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Research Article

Pterygium Surgery Using Anchored Conjunctival Rotation Flap Vs Conjunctival Autograft – A Comparative Study

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ABSTRACT

Background: Pterygium is a common ocular surface disorder characterized by fibrovascular proliferation of conjunctival tissue onto the cornea, often resulting in irritation, cosmetic concerns, induced astigmatism, and visual impairment. Conjunctival autograft is widely regarded as the standard surgical treatment; however, anchored conjunctival rotation flap surgery has emerged as an alternative technique with potential advantages in surgical efficiency and graft stability. This study compared the efficacy, safety, and postoperative outcomes of anchored conjunctival rotation flap and conjunctival autograft techniques in the management of primary pterygium.

Methods: A hospital-based analytical comparative study was conducted at the Department of Ophthalmology, Jawaharlal Nehru Medical College, Ajmer, from June 2024 to May 2025. Eighty patients with primary pterygium were enrolled and equally divided into two groups: conjunctival autograft (Group A, n=40) and anchored conjunctival rotation flap (Group B, n=40). Demographic characteristics, surgical duration, postoperative astigmatism, complications, and recurrence rates were evaluated during follow-up visits up to one year. Statistical analysis was performed using SPSS version 26.0, with $p<0.05$ considered statistically significant.

Results: Baseline demographic and clinical characteristics were comparable between the groups. Mean surgical duration was significantly shorter in the rotation flap group (27.4±5.4 minutes) compared with the autograft group (30.25±5.3 minutes) ($p=0.020$). Both groups demonstrated significant reduction in postoperative astigmatism, with a significant intergroup difference observed at three months ($p=0.026$). Recurrence occurred in 5.0% of patients in the autograft group and 8.1% in the rotation flap group. Postoperative complications were mild and self-limiting in both groups.

Conclusion: Both conjunctival autograft and anchored conjunctival rotation flap techniques are safe and effective for primary pterygium surgery. The anchored conjunctival rotation flap technique offers shorter operative time with comparable clinical outcomes, making it a reliable alternative to conjunctival autografting.

Keywords: Pterygium, Conjunctival Autograft, Anchored Conjunctival Rotation Flap, Recurrence, Astigmatism, Ophthalmic Surgery.

INTRODUCTION

Pterygium is a common ocular surface disorder characterized by a triangular fibrovascular proliferation of conjunctival tissue extending onto the cornea. It is considered a degenerative and proliferative condition of the ocular surface and is particularly prevalent in tropical and subtropical regions where exposure to ultraviolet (UV) radiation is high (1,2). Although pterygium is generally regarded as a benign lesion, its progressive growth can induce significant visual impairment through corneal astigmatism, tear film instability, chronic ocular irritation, and encroachment onto the visual axis. Consequently, it remains an important cause of ocular morbidity, especially in populations with prolonged outdoor exposure and limited access to eye care services (3,4).

The etiology of pterygium is multifactorial. Chronic ultraviolet-B radiation exposure is considered the most important environmental risk factor, leading to limbal stem cell

dysfunction, oxidative stress, and abnormal fibrovascular proliferation (2,4). Other contributing factors include dry climatic conditions, dust, wind exposure, genetic predisposition, chronic inflammation, and occupational exposure to environmental irritants (5,6). Histopathological studies have demonstrated elastotic degeneration, fibrovascular proliferation, inflammatory cell infiltration, and extracellular matrix remodeling within pterygial tissue, supporting the concept that pterygium represents a complex degenerative and proliferative disorder rather than a simple conjunctival overgrowth (3).

Apart from its cosmetic implications, pterygium can significantly affect visual function. Progressive advancement onto the cornea alters corneal curvature and induces irregular astigmatism, resulting in blurred vision and reduced visual quality. The magnitude of astigmatism often correlates with the size and extent of corneal involvement. In advanced cases, visual impairment may occur due to direct encroachment upon the pupillary area. Surgical excision remains the treatment of choice for symptomatic lesions causing visual disturbance, chronic irritation, recurrent inflammation, or cosmetic concern (7,8).

Over the years, numerous surgical techniques have been developed to reduce recurrence following pterygium excision. Historically, bare sclera excision was widely practiced; however, recurrence rates ranging from 30% to 80% limited its effectiveness (3). To overcome this problem, several adjunctive procedures, including conjunctival autografting, limbal conjunctival transplantation, amniotic membrane transplantation, and the use of antimetabolites, have been introduced. Among these techniques, conjunctival autografting has emerged as one of the most commonly accepted methods because of its favorable safety profile and relatively low recurrence rates (3). The procedure involves harvesting healthy conjunctival tissue from the superior bulbar conjunctiva and transplanting it to cover the bare scleral defect created after pterygium excision.

Despite its effectiveness, conjunctival autografting has certain limitations. The procedure requires meticulous graft harvesting and orientation, increases operative time, and may be associated with graft edema, graft loss, displacement, or retraction during the postoperative period. These challenges have encouraged the development of alternative surgical approaches aimed at simplifying the procedure while maintaining comparable clinical outcomes (8).

Anchored conjunctival rotation flap surgery is one such modification. In this technique, a vascularized conjunctival flap is mobilized from the adjacent superior conjunctiva and rotated to cover the excised area while maintaining its limbal attachment. Preservation of the vascular pedicle may facilitate faster healing, improve graft viability, and reduce the risk of graft-related complications. Furthermore, the technique avoids the need for complete graft harvesting and orientation, potentially shortening surgical duration and improving intraoperative efficiency (8).

MATERIALS AND METHODS

Study Design and Setting

This hospital-based analytical comparative study was conducted in the Department of Ophthalmology, Jawaharlal Nehru Medical College and Associated Hospitals, Ajmer, Rajasthan, India. The study was carried out over a period of one year from June 2024 to May 2025, following approval from the Institutional Ethics Committee and Research Review Board. An additional period was utilized for data compilation, statistical analysis, and manuscript preparation.

Study Population

Patients presenting to the Ophthalmology Outpatient Department with clinically diagnosed primary pterygium and fulfilling the eligibility criteria were considered for inclusion. Written informed consent was obtained from all participants before enrollment.

Inclusion Criteria

- Patients diagnosed with primary pterygium.
- Age between 20 and 80 years.
- Patients willing to participate and provide written informed consent.

Exclusion Criteria

- Recurrent pterygium.
- Severe ocular surface disorders including severe dry eye disease and blepharitis.
- Previous ocular surgery in the affected eye.
- Coexisting ocular pathology likely to influence postoperative outcomes.
- Patients unwilling to participate in the study.

Sample Size and Sampling Technique

Sample size calculation was based on the expected difference in postoperative graft edema reported in previous comparative

studies evaluating anchored conjunctival rotation flap and conjunctival autograft techniques. At a confidence level of 95% and study power of 80%, a minimum sample size of 30 patients per group was estimated. To compensate for possible attrition and loss to follow-up, the sample size was increased to 40 patients in each group.

A total of 80 patients were enrolled using convenient sampling and allocated into two equal groups:

- **Group A (Conjunctival Autograft Group):** 40 patients
- **Group B (Anchored Conjunctival Rotation Flap Group):** 40 patients

Preoperative Evaluation

All enrolled patients underwent detailed ophthalmic evaluation. Demographic characteristics, clinical history, and ocular examination findings were recorded using a predesigned proforma.

The preoperative assessment included:

- Best-corrected visual acuity (BCVA)
- Refraction and keratometric assessment
- Slit-lamp biomicroscopy
- Detailed anterior segment examination
- Fundus examination
- Measurement of pterygium morphology and grading
- Assessment of corneal astigmatism

Pterygium was classified clinically as atrophic, intermediate, or fleshy based on slit-lamp findings.

Surgical Procedures

All surgeries were performed under local anesthesia using standard aseptic precautions by experienced ophthalmic surgeons.

Conjunctival Autograft Technique

After complete excision of the pterygium tissue, a free conjunctival graft was harvested from the superior bulbar conjunctiva. Care was taken to obtain a thin graft without excessive Tenon's tissue. The graft was transferred to the bare scleral area with proper limbal orientation and secured using interrupted 8-0 vicryl sutures.

Anchored Conjunctival Rotation Flap Technique

Following pterygium excision, a superior nasal conjunctival flap measuring approximately 6–8 mm was fashioned while preserving a limbal anchoring point. The conjunctival flap was carefully dissected and rotated nasally to cover the bare scleral defect. The flap was then secured with interrupted 8-0 vicryl sutures. Preservation of the vascular pedicle ensured maintenance of flap blood supply and enhanced tissue viability.

Postoperative Management

All patients received a standardized postoperative treatment regimen consisting of:

- Prednisolone acetate 1% eye drops four times daily for 8 weeks
- Levofloxacin 0.1% eye drops four times daily for 4 weeks
- Lubricating eye drops as required

Patients were instructed regarding postoperative eye care and adherence to follow-up visits.

Follow-up and Outcome Assessment

Patients were evaluated postoperatively at:

- 1 week
- 1 month
- 3 months
- 6 months
- 12 months

At each follow-up visit, a comprehensive ophthalmic examination was performed. The primary outcome measures included surgical duration, recurrence rate, postoperative astigmatism, and procedure-related complications.

Secondary outcome measures included graft-related complications, wound healing characteristics, and overall surgical safety.

Assessment of Recurrence

Recurrence was evaluated using a standardized grading system:

- **Grade 1:** Normal appearance of the operated site.
- **Grade 2:** Fine episcleral vessels extending to the limbus without fibrous tissue.
- **Grade 3:** Fibrovascular tissue reaching the limbus without corneal invasion.
- **Grade 4:** True recurrence with fibrovascular tissue crossing the limbus and invading the cornea.

Grades 1–3 were considered non-recurrent outcomes, whereas Grade 4 was considered recurrence.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) version 26.0. Quantitative variables were expressed as mean ± standard deviation (SD), whereas qualitative variables

were presented as frequencies and percentages.

Intergroup comparisons of continuous variables were performed using the Student's t-test. Paired t-test was used for intragroup comparisons during follow-up. Categorical variables were analyzed using the Chi-square test. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Table 1. Baseline Demographic and Clinical Characteristics of Patients

Variable	Autograft (n=40)	Rotation Flap (n=40)	P value
Male, n (%)	12 (30.0)	9 (22.5)	0.611
Female, n (%)	28 (70.0)	31 (77.5)	
Mean age group predominance	40–69 years	40–59 years	**0.166**
Right eye, n (%)	19 (47.5)	20 (50.0)	1.000
Left eye, n (%)	21 (52.5)	20 (50.0)	

Table 2. Pterygium Characteristics at Baseline

Characteristic	Autograft (n=40)	Rotation Flap (n=40)	P value
Atrophic	4 (10.0%)	1 (2.5%)	
Fleshy	17 (42.5%)	19 (47.5%)	
Intermediate	19 (47.5%)	20 (50.0%)	0.215
Grade 1	6 (15.0%)	3 (7.5%)	
Grade 2	28 (70.0%)	27 (67.5%)	
Grade 3	6 (15.0%)	10 (25.0%)	0.365

Table 3. Surgical Outcomes

Parameter	Autograft	Rotation Flap	P value
Duration of surgery (minutes)	30.25 ± 5.3	27.4 ± 5.4	0.020*
Intraoperative graft loss	2 (5.0%)	0 (0%)	0.154

*Statistically significant

Table 4. Comparison of Recurrence of Pterygium after Surgery between the Two Study Groups

Recurrence	Autograft (n=40)	Rotation Flap (n=40)	P value
Yes	2 (5.0)	3 (8.1)	**0.623**
No	38 (95.0)	37 (91.9)	

Table 5. Changes in Corneal Astigmatism Following Surgery

Follow-up	Autograft Mean ± SD	Rotation Flap Mean ± SD	P value
Preoperative	1.94 ± 0.70	1.90 ± 0.50	0.799
1 Week	1.39 ± 0.37	1.34 ± 0.31	0.518
1 Month	1.26 ± 0.27	1.16 ± 0.35	0.166
3 Months	1.04 ± 0.22	0.91 ± 0.29	0.026*
6 Months	0.96 ± 0.18	0.89 ± 0.23	0.159

Table 6. Postoperative Complications

Complication	Autograft n (%)	Rotation Flap n (%)
Congestion (1 Week)	6 (15.0)	5 (12.5)
Hematoma (1 Week)	0	1 (2.5)
Loose suture (1 Week)	1 (2.5)	2 (5.0)
Retraction (1 Month)	0	1 (2.5)
Superficial vascularization (1 Month)	1 (2.5)	4 (10.0)
Superficial vascularization (3 Months)	3 (7.5)	4 (10.0)
Superficial vascularization (6 Months)	2 (5.0)	4 (10.0)

DISCUSSION

The present study compared the clinical outcomes of conjunctival autograft and anchored conjunctival rotation flap techniques in the surgical management of primary pterygium. Both procedures demonstrated

satisfactory efficacy with low recurrence rates and acceptable postoperative complication profiles. The baseline demographic and clinical characteristics were comparable between the two groups, suggesting that the observed outcomes were primarily attributable to the surgical techniques rather than differences in patient characteristics.

Pterygium surgery aims not only to remove the fibrovascular growth but also to minimize recurrence and postoperative morbidity. Conjunctival autografting has long been regarded as the gold standard technique because of its consistently low recurrence rates and favorable cosmetic outcomes. However, the procedure requires meticulous graft harvesting and placement, which may increase surgical complexity and operative time. In contrast, anchored conjunctival rotation flap surgery utilizes adjacent vascularized conjunctival tissue while maintaining limbal attachment, potentially enhancing graft survival and simplifying the surgical procedure (8,9).

In the present study, the mean duration of surgery was significantly lower in the anchored conjunctival rotation flap group compared with the conjunctival autograft group. This finding is consistent with previous reports indicating that rotational flap procedures are technically less demanding and require less time because a free graft does not need to be harvested, oriented, and secured separately. Kim et al. reported that anchored conjunctival rotation flap surgery was associated with shorter operative times while maintaining comparable clinical outcomes to conjunctival autografting (8). Similar observations were reported by Bilgin et al. and Navin Chandra et al., who concluded that rotational flap techniques provide procedural simplicity and greater intraoperative efficiency (13,14).

Corneal astigmatism is an important indicator of visual rehabilitation following pterygium excision. Both groups in the current study demonstrated progressive reduction in astigmatism during follow-up, reflecting restoration of corneal contour after removal of the fibrovascular tissue. A statistically significant difference was observed at the third postoperative month, favoring the anchored rotation flap group. Previous studies have shown that pterygium excision significantly reduces corneal astigmatism regardless of the surgical technique employed. The improvement in astigmatism observed in the present study is consistent with the findings of comparative studies evaluating rotational flap and autograft procedures, which reported significant postoperative refractive improvement in both treatment groups (12,13).

Postoperative complications were generally mild and self-limiting in both groups. Early complications such as conjunctival congestion, loose sutures, hematoma, and graft-related changes occurred infrequently and did not significantly affect final outcomes. Although superficial vascularization appeared slightly more common in the rotation flap group, the difference was clinically insignificant. Similar complication profiles have been documented in previous studies comparing conjunctival autografts and rotational flap techniques. Haider et al. observed that rotational flap procedures were associated with acceptable postoperative safety and favorable healing characteristics, while Akhter et al. reported comparable complication rates between the two techniques (11,12).

Recurrence remains the most important indicator of long-term success following pterygium surgery. In the present study, recurrence occurred in 5% of patients undergoing conjunctival autografting and 8.1% of patients undergoing anchored conjunctival rotation flap surgery. Although recurrence was numerically higher in the rotation flap group, the difference was not statistically significant. These findings suggest that both procedures are effective in reducing recurrence after primary pterygium excision. Kim et al. reported low recurrence rates with anchored conjunctival rotation flap surgery and demonstrated outcomes comparable to conjunctival autografting (8,9). Similarly, Shakil et al. observed no significant difference in recurrence between the two techniques and concluded that rotational flap surgery represents a safe and effective alternative to conjunctival autografting (15).

The favorable outcomes observed with anchored conjunctival rotation flap surgery may be attributed to preservation of the vascular pedicle and maintenance of limbal orientation, which potentially enhance tissue viability and wound healing. Furthermore, because conjunctival tissue remains attached to its original blood supply, flap edema and graft loss may be minimized. In the current study, intraoperative graft loss was observed only in the autograft group, supporting the technical advantages of the anchored flap technique. Comparable observations have been reported by Kim et al. and Bilgin et al., who highlighted improved graft stability and reduced

manipulation with rotational flap procedures (8,14).

The present study has certain limitations. It was conducted at a single center with a relatively modest sample size and limited long-term follow-up. Larger multicentric studies with longer observation periods are required to establish the long-term superiority of either technique. Nevertheless, the study provides valuable evidence supporting the effectiveness and safety of both conjunctival autograft and anchored conjunctival rotation flap surgery in the management of primary pterygium.

CONCLUSION

The present study demonstrated that both conjunctival autograft and anchored conjunctival rotation flap techniques are effective and safe surgical options for the management of primary pterygium. Both procedures resulted in significant improvement in postoperative corneal astigmatism, low recurrence rates, and acceptable complication profiles during the follow-up period.

The anchored conjunctival rotation flap technique was associated with a significantly shorter surgical duration and absence of intraoperative graft loss, highlighting its technical simplicity and procedural efficiency. Both techniques demonstrated low recurrence rates, and the difference between the two groups was not statistically significant. Overall clinical outcomes remained comparable between the two surgical approaches.

Postoperative complications in both groups were generally mild and self-limiting, with no sight-threatening adverse events observed. These findings suggest that anchored conjunctival rotation flap surgery can serve as a reliable alternative to conventional conjunctival autografting, particularly in settings where shorter operative time and easier surgical handling are desirable.

Further multicentric studies with larger sample sizes and longer follow-up are recommended to validate the long-term efficacy and recurrence outcomes of these techniques.

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