Original article:

Complications, Recurrence Rate, and Refractive Outcomes After Pterygium Excision with Fibrin Glue–Assisted Limbal Conjunctival Autograft

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Abstract

Background: Pterygium is a common ocular surface disorder characterized by fibrovascular conjunctival growth onto the cornea and is frequently associated with chronic ultraviolet light exposure. Progressive lesions can cause ocular irritation, cosmetic disfigurement, recurrence after surgery, and significant refractive changes due to induced corneal astigmatism. Although conjunctival and limbal conjunctival autografting have reduced recurrence rates compared to bare sclera excision, suture-related inflammation and patient discomfort remain concerns. The use of fibrin glue for graft fixation has emerged as an alternative to sutures, with the potential advantages of shorter operative time, improved postoperative comfort, and comparable graft stability.

Aim: To evaluate postoperative complications, recurrence rate, and refractive outcomes following pterygium excision with fibrin glue–assisted limbal conjunctival autograft.

Materials and Methods: This prospective clinical study included 50 patients undergoing pterygium excision with fibrin glue–assisted limbal conjunctival autograft at Department of Ophthalmology, S.M.S. Medical College and Hospital, Jaipur, Rajasthan, India. Preoperative evaluation comprised detailed demographic data, assessment of sunlight exposure, pterygium size measurement, visual acuity testing, slit-lamp biomicroscopy, and keratometric analysis. All surgeries were performed under local anesthesia, and operative time was recorded. Postoperative follow-up was conducted on day 1, day 7, day 15, day 30, month 3, and month 6 to evaluate patient symptoms, graft status, postoperative complications, recurrence grading, visual acuity, and refractive changes. Final outcome analysis was based on 46 patients who completed six months of follow-up.

Results: The study population showed a male predominance (62%), with the majority of patients in the 21–40-year age group. Larger pterygia (>3.5 mm) were associated with significantly longer operative time compared to smaller lesions (29.42 ± 2.52 vs 26.68 ± 2.20 minutes; $P < 0.001$). Early postoperative symptoms such as pain, lacrimation, photophobia, and conjunctival congestion were common but resolved rapidly over follow-up. Graft-related complications were infrequent, including one graft loss and two cases of graft retraction. At six months, Grade III recurrence was observed in 2 patients (4.4%), while 73.9% showed no recurrence. Significant reduction in corneal astigmatism (1.92 ± 1.80 D to 0.78 ± 0.84 D; $P < 0.001$) and improvement in keratometric values along the steep meridian were noted postoperatively.

Conclusion: Fibrin glue–assisted limbal conjunctival autograft fixation is a safe and effective technique for pterygium surgery, providing low recurrence rates, minimal postoperative morbidity, and significant improvement in refractive outcomes.

Key words: Pterygium; Fibrin Glue; Limbal Conjunctival Autograft; Recurrence; Corneal Astigmatism.

INTRODUCTION

Pterygium is a common, visually relevant disorder of the ocular surface characterized by a fibrovascular, wing-shaped conjunctival encroachment onto the cornea. Clinically, it may remain cosmetically troubling and intermittently inflamed, but it can also become functionally significant by inducing ocular surface irritation, recurrent redness, and progressive distortion of the corneal contour. The modern understanding of pterygium emphasizes that it is not simply a "degenerative" lesion; rather, it represents a complex, multifactorial proliferative process involving epithelial alteration, inflammatory cell recruitment, fibroblast activation, and angiogenesis, with chronic ultraviolet exposure acting as an important upstream driver in susceptible individuals.[1] In regions with high sunlight exposure and outdoor occupations, the burden of disease is substantial, and surgical care remains a frequent requirement in routine ophthalmic practice. Surgical excision is the definitive treatment when pterygium becomes progressive, induces symptoms refractory to conservative measures, threatens the visual axis, or produces visually significant astigmatism. However, the historical challenge of pterygium surgery has been recurrence, which may be cosmetically unacceptable and can be more aggressive than the primary lesion. For this reason, technique selection in pterygium surgery is primarily judged by recurrence control, safety, postoperative comfort, and the stability of ocular surface reconstruction. Numerous refinements have been introduced to reduce recurrence risk, including meticulous removal of fibrovascular tissue, attention to the limbal barrier concept, and methods that minimize postoperative inflammation and traction. Large clinical series using tissue adhesive–based "no-suture" approaches have reinforced the principle that careful ocular surface reconstruction and avoidance of excessive suture-related inflammation can contribute to low recurrence rates and favorable healing profiles.[2] Conjunctival autografting has become widely accepted as a cornerstone method for reducing recurrence, because it restores conjunctival integrity and provides a barrier effect at the excised site. Limbal conjunctival autografting extends this concept by including limbal tissue at the graft edge, aiming to reinforce the limbal stem cell barrier and reduce conjunctivalization-type regrowth. In practice, limbal conjunctival autograft techniques are designed to provide durable anatomical resurfacing while maintaining a smooth corneal interface and minimizing postoperative scarring. When the graft is appropriately sized, oriented, and placed with minimal Tenon's tissue, the ocular surface tends to epithelialize efficiently and achieve a satisfactory cosmetic result. The method of graft fixation, therefore, becomes a critical operative variable because it can influence operative time, postoperative inflammation, patient comfort, and graft stability—factors that ultimately may affect recurrence and complication rates. Traditionally, conjunctival or limbal conjunctival autografts have been secured using sutures, most commonly absorbable materials. Although effective, sutures may prolong operating time and can contribute to postoperative foreign body sensation, localized inflammation, suture track irritation, granuloma formation, and patient dissatisfaction during early healing. These drawbacks are clinically relevant because early postoperative inflammation is considered a potential contributor to fibrovascular proliferation and recurrence. Consequently, there has been increasing interest in suture-sparing alternatives that can provide reliable graft adherence with less tissue reaction. Fibrin glue is a biologic tissue adhesive that polymerizes rapidly to create a fibrin clot, offering immediate graft adhesion without the mechanical friction and inflammatory stimulus associated with suture knots. In controlled clinical comparisons, fibrin glue fixation has been associated with shorter surgical duration and improved early postoperative comfort compared with suturing, while maintaining acceptable graft stability and healing.[3] Beyond operative efficiency, the safety and complication profile of fibrin glue–assisted grafting is a central concern. Early events may include transient irritation, subconjunctival hemorrhage, mild chemosis, or localized inflammation, while graft-specific issues may include edge retraction, partial dehiscence, or (rarely) graft displacement. These events are clinically important because they may necessitate additional interventions and could influence the likelihood of recurrence. Comparative work evaluating fibrin adhesive versus sutures for autograft fixation has generally focused on recurrence, discomfort, and operative time, but complication patterns and their timing across follow-up remain equally important endpoints in real-world practice. In particular, smaller studies have specifically documented recurrence outcomes after conjunctival autograft surgery when fibrin adhesive is used instead of sutures, supporting the feasibility of adhesive fixation while emphasizing the need for careful surgical technique to ensure graft apposition and stability.[4] Additional prospective and comparative studies have further clarified the role of fibrin sealant in graft fixation. Evidence from clinical series and comparative trials indicates that fibrin sealant can reduce operating time and early discomfort, with recurrence rates that are broadly comparable to, and in some settings potentially lower than, sutured fixation—depending on patient selection, surgical technique, and follow-up duration.[5] Importantly, because limbal conjunctival autograft procedures are specifically intended to reduce recurrence and restore limbal anatomy, outcomes from limbal-inclusive techniques using fibrin adhesive are particularly relevant. Clinical reports describing conjunctivolimbal autografts secured with fibrin adhesive have highlighted the practical advantages of rapid fixation and satisfactory early healing, while also noting that rigorous follow-up is required to establish long-term recurrence and complication trends.[6] In addition to recurrence and complications, refractive outcomes are a major determinant of functional success after pterygium surgery. Pterygium can induce corneal astigmatism and irregularity through localized traction and corneal flattening, often producing measurable keratometric asymmetry. Surgical removal typically improves corneal regularity, but the magnitude and time course of stabilization can vary, and early postoperative measurements may not fully reflect late refractive remodeling. Studies evaluating corneal topography before and after pterygium excision demonstrate that significant improvements may occur early, with further normalization over subsequent months.

MATERIALS & METHODS

A prospective hospital-based study was undertaken at the Department of Ophthalmology, S.M.S. Medical College and Hospital, Jaipur, Rajasthan (India) in which 50 outdoor patients with pterygium underwent excision followed by limbal conjunctival autografting secured using fibrin glue. The methodology was designed to document postoperative complications, recurrence characteristics, and refractive/keratometric changes over a structured follow-up period. Informed consent was obtained from all participants prior to surgical intervention.

Participants were enrolled according to clinical eligibility requirements. Cases with primary pterygium and recurrent pterygium were included provided the lesion extended more than 2 mm onto the cornea, the patient age was between 20 and 50 years, and the pterygium was either progressive or stationary. Exclusion criteria were applied to avoid confounders affecting recurrence and healing: pterygium involving less than 2 mm of cornea, extremes of age (<20 years or >50 years), old atrophic lesions, one-eyed patients, concurrent conjunctival disease or infection (conjunctiva/lids/lacrimal apparatus), and systemic conditions associated with impaired wound healing or bleeding risk (bleeding disorders, diabetes mellitus, hypertension, uremia, and connective tissue disorders).

Baseline clinical profiling was performed to support postoperative comparisons, particularly for refractive outcomes. History emphasized symptom burden (redness, pain, diplopia), duration, occupational and sunlight exposure (including outdoor exposure regarded as significant when early-life exposure was at least five years with 6–8 hours daily), family history, and prior surgery for pterygium. Ophthalmic examination comprised unaided and best-corrected Snellen visual acuity, refraction/retinoscopy when possible, keratometry by Javel-Schiotz keratometer for quantifying pterygium-associated astigmatism, fluorescein staining for epithelial compromise, ocular motility assessment, and slit-lamp biomicroscopy documenting pterygium dimensions, vascularity, and associated corneal findings (including grey haze and Stocker's line when present). Posterior segment assessment was completed using direct ophthalmoscopy.

All procedures were performed under local anaesthesia. A peribulbar block was administered using 0.5% sensoricaine (2 ml) combined with 2% xylocaine (4 ml), along with facial block using 0.5% sensoricaine (1 ml) and 2% xylocaine (3 ml). Operative duration was recorded consistently from the time of lid speculum placement to removal, allowing comparison of surgical efficiency in a fibrin glue–assisted technique. After povidone-iodine preparation and sterile draping, a lid speculum was placed and the conjunctival part of the pterygium was hydrodissected using 0.5 ml of 2% lidocaine with adrenaline to reduce bleeding and facilitate tissue separation.

The pterygium head was removed from the cornea using a Bard-Parker No. 15 blade with meticulous keratectomy, initiated just anterior to the lesion to include approximately 0.5 mm of clear cornea and to ensure complete removal of fibrovascular tissue. Residual tissue was cleared to achieve a smooth corneal surface. The conjunctival component was dissected with spring scissors, the body excised in one piece, and the conjunctival margins trimmed, leaving an approximately 3 mm bare scleral zone. Haemostasis was achieved with wet-field cautery. A limbal conjunctival autograft was harvested from the superotemporal bulbar conjunctiva using a thin dissection approach based on the technique described by Starck et al., aiming to optimize epithelial healing and reduce donor-site morbidity. The graft outline was marked with gentian violet to obtain an oversized graft with an additional 1.0 mm in both dimensions relative to the recipient bed, and the epithelial surface was marked to prevent inversion.

Fibrin glue fixation was performed using ReliSeal™ fibrin sealant (Reliance Life Sciences), supplied as a kit containing freeze-dried human fibrinogen and thrombin, aprotinin solution, sterile water, and a dual-chamber applicator. Fibrinogen was reconstituted with aprotinin solution and warmed to 37°C for 10 minutes after dissolution; thrombin was reconstituted with sterile water. Both solutions were loaded into the applicator system to permit mixing at the needle tip during delivery. The recipient bed was dried prior to glue application. A drop of mixed sealant was applied, and the graft was immediately positioned with correct limbal orientation and edge-to-edge apposition against the recipient conjunctiva. A settling period of approximately 5 minutes was allowed to enhance adherence. Subconjunctival gentamicin and dexamethasone were administered away from the graft site, and graft stability was checked after lid speculum removal by asking the patient to blink. Antibiotic ointment was instilled and the eye was patched for 24 hours. In routine practice, one reconstituted sealant preparation was used for approximately 5–6 patients.

Postoperative management was standardized to ensure consistent complication and refractive assessment. All surgeries were day-care procedures, and patients received oral antibiotics and systemic NSAIDs for three days. Follow-up examinations were performed on postoperative day 1 and subsequently on day 3, day 10, day 30, day 90, and day 180. At each visit, complications were actively evaluated (pain, congestion, lid swelling, photophobia, blepharospasm; conjunctival cyst, granuloma, chemosis, subconjunctival haemorrhage; scleral thinning/calcification; corneal oedema/thinning/opacity; anterior chamber inflammation; and ocular motility limitations). Visual acuity and refraction were documented to capture refractive outcomes, and keratometry was repeated to quantify changes in astigmatism following surgery. Fluorescein staining was performed serially to identify epithelial defects or persistent staining. Recurrence was graded using a four-step scale: Grade 0 (no difference from normal), Grade I (fine episcleral vessels up to limbus without fibrous tissue), Grade II (fibrous tissue in excised area without corneal invasion), and Grade III (fibrovascular recurrence invading cornea), with careful notation of the timing and corneal involvement when recurrence occurred. Of the 50 operated cases, 2 patients were lost after 3 months and 2 additional patients did not attend the 6-month visit; hence, final evaluation and results were derived from 46 patients, while the enrolment and operative sample size remained 50.

RESULTS

The age and sex distribution of the study population is summarized in Table 1. Out of the 50 patients included in the study, 31 (62.0%) were males and 19 (38.0%) were females, showing a clear male predominance. The majority of patients, 36 (72.0%), belonged to the 21–40-year age group, while 14 patients (28.0%) were older than 40 years.

The relationship between pterygium size and operative time is shown in Table 2. The mean operative time for pterygia measuring less than 3.5 mm was 26.68 ± 2.20 minutes, whereas pterygia larger than 3.5 mm required a longer mean operative time of 29.42 ± 2.52 minutes. This difference was found to be highly statistically significant ($P < 0.001$).

Changes in corneal curvature following surgery are presented in Table 3. Preoperatively, the mean keratometric reading along the steepest meridian (90°) was 45.40 ± 2.06 dioptres, which reduced significantly to 44.17 ± 1.41 dioptres postoperatively. The mean change of 1.23 ± 1.55 dioptres was highly significant ($P < 0.001$). In contrast, the keratometric readings along the flattest meridian (0°) showed only a minimal change from 43.77 ± 1.39 dioptres preoperatively to 43.59 ± 1.22 dioptres postoperatively, which was not statistically significant ($P > 0.05$).

The correlation between pterygium size and astigmatism is detailed in Table 4. Preoperative corneal astigmatism showed a strong positive correlation with the size of the pterygium ($r = +0.708$, $P < 0.01$), indicating that larger pterygia were associated with higher degrees of astigmatism. Additionally, the magnitude of astigmatic change after surgery also demonstrated a significant positive correlation with preoperative pterygium size (r = +0.552, P < 0.01).

Overall changes in corneal astigmatism before and after surgery are summarized in Table 5. The mean preoperative astigmatism was 1.92 ± 1.80 dioptres, which decreased to 0.78 ± 0.84 dioptres postoperatively. The mean reduction in astigmatism was 1.14 ± 1.46 dioptres, and this improvement was found to be highly statistically significant (P < 0.001).

Recurrence outcomes at the end of six months of follow-up are presented in Table 6. Of the 46 patients available for final evaluation, 34 patients (73.9%) showed no recurrence (Grade 0). Mild recurrence in the form of fine episcleral vessels not crossing the limbus (Grade I) was observed in 7 patients (15.2%), while 3 patients (6.5%) had Grade II recurrence with fibrous tissue not invading the cornea. Only 2 patients (4.4%) developed Grade III recurrence with fibrovascular tissue invading the cornea.

Table 1: Age and sex distribution (N = 50)

Age group (years)	Male n (%)	Female n (%)	Total n (%)
21–40	20 (40.0)	16 (32.0)	36 (72.0)
>40	11 (22.0)	3 (6.0)	14 (28.0)
Total	**31 (62.0)**	**19 (38.0)**	**50 (100.0)**

Table 2: Operative time by pterygium size (N = 50)

Operative time (minutes)	<3.5 mm (n = 31) Mean ± SD	>3.5 mm (n = 19) Mean ± SD	P-value	Significance
Mean ± SD	26.68 ± 2.20	29.42 ± 2.52	<0.001	HS

Table 3: Keratometry comparison (Dioptres) preoperative vs postoperative at end of study (N = 46)

Keratometry parameter	Pre-op Mean ± SD	Post-op Mean ± SD	Mean change ± SD	P-value	Significance
Steepest meridian (90°)	45.40 ± 2.06	44.17 ± 1.41	1.23 ± 1.55	<0.001	HS
Flattest meridian (0°)	43.77 ± 1.39	43.59 ± 1.22	0.18 ± 1.01	>0.05	NS

Table 4: Correlation of astigmatism with preoperative pterygium size

Correlation assessed	r-value	P-value	Significance
Pre-op astigmatism vs size	+0.708	<0.01	Significant
Change in astigmatism vs size	+0.552	<0.01	Significant

Table 5: Corneal astigmatism (Dioptres) preoperative vs postoperative (end of study, N = 46)

Astigmatism	Pre-op Mean ± SD	Post-op Mean ± SD	Mean change ± SD	P-value	Significance
Mean ± SD	1.92 ± 1.80	0.78 ± 0.84	1.14 ± 1.46	<0.001	HS

Table 6: Recurrence grading at 6 months (N = 46)

Recurrence grade	n (%)
Grade 0	34 (73.9)
Grade I	7 (15.2)
Grade II	3 (6.5)
Grade III	2 (4.4)

DISCUSSION

The present series demonstrated a low rate of clinically significant corneal recurrence (Grade III) of 4.4% (2/46) at 6 months, with 73.9% of eyes showing no recurrence (Grade 0). This favorable early outcome is broadly consistent with the historically improved recurrence profile of conjunctival autograft–based techniques: Kenyon et al (1985) reported recurrence in 3 eyes (5.3%) after conjunctival autograft transplantation over a mean follow-up of 24 months, supporting the principle that replacing the excised conjunctival tissue reduces the biologic drive for regrowth compared with bare sclera approaches.[7] Although follow-up duration and recurrence definitions vary across studies, our distribution of minimal to mild recurrence (Grade I 15.2%, Grade II 6.5%) suggests that most postoperative vascular responses remained non-progressive and did not advance to corneal invasion during the study window. In a large tertiary-center review, Ti et al (2000) documented recurrence in 20.8% of primary cases and 31.2% of recurrent cases, and emphasized that outcomes can vary widely among surgeons and settings (reported ranges 5%–82%), reinforcing that recurrence rates depend not only on technique but also on operative consistency and postoperative healing dynamics.[8] The recurrence performance in this study is also clinically meaningful when contrasted with older non-graft techniques. In survival-curve analyses, Riordan-Eva et al (1993) reported a 14% probability of recurrence at 36 months after conjunctival autografting in previously unoperated eyes, compared with approximately 70% after bare sclera excision (and ~69% after excision with complete conjunctival closure), highlighting the protective effect of grafting against long-term regrowth.[9] Operative efficiency in the current cohort remained acceptable, with a clear size-dependent increase: mean operative time was 26.68 ± 2.20 minutes for pterygia <3.5 mm versus 29.42 ± 2.52 minutes for >3.5 mm (P < 0.001). The direction of this finding aligns with the procedural advantage of tissue adhesives in reducing handling time: Hall et al (2009), in a randomized trial, reported mean surgical time of 12 minutes with fibrin glue compared with 26 minutes using sutures (P < 0.001). While our absolute times were longer—likely reflecting the broader time definition used (speculum placement to removal) and the additional dissection required for larger lesions—the same principle holds: complexity and lesion size increase dissection and positioning demands, prolonging surgery despite glue-assisted fixation.[10] Refractive improvement after surgery was a key strength of this study. Mean corneal astigmatism decreased from 1.92 ± 1.80 D preoperatively to 0.78 ± 0.84 D at the end of follow-up (mean reduction 1.14 ± 1.46 D, P < 0.001). Comparable directional improvements are well documented: Maheshwari (2007) reported reduction of corneal astigmatism from 4.40 ± 3.64 D to 1.55 ± 1.63 D after surgery (P < 0.001). Although baseline astigmatism was lower in our cohort, both datasets support that pterygium excision with surface reconstruction meaningfully reduces induced astigmatism and improves optical regularity.[11] Keratometric analysis in our study showed that pterygium predominantly altered the steep (vertical) meridian, with a significant postoperative reduction along 90° (45.40 ± 2.06 D to 44.17 ± 1.41 D, mean change 1.23 ± 1.55 D, P < 0.001), while the flattest meridian change was small and non-significant. This pattern is consistent with videokeratographic observations reported by Bahar et al (2004), who found simulated keratometric astigmatism reduction from 3.12 ± 2.43 D to 2.51 ± 2.50 D (P = 0.05) along with improvement in best-corrected visual acuity (from 20/40 to 20/25, P < 0.01). Together, these findings support that pterygium-induced corneal distortion is anisotropic and tends to normalize after removal and ocular surface stabilization.[12] A particularly important observation in this cohort was the strong size–astigmatism relationship: preoperative astigmatism correlated positively with pterygium size (r = +0.708, P < 0.01), and the magnitude of astigmatic change after surgery also correlated with size (r = +0.552, P < 0.01). This is directionally similar but stronger than relationships reported by Mohammad-Salih et al (2008), who found that pterygium extension had the best correlation with corneal astigmatism (r = 0.462, P < 0.001) and that affected eyes had significantly higher astigmatism (1.2 ± 0.9 D) than controls (0.6 ± 0.5 D, P < 0.0001). The stronger correlation in our dataset may reflect our inclusion of lesions with corneal encroachment >2 mm, which accentuates size-driven optical distortion.[13] These data also reinforce the rationale for timely intervention before advanced corneal distortion develops. Avisar et al (2000) showed that when a primary pterygium exceeds roughly 1.0 mm from the limbus, it can induce significant with-the-rule astigmatism (≥ 1.0 D), with increasing prevalence of significant astigmatism as size increases (e.g., 45.45% for 1.1–3.0 mm and 100% for very large lesions in their dataset).[14]

CONCLUSION

Pterygium excision with fibrin glue–assisted limbal conjunctival autograft provides a safe and effective approach with a low rate of clinically significant recurrence and minimal postoperative complications. The technique offers stable graft adherence, reduced operative time, and good patient tolerance during the early postoperative period. Significant improvement in corneal curvature and astigmatism was observed, contributing to favorable visual and refractive outcomes. Overall, this method represents a reliable surgical option for achieving both anatomical restoration and functional improvement in pterygium management.

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