival autograft is a preferred treatment modality, offering promising outcomes in reducing recurrence and complications. This study evaluates the postoperative outcomes of this procedure, focusing on visual acuity, keratometry, and complications.

Materials and Methods: A prospective study was conducted involving 70 patients with primary pterygium undergoing surgical excision with conjunctival autograft. Preoperative and postoperative assessments included best-corrected visual acuity (BCVA) using the Snellen chart, keratometry (manual keratometer and Scheimpflug imaging), and complication monitoring over a two-month follow-up. Statistical analyses were performed to assess changes in clinical parameters and evaluate the significance of findings.

Results: Postoperative keratometry showed significant improvement, with mean keratometric values reduced from 1.351 ± 1.127 diopters preoperatively to 0.711 ± 0.654 diopters at two months ($p < 0.001$). BCVA showed a marginal increase postoperatively but was statistically insignificant ($p = 0.152$). Complications were minimal, with recurrence observed in 4.3% of cases and 85.6% of patients experienced no adverse outcomes. Comparative analyses revealed consistent results with previous studies, reinforcing the efficacy of conjunctival autograft in managing pterygium.

Conclusion: Surgical excision of pterygium with conjunctival autograft effectively restores corneal topography, reduces astigmatism, and ensures low recurrence rates with minimal complications. These findings emphasize its reliability as a preferred treatment modality. Further studies are warranted to optimize outcomes and explore advancements in surgical techniques.

Keywords: Pterygium, Conjunctival autograft, Keratometry, Visual acuity, Astigmatism.

INTRODUCTION

Pterygium is a fibrovascular growth originating from the conjunctiva that extends onto the cornea, often leading to significant ocular morbidity. It is commonly observed in populations residing in regions with high ultraviolet (UV) radiation exposure, such as tropical and subtropical climates, where its prevalence ranges from 2% to 29%.[1,2] Chronic UV radiation, wind, dust, and genetic predisposition are thought to play pivotal roles in its pathogenesis. The condition frequently induces inflammation and degenerative changes, resulting in vision-related complications such as irregular astigmatism, dryness, and, in severe cases, visual axis obstruction.[3,4]

The impact of pterygium on vision is primarily attributed to changes in corneal topography and curvature. Studies have reported that the astigmatism caused by pterygium can range from 1.00 to 6.00 diopters, depending on the size and extent of corneal involvement.[5,6] Surgical intervention remains the

mainstay of treatment, aiming to restore ocular surface integrity, improve visual outcomes, and reduce astigmatism. Among the commonly employed techniques, conjunctival autografting has shown superior outcomes with a recurrence rate of less than 5%, compared to 30–50% for the bare sclera technique.[7]

Postoperative improvements in best corrected visual acuity (BCVA) and reduction in keratometric astigmatism have been well-documented, with studies reporting a mean reduction in corneal astigmatism ranging from 1.50 to 3.00 diopters following pterygium excision.[8] Advances in corneal topography now allow precise quantification of these changes, offering a deeper understanding of the refractive benefits of surgery.[9] Despite these advancements, limited data exist regarding the comparative evaluation of BCVA, keratometric parameters, and corneal topographic astigmatism pre- and postoperatively.[10]

This study aimed to evaluate the changes in BCVA, keratometry, and corneal topographic astigmatism associated with pterygium surgery, so to enhance the understanding of the visual and refractive benefits of surgical intervention, contributing to the optimization of treatment strategies for patients with pterygium.

MATERIALS AND METHODS

Study Setting and Design: This longitudinal interventional study was conducted at the Department of Ophthalmology, SMS Medical College & Attached Hospitals, Jaipur, from March 2016 to February 2017. The study focused on evaluating changes in best corrected visual acuity (BCVA), keratometric values, and corneal topographic astigmatism in patients undergoing pterygium surgery with conjunctival autograft.

Study Population and Eligibility Criteria

The study enrolled 70 patients who underwent pterygium surgery during the study period. Inclusion criteria were patients with pterygium encroaching more than 2 mm over the cornea, aged 20 to 50 years, and willing to participate in the study and follow-up evaluations. Exclusion criteria included recurrent pterygium, symblepharon, pseudopterygium, conjunctival malignancy, history of glaucoma or ocular hypertension, ocular surface disorders, unwillingness to provide informed consent, and inability to comply with follow-up schedules.

Preoperative Evaluation: All participants underwent a detailed preoperative assessment. This included a thorough history covering ocular, medical, and family backgrounds. A complete ophthalmological examination was performed, including BCVA measurement using Snellen's chart, keratometry, auto-refractometry, and Scheimpflug-based corneal imaging. Slit-lamp examination and indirect ophthalmoscopy for fundus evaluation were also conducted. Routine investigations, including blood sugar levels (fasting or random), urine analysis, electrocardiogram (ECG), and blood pressure measurement, were performed. Preoperative medications included ciprofloxacin eye drops administered at two-hour intervals on the day before surgery and oral ciprofloxacin 500 mg tablets taken twice daily for five days.

Surgical Technique: All surgeries were performed by a single experienced surgeon under local anesthesia using 0.5% bupivacaine (3 mL) and 2% xylocaine (4 mL). After aseptic preparation, including betadine painting and eye speculum placement, the conjunctival portion of the pterygium was ballooned using 2% xylocaine with adrenaline. The pterygium head was excised from the cornea using a No. 15 Bard-Parker blade, followed by keratectomy extending 0.5 mm into normal corneal tissue.

The conjunctival autograft was harvested from the superotemporal conjunctiva after measuring the defect with calipers. The graft was prepared as thinly as possible, ensuring precise dissection. It was then positioned at the recipient site, with the limbal end aligned to the limbal tissue bed. Hemostasis was achieved spontaneously without cautery. Tobramycin 0.3% eye drops were instilled at the end of the procedure, and the eye was patched for 24 hours.

Postoperative Care and Follow-Up: Postoperative care included Tobramycin 0.3% and Fluorometholone 0.1% eye drops, administered at two-hour intervals in tapering doses for six weeks, and carboxymethyl cellulose 0.5% eye drops for three weeks. Ciprofloxacin eye ointment was applied twice daily for one week. Patients were followed up on postoperative day one, week one, and at one and two months. During follow-up, BCVA, slit-lamp evaluation, and corneal imaging were performed, with keratometric and corneal topographic astigmatism assessed at one and two months.

Statistical Analysis: Data were analyzed using SPSS software version 23.0, with continuous variables such as age, BCVA (Best Corrected Visual Acuity), keratometry measurements, pterygium encroachment, and duration of symptoms expressed as mean ± standard deviation (SD), and categorical variables like gender, laterality of pterygium, and complications summarized as frequencies and percentages. Pre- and post-operative changes in outcome variables, including BCVA and keratometric readings (measured using both a keratometer and Scheimpflug imaging), were evaluated using repeated measures ANOVA to compare means at baseline (preoperative), 1st week, 1st month, and 2nd month postoperatively, with pairwise comparisons performed using Bonferroni correction to identify significant differences between time points. Descriptive statistics and proportions were calculated for categorical variables such as the frequency of complications, and a P-value < 0.05 was considered statistically significant.

Ethical Considerations: Ethical approval for the study was obtained from the Institutional Ethics Committee. Written informed consent was obtained

from all participants after explaining the study objectives, procedures, and potential risks. The study adhered to the principles outlined in the Declaration of Helsinki.

RESULTS

The study included 70 participants with a mean age of 37.23 ± 1.71 years. The gender distribution showed a slightly higher proportion of females (39, 55.7%) compared to males (31, 44.3%). The laterality of the pterygium was nearly equal, with 36 cases (51.4%) involving the right eye and 34 cases (48.6%) involving the left eye. The mean pterygium encroachment was 2.4 ± 0.6 mm, reflecting the extent of corneal involvement. The median duration of symptoms was 12.8 ± 9.6 months, indicating a wide variability in the onset and progression of the condition among the study population [Table 1].

Table 1: Demographic and Clinical Characteristics of the Study Population.

Parameter	Frequency (%)/ Mean ± SD
Age (years)	37.23 ± 1.71
Gender	
Male	31 (44.3)
Female	39 (55.7)
Laterality of Pterygium	
Right eye	36 (51.4)
Left eye	34 (48.6)
Pterygium Encroachment (mm)	2.4 ± 0.6
Duration of Symptoms (months)	12.8 ± 9.6

The best-corrected visual acuity (BCVA), measured using the Snellen chart, showed minimal change across the time points, with preoperative values of 0.254 ± 0.211 and postoperative values of 0.264 ± 0.188, 0.259 ± 0.181, and 0.260 ± 0.188 at the 1st week, 1st month, and 2nd month, respectively. The p-value of 0.152 suggests that the changes in BCVA were not statistically significant. In contrast, keratometry measurements from the Keratometer showed a significant reduction in diopter values from preoperative (1.351 ± 1.127) to postoperative values of 0.754 ± 0.686 at 1st week, 0.718 ± 0.655 at 1st month, and 0.711 ± 0.654 at 2nd month, with a highly significant p-value of <0.001. These findings suggest a marked improvement in corneal curvature after pterygium surgery. On the other hand, the keratometry measurements from Scheimpflug imaging demonstrated greater variability in diopter values, with preoperative measurements of 1.221 ± 0.952 and postoperative values of 0.894 ± 0.717, 1.291 ± 0.952, and 1.295 ± 4.778 at the 1st week, 1st month, and 2nd month, respectively. The p-value of 0.254 indicates no statistically significant change, implying that the Scheimpflug imaging results were less consistent compared to the keratometry measurements [Table 2].

Table 2: Comparison of Preoperative and Postoperative Outcome Variables (BCVA, Keratometry Measurements).

Outcome variables (Mean ± SD)				P value
Preoperative	Postoperative			
	1st week	1st Month	2nd Month	
BCVA (Snellen chart)				
0.254±0.211	0.264 ±0.188	0.259 ±0.181	0.260 ±0.188	0.152
Keratometry from Keratometer (Diopters)				
1.351 ±1.127	0.754 ±0.686	0.718±0.655	0.711±0.654	<0.001
Keratometry from Scheimpflug imaging (Diopters)				
1.221±0.952	0.894±0.717	1.291±0.952	1.295±.4.778	0.254

Corneal thinning was reported in 1 patient (1.4%), while graft retraction after 30 days, granuloma at the suture site, and medically displaced graft after 30 days each occurred in 2 patients (2.9%). The incidence of recurrence was noted in 3 patients (4.3%), with the recurrence graded as Grade 2 in 2 patients (2.9%) and Grade 4 in 1 patient (1.4%). A majority of the patients, 60 (85.6%), did not experience any complications postoperatively. These findings highlight that while complications were observed in some cases, the overall rate of complications remained relatively low, with the most common issue being recurrence [Table 3].

Table 3: Postoperative Complications and Recurrence in Pterygium Surgery.

Complication	Frequency	%
Corneal Thinning	1	1.4
Graft retraction after 30 days	2	2.9
Granuloma at suture site	2	2.9
Medical displaced graft after 30 days	2	2.9
Recurrence	3	4.3
Recurrence Grade		
Grade 2	2	2.9

Grade 4	1	1.4
None	60	85.6

DISCUSSION

Our study provides significant insights into the outcomes of pterygium excision with conjunctival autograft, encompassing visual acuity, keratometric changes, and postoperative complications, while comparing our findings with existing literature. The mean preoperative best-corrected visual acuity (BCVA) was 0.254 ± 0.211, which demonstrated a marginal but statistically insignificant improvement over the postoperative follow-up period ($p = 0.152$). This finding aligns with a study by Altan-Yaycioglu et al., which reported that pterygium removal may not always lead to significant improvement in BCVA, especially in cases where residual corneal opacity or irregular astigmatism persists.[11] In contrast, a study by Garg et al. documented a significant improvement in BCVA postoperatively, suggesting that early surgical intervention, particularly before significant corneal scarring develops, may yield better visual outcomes.[12] The variability between studies underscores the importance of preoperative corneal status and patient selection in influencing postoperative visual recovery.[13]

Keratometric changes in our cohort revealed notable improvements. Keratometry values measured using a manual keratometer showed a significant reduction from 1.351 ± 1.127 diopters preoperatively to 0.711 ± 0.654 diopters at two months postoperatively ($p < 0.001$). This finding concurs with a study by Khan et al., which reported a similar reduction in pterygium-induced astigmatism following conjunctival autograft.[14] Such reductions are attributed to the removal of the pterygium-induced tractional forces on the cornea, allowing restoration of normal corneal topography.[15] Scheimpflug imaging, however, showed nonsignificant changes in keratometric values ($p = 0.254$). These findings align with a study by Belin et al., where Scheimpflug-derived measurements were influenced by postoperative corneal remodeling and changes in the posterior corneal surface, which are not captured by conventional keratometry.[16] This highlights the need for multi-modal corneal assessment to fully understand the impact of pterygium surgery on corneal biomechanics.[17]

Our study also reported a recurrence rate of 4.3%, which is lower than the rates of 5–10% observed in other studies, such as those by studies by Torres-Gimeno et al. and Palewski et al.[18,19] The low recurrence in our cohort can be attributed to precise surgical techniques, including meticulous conjunctival graft harvesting and secure fixation using sutures or fibrin glue. Most recurrences in our study were of Grade 2 severity, consistent with findings from Clearfield et al. which emphasize that early detection and management of recurrence can mitigate progression to more severe grades.[20] Notably, the use of antimitotic agents such as mitomycin-C or 5-fluorouracil in other studies has been associated with lower recurrence rates, albeit at the expense of potential complications like scleral thinning or delayed wound healing.[21] This raises the question of balancing efficacy and safety in the choice of adjuvant therapies.

Postoperative complications in our study were minimal. Corneal thinning (1.4%), graft retraction (2.9%), granuloma formation at the suture site (2.9%), and medial graft displacement (2.9%) were observed, which are comparable to the rates reported by Alizadah et al.[22] The recurrence rate of 4.3% was slightly lower than the average rates reported in larger meta-analyses, further supporting the safety and efficacy of our surgical approach. The high percentage of patients (85.6%) without complications reaffirms the safety profile of conjunctival autograft. In comparison, Kodavoor et al. reported higher rates of complications, likely due to less standardized surgical protocols and varying surgeon experience.[23]

The clinical significance of our findings lies in the substantial reduction in keratometric astigmatism, which has a profound impact on visual quality, even in the absence of significant BCVA improvement. The limited improvement in BCVA observed in our study may suggest a need for adjunctive interventions, such as excimer laser-based phototherapeutic keratectomy, to address residual corneal irregularities.[24] Furthermore, the role of patient-related factors, such as age, duration of symptoms, and extent of pterygium encroachment, warrants further exploration, as these factors are known to influence surgical outcomes.[25]

Limitations: Finally, while our study demonstrates promising results, it is essential to acknowledge the limitations, including the relatively short follow-up period and single-center design. Long-term, multi-center studies with larger sample sizes are necessary to validate our findings and assess the durability of outcomes. Moreover, future research should explore the integration of newer surgical techniques, such as amniotic membrane grafts, and their impact on reducing recurrence rates and complications, particularly in high-risk populations.

CONCLUSION

This study highlights the effectiveness of pterygium excision with conjunctival autograft in reducing pterygium-induced astigmatism and ensuring favorable postoperative outcomes with minimal complications. Significant improvements in keratometric parameters, particularly those measured by manual keratometry, were observed, underscoring the procedure's ability to restore corneal topography. Although best-corrected visual acuity showed only a marginal improvement, the reduction in astigmatism is clinically significant, as it enhances visual quality.

The low recurrence rate of 4.3% and minimal postoperative complications, such as graft retraction and granuloma formation, further demonstrate the safety and efficacy of this surgical approach. Comparisons with peer-reviewed studies affirm the reliability of conjunctival autograft, especially when meticulous surgical techniques are employed. However, variability in outcomes across studies highlights the need for individualized patient evaluation and management. Future research should focus on optimizing surgical protocols and exploring innovative techniques to improve visual outcomes and reduce recurrence rates further.

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