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COMPARATIVE EVALUATION OF PTERYGIUM EXCISION USING SYMMETRICAL CONJUNCTIVAL FLAP TRANSPOSITION WITH AND WITHOUT ADJUNCTIVE INTRAOPERATIVE MITOMYCIN C

Ophthalomology

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ABSTRACT

Background: Pterygium is a common ocular surface disorder in which fibrovascular conjunctival tissue extends onto the cornea, causing irritation, astigmatism, visual disturbance, and cosmetic concerns. Although surgical excision is the standard treatment, recurrence remains a major challenge. This study compared the outcomes of symmetrical conjunctival flap transposition alone with the same procedure combined with intraoperative 0.02% mitomycin C.**Methods:** This prospective comparative study was conducted over one year at Jaipur National University Institute for Medical Sciences and Research Centre, Jaipur. One hundred patients with primary pterygium were equally allocated into two groups. Group A underwent pterygium excision with symmetrical conjunctival flap transposition, while Group B received additional intraoperative 0.02% mitomycin C. Patients were followed to evaluate recurrence and postoperative complications.**Results:** Clinically significant recurrence was lower in the mitomycin C group (2.27%) than in the flap-only group (6.5%). Postoperative complications were generally mild, with no increase in serious adverse events during follow-up.**Conclusion:** Adjunctive intraoperative 0.02% mitomycin C combined with symmetrical conjunctival flap transposition was associated with a lower recurrence rate while maintaining an acceptable safety profile. Larger studies with longer follow-up are recommended to confirm these findings.

KEYWORDS

Pterygium; Symmetrical Conjunctival Flap Transposition; Mitomycin C; Recurrence; Ocular Surface Surgery.

INTRODUCTION

Pterygium is a chronic ocular surface disorder characterized by the growth of a fibrovascular conjunctival tissue across the limbus onto the cornea. Once regarded primarily as a degenerative condition, it is now recognized as a multifactorial disease resulting from the combined effects of chronic ultraviolet (UV) radiation exposure, oxidative stress, persistent inflammation, limbal stem cell dysfunction, abnormal wound healing, and extracellular matrix alterations. Progressive enlargement of the lesion can lead to corneal irregularity, induced astigmatism, visual impairment, chronic ocular discomfort, and cosmetic disfigurement, thereby adversely affecting patients' quality of life.[1–3]

The frequency of pterygium differs among populations and is greatest in tropical and subtropical regions where exposure to ultraviolet-B radiation, dust, wind, and dry climatic conditions is prolonged. Advancing age, outdoor occupations, male sex, and inadequate ocular protection have consistently been identified as important predisposing factors. Histopathological studies have demonstrated elastotic degeneration, fibroblast activation, inflammatory cell infiltration, angiogenesis, and increased production of cytokines and growth factors, including vascular endothelial growth factor (VEGF), transforming growth factor-beta (TGF-β), and platelet-derived growth factor (PDGF), all of which contribute to fibrovascular proliferation and disease progression.[4,5]

Surgical removal remains the treatment of choice for symptomatic or progressive pterygium. Surgery is generally indicated when the lesion threatens the visual axis, induces significant astigmatism, produces recurrent inflammation or persistent irritation despite medical therapy, restricts ocular motility, or causes unacceptable cosmetic appearance. Despite advances in surgical techniques, recurrence after excision continues to represent the greatest obstacle to successful management. Recurrent lesions are often more aggressive than primary pterygia because of excessive fibroblast proliferation and abnormal conjunctival wound healing. Therefore, minimizing recurrence while achieving favorable functional and cosmetic outcomes has become the principal goal of contemporary pterygium surgery.[6]

To reduce recurrence, several surgical approaches have been developed over the years. Earlier techniques such as bare sclera excision were simple to perform but were associated with unacceptably high recurrence rates. Subsequently, conjunctival autografting, limbal conjunctival transplantation, conjunctival rotational flaps, amniotic membrane transplantation, and other reconstructive procedures were introduced. Among these methods, symmetrical conjunctival flap transposition offers several advantages, including preservation of healthy conjunctiva, maintenance of limbal anatomy, shorter surgical duration, reduced wound tension, and rapid epithelial healing. The technique also provides effective coverage of the bare scleral area while conserving conjunctival tissue for possible future ocular procedures.[7,8]

Mitomycin C is an antimetabolite with potent antiproliferative activity that has been widely employed as an adjunct in pterygium surgery. By suppressing fibroblast proliferation and inhibiting DNA synthesis, intraoperative application of low-dose mitomycin C reduces postoperative subconjunctival fibrosis and lowers the likelihood of recurrence. However, inappropriate concentration or prolonged exposure may result in complications such as delayed epithelial healing, scleral thinning, scleral necrosis, infectious scleritis, secondary glaucoma, or cataract formation. Consequently, careful patient selection, standardized application techniques, and close postoperative surveillance are essential to maximize its therapeutic benefit while minimizing potential adverse effects.[9]

Although both symmetrical conjunctival flap transposition and intraoperative mitomycin C have independently demonstrated favorable surgical outcomes, evidence regarding their combined use remains limited. Determining whether adjunctive low-dose mitomycin C offers additional protection against recurrence without increasing postoperative complications is clinically important, particularly in regions where pterygium is highly prevalent. Accordingly, the present study was undertaken to compare the efficacy and safety of symmetrical conjunctival flap transposition alone with the same surgical technique combined with intraoperative 0.02% mitomycin C, with particular emphasis on recurrence and postoperative complications.[10]

Aim

To evaluate and compare the efficacy and safety of pterygium excision with symmetrical conjunctival flap transposition alone and the same surgical technique combined with intraoperative 0.02% mitomycin C in patients with primary pterygium.

Objectives

Primary Objective

- To compare the recurrence rate of primary pterygium after excision using symmetrical conjunctival flap transposition alone and after the same procedure supplemented with intraoperative 0.02% mitomycin C.

Secondary Objectives

- To compare the frequency and nature of postoperative complications between the two treatment groups.
- To assess the safety of low-dose intraoperative mitomycin C when used as an adjunct to pterygium surgery.
- To evaluate the overall clinical outcomes of both surgical techniques during the **scheduled follow-up period.**

Methodology

Study Design
A prospective, comparative, interventional hospital-based study was conducted.

Study Setting
The study was carried out in the Department of Ophthalmology, Jaipur National University Institute for Medical Sciences and Research Centre (JNUIMSRC), Jaipur, Rajasthan, India.

Study Duration
The study was conducted over a period of one year.

Study Population
A total of 100 patients diagnosed with primary pterygium who fulfilled the eligibility criteria were enrolled. Only one eye from each participant was included in the study.

Sample Size
One hundred eyes from 100 patients were equally assigned to two treatment groups:
- Group A (n = 50): Pterygium excision followed by symmetrical conjunctival flap transposition.
- Group B (n = 50): Pterygium excision followed by symmetrical conjunctival flap transposition with adjunctive intraoperative application of 0.02% mitomycin C.

Inclusion Criteria
- Patients aged 18 years or older.
- Clinically diagnosed primary nasal pterygium requiring surgical treatment.
- Progressive pterygium associated with visual impairment, induced astigmatism, recurrent ocular irritation, or cosmetic concern.
- Willingness to participate in the study and provide written informed consent.

Exclusion Criteria
- Recurrent pterygium.
- Pseudopterygium.
- Active ocular infection or significant ocular surface disease.
- Previous surgery involving the affected eye.
- History of glaucoma, scleral thinning, autoimmune ocular disorders, or known hypersensitivity to mitomycin C.
- Inability or unwillingness to comply with the follow-up schedule.

Study Procedure
After obtaining written informed consent, all eligible participants underwent a comprehensive ophthalmic evaluation. This included assessment of best-corrected visual acuity, slit-lamp biomicroscopy, intraocular pressure measurement, anterior segment examination, and documentation of the size and extent of the pterygium.

Participants were allocated equally into two groups. In Group A, pterygium excision was followed by symmetrical conjunctival flap transposition. In Group B, after excision of the pterygium, a sterile sponge soaked in 0.02% mitomycin C was applied to the exposed scleral bed for the predetermined duration. The operative field was then irrigated thoroughly with balanced salt solution before completing symmetrical conjunctival flap transposition.

All procedures were performed under strict aseptic precautions using a standardized surgical technique by experienced ophthalmic surgeons. Following surgery, patients in both groups received the same postoperative treatment regimen consisting of topical antibiotics, corticosteroids, and lubricating eye drops according to the departmental protocol.

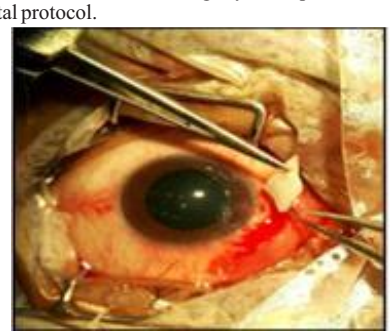

Figure 1- Intraoperative Scleral Application Of Mitomycin-C In Group 2

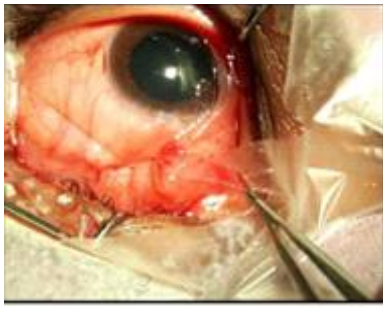

Figure 2- Burning excised pterygium tissue in to lower fornix by 8-0 vicryl in group 1 and group 2

Outcome Measures
Primary Outcome
- Recurrence of pterygium during follow-up, defined as fibrovascular tissue extending beyond the limbus onto the corneal surface.

Secondary Outcomes
- Postoperative complications including flap edema, flap retraction, wound dehiscence, conjunctival granuloma, delayed epithelial healing, infection, scleral complications, and other adverse events.
- Overall surgical safety and postoperative clinical outcomes.

Follow-up
Patients were reviewed at scheduled postoperative visits throughout the one-year study period. At each visit, slit-lamp examination was performed to evaluate wound healing, identify recurrence, and detect any postoperative complications.

Ethical Considerations
The study was conducted in accordance with the principles of the Declaration of Helsinki and Good Clinical Practice guidelines. Approval was obtained from the Institutional Ethics Committee of Jaipur National University Institute for Medical Sciences and Research Centre before the commencement of the study. Written informed consent was obtained from all participants after explaining the purpose of the study, the surgical procedures, expected benefits, possible risks, and the importance of follow-up. Confidentiality of patient information was maintained throughout the study, and participants retained the right to withdraw at any stage without affecting their standard medical care.

RESULTS
Study Population
A total of 100 patients with primary pterygium were enrolled in the study and allocated equally into two groups (50 patients each). During the follow-up period, 10 patients were lost to follow-up (4 from Group 1 and 6 from Group 2). Consequently, 90 patients completed the study and were included in the final analysis, comprising 46 patients in Group 1 (symmetrical conjunctival flap transposition) and 44 patients in Group 2 (symmetrical conjunctival flap transposition with intraoperative 0.02% mitomycin C).

Table 1. Patient distribution

Study parameter	Group 1	Group 2	Total
Initially enrolled	50	50	100
Lost to follow-up	4	6	10
Completed follow-up	46	44	90

Postoperative Complications
Postoperative complications other than recurrence were recorded during the follow-up period. The majority of patients in both groups had an uncomplicated postoperative course.

Among patients who completed follow-up, 39 patients (84.8%) in Group 1 and 29 patients (65.9%) in Group 2 experienced no postoperative complications.

Granuloma formation was the most common complication in Group 1, occurring in 4 patients (8.69%), whereas only 1 patient (2.27%) developed granuloma in Group 2.

Broken sutures were observed in 2 patients (4.34%) in Group 1 and 1 patient (2.27%) in Group 2.

Delayed wound healing occurred more frequently in Group 2 (6 patients; 13.64%) than in Group 1 (1 patient; 2.17%). Likewise, superficial punctate keratitis was observed exclusively in Group 2 (6 patients; 13.64%).

One patient (2.27%) in Group 2 developed corneoscleral melting with associated iritis. No such case was observed in Group 1.

Table 2. Postoperative complications

Complication	Group 1 n (%)	Group 2 n (%)
No complication	39 (84.8)	29 (65.9)
Corneoscleral melting with iritis	0 (0.0)	1 (2.27)
Granuloma	4 (8.69)	1 (2.27)
Broken sutures	2 (4.34)	1 (2.27)
Delayed wound healing	1 (2.17)	6 (13.64)
Superficial punctate keratitis	0 (0.0)	6 (13.64)

Overall, postoperative complications were generally mild and manageable with appropriate medical treatment. Serious complications were uncommon in both groups.

RECURRENCE

Patients were evaluated for recurrence throughout the follow-up period. All recurrences occurred between 3 and 6 months after surgery. Grade 0 (absence of recurrence) was observed in 32 patients (69.6%) in Group 1 and 37 patients (84.09%) in Group 2.

Grade 1 recurrence occurred in 8 patients (17.4%) in Group 1 and 4 patients (9.09%) in Group 2.

Grade 2 recurrence was noted in 3 patients (6.5%) in Group 1 and 2 patients (4.54%) in Group 2.

Clinically significant recurrence (Grade 3), characterized by fibrovascular tissue crossing the limbus onto the cornea, was observed in 3 patients (6.5%) in Group 1 compared with 1 patient (2.27%) in Group 2.

Table 3. Recurrence grading

Recurrence grade	Group 1 n (%)	Group 2 n (%)
Grade 0	32 (69.6)	37 (84.09)
Grade 1	8 (17.4)	4 (9.09)
Grade 2	3 (6.5)	2 (4.54)
Grade 3	3 (6.5)	1 (2.27)
Total	46 (100)	44 (100)

Summary of Findings

The addition of intraoperative 0.02% mitomycin C was associated with a lower observed incidence of Grade 3 recurrence (2.27%) compared with symmetrical conjunctival flap transposition alone (6.5%). However, delayed wound healing and superficial punctate keratitis were more frequently observed in the mitomycin C group. Granuloma formation and broken sutures were comparatively more common in the conjunctival flap-only group. Overall, severe postoperative complications were infrequent in both treatment groups.

DISCUSSION

The present study compared the outcomes of pterygium excision using symmetrical conjunctival flap transposition alone with those of the same procedure combined with intraoperative 0.02% mitomycin C (MMC). The primary endpoint was postoperative recurrence, whereas postoperative complications served as secondary outcome measures. The findings demonstrated a lower rate of clinically significant (Grade 3) recurrence among patients who received adjunctive MMC (2.27%) than among those treated with conjunctival flap transposition alone (6.5%). Although the number of recurrence events was small and statistical significance could not be established, the observed trend suggests that intraoperative MMC may enhance the effectiveness of surgical treatment by reducing the likelihood of postoperative fibrovascular regrowth.[11]

Recurrence following pterygium surgery continues to be a major concern despite improvements in surgical techniques. The process is driven by complex biological mechanisms involving fibroblast proliferation, inflammatory mediator release, angiogenesis, and extracellular matrix remodeling during conjunctival wound healing. Excessive activation of these pathways promotes regrowth of fibrovascular tissue over the cornea, resulting in recurrent disease that may be more aggressive than the primary lesion. Because MMC inhibits DNA synthesis and suppresses fibroblast activity, its intraoperative application is believed to reduce subconjunctival fibrosis and limit postoperative scar formation, thereby decreasing recurrence. These pharmacological properties explain the favorable outcomes reported in several previous studies using carefully controlled low-dose MMC.[12]

In this study, all clinically significant recurrences were detected between three and six months after surgery. This observation agrees with published evidence indicating that recurrence most commonly develops during the early postoperative healing phase, when fibrovascular activity is greatest. Consequently, careful postoperative monitoring during the first six months remains essential for early recognition of recurrence and timely clinical intervention when required.[13]

Postoperative complications were generally infrequent and manageable in both treatment groups. Granuloma formation and broken sutures occurred more often following conjunctival flap transposition alone, whereas delayed wound healing and superficial punctate keratitis were encountered more frequently in patients receiving adjunctive MMC. A single patient in the MMC group developed corneoscleral melting associated with iritis. Although this complication was isolated, it emphasizes the importance of meticulous surgical technique and cautious use of MMC. Previous studies have similarly reported delayed epithelial healing and ocular surface toxicity associated with mitomycin C, particularly when higher concentrations or prolonged exposure times are used. Appropriate dosing, limited exposure, and thorough irrigation are therefore essential to minimize treatment-related complications.[14]

Symmetrical conjunctival flap transposition offers several practical advantages in the surgical management of primary pterygium. The technique provides immediate coverage of the exposed scleral bed with healthy vascularized conjunctiva, promotes rapid epithelialization, and maintains normal limbal anatomy. In addition, preservation of superior bulbar conjunctiva may be beneficial should future glaucoma filtration surgery become necessary. When combined with low-dose intraoperative MMC, the antiproliferative effect of the drug appears to complement the reconstructive benefits of the flap technique by reducing fibroblast activity without substantially increasing serious postoperative morbidity.

The findings of the present investigation are broadly consistent with those reported in previous studies evaluating MMC as an adjunct to conjunctival reconstructive procedures. Although direct comparison between studies should be interpreted cautiously because of variations in patient characteristics, surgical techniques, recurrence definitions, environmental ultraviolet exposure, follow-up duration, and MMC application protocols, most published evidence supports the selective use of low-dose intraoperative MMC to reduce recurrence, particularly in patients considered to be at increased risk of disease recurrence.[15]

Several limitations should be acknowledged when interpreting the results of this study. The sample size was relatively small, and 10 participants were lost during follow-up, leaving 90 patients for the final analysis. Furthermore, the follow-up period was limited to one year, which may not be sufficient to identify late recurrences or delayed complications related to MMC. Future multicentric studies involving larger patient populations and longer follow-up periods would provide more robust evidence regarding the long-term efficacy and safety of combining symmetrical conjunctival flap transposition with intraoperative MMC.

Overall, the results of the present study indicate that adjunctive intraoperative 0.02% mitomycin C may reduce the frequency of clinically significant recurrence when used with symmetrical conjunctival flap transposition while maintaining an acceptable safety profile. Appropriate patient selection, standardized surgical techniques, careful intraoperative application of MMC, and regular postoperative follow-up remain essential for achieving favorable long-term clinical outcomes.

CONCLUSION

Pterygium remains a common ocular surface disorder for which surgical excision is the primary treatment, although postoperative recurrence continues to be an important clinical concern. The findings of this study indicate that combining symmetrical conjunctival flap transposition with intraoperative low-dose (0.02%) mitomycin C was associated with a lower rate of clinically significant recurrence compared with conjunctival flap transposition alone. While mild postoperative complications such as delayed wound healing and superficial punctate keratitis were observed more frequently in the mitomycin C group, serious adverse events were uncommon and both procedures demonstrated an acceptable safety profile. These results suggest that adjunctive low-dose mitomycin C may be a useful addition to symmetrical conjunctival flap transposition, particularly in patients considered to be at greater risk of recurrence. Nevertheless, careful intraoperative application, appropriate patient selection, and regular postoperative follow-up remain essential to optimize surgical outcomes and minimize complications. Further multicentric studies with larger sample sizes and longer follow-up are recommended to confirm the long-term efficacy and safety of this combined surgical approach.

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