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Comparative study to evaluate the clinical outcome between conjunctival autograft transplantation and amniotic membrane transplantation in pterygium

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ABSTRACT

Background: Pterygium is a common ocular surface disorder. Ultraviolet light can induce chronic inflammatory cells in the conjunctiva or damage limbal stem cells, suggesting that chronic inflammation may play a role in the development of pterygium. Surgical excision is the only treatment, with recurrence a major complication. This study is to compare the recurrence rates and surgical outcomes of primary pterygium with conjunctival autograft and amniotic membrane graft.

Materials and Methods: Patients were randomly divided into two groups of 80 patients each. One group received amniotic membrane transplantation (AMT), while the other group underwent pterygium excision with conjunctival autograft transplantation (PECAT). Patients were followed up postoperatively on day 1, day 7, 1 month, 3 months and 6 months and were observed for best corrected visual acuity, recurrence and graft related complications.

Results: Complications were almost equal in both the groups. The recurrence rate was not statistically significant across the groups in our study.

Conclusion: Our study concludes that both the procedures are equally effective in terms of efficacy and outcome. AMT an alternative for bilateral heads or patients who might need glaucoma surgery later. Amniotic membrane grafting is a feasible option for patients, due to the rising prevalence of glaucoma, preserving the conjunctiva for individuals who may require filtering procedures in the future.

1. Introduction

Pterygium is a common ocular surface disorder. Ultraviolet light can induce chronic inflammatory cells in the conjunctiva or damage limbal stem cells, suggesting that chronic inflammation may play a role in the development of pterygium. Surgical excision is the only treatment, with recurrence a major complication. Pterygium affects men twice as often as it does women, and as people age their prevalence rises.[1–4]

Pterygium can be treated surgically using a variety of techniques. The approach to the bare area formed and the manner of excision differ in these approaches.[5–9] After excision in the bare sclera approach,[10,11] the defect area is left exposed without any graft; alternatively, it can be covered with a pedicle flap or the transposition of the pterygium head, or it can be covered by the conjunctiva around it in the primary closure method.[12–14] Another option for covering defects is a conjunctival autograft.[15,16] These conjunctival autografts can be substituted with preserved human amniotic membrane transplants. In addition to helping to preserve the healthy conjunctival tissue, they also reduce the amount of tissue handled during surgery, shorten the recovery period, require less raw tissue for healing, and help to prevent recurrences by reducing

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inflammation by limiting the expression of chemokines by fibroblasts,[17,18] interleukin 1 by epithelial cells, and limit the growth of vascular endothelial cells.[19]

Recurrence is the most common complication after pterygium excision and various techniques have been implemented to reduce its recurrence. Many studies using cryopreserved amniotic membrane after pterygium excision have reported a higher recurrence rate due to the loss of beneficial factors and decreased efficacy of the graft during the process of cryopreservation.[20–22]

This study is to compare the recurrence rates and surgical outcomes of primary pterygium with conjunctival autograft and amniotic membrane graft.

2. Materials and Methods

A prospective observational study was conducted on 80 patients at a tertiary care center who underwent pterygium surgery. The study was reviewed by the Institution Research Ethics Committee ASRAMS BHR-EC/Approval No.7/2023, and informed consent was obtained from all participants before data collection. The tenets of the Declaration of Helsinki were followed during the conduct of this study.

2.1. Sample size

Patients were randomized into two groups of 40 patients each using a random allocation table. One group received amniotic membrane transplantation (AMT), while the other group underwent pterygium excision with conjunctival autograft transplantation (PECAT).

2.2. Inclusive criteria

Consecutive patients over 20 years old, of any gender, and with all grades of pterygium, were included.

2.3. Exclusion criteria

Patients with squint, glaucoma, retinal pathology, pseudopterygium, prior history of ocular surgery, severe dry eye, recurrent pterygium, eyelid disorders, and chronic ocular surface disorders were excluded from the study.

2.4. Study procedure

The study collected demographic details including age, gender, occupation, presenting symptoms, and duration of symptoms. After best-corrected visual acuity (BCVA) was assessed using a Snellen chart, the visual acuity was converted to a logarithm of minimal angle resolution (LogMAR). All patients then underwent an anterior segment examination by slit-lamp biomicroscopy and the type and extent of pterygium were noted. Based on the amount of corneal encroachment the pterygium graded as follows.[23]

1. Grade I- between the limbus and a point midway between the limbus and pupillary margin.
2. Grade II- head of the pterygium present between a point midway between the limbus and pupillary margin and pupillary margin.
3. Grade III- crossing the pupillary margin.

All surgeries were performed by the same surgeon. All patients received peribulbar anaesthesia (3 ml lignocaine 2%+ 2 ml bupivacaine 0.5%). The surgical eye was prepared and covered in a standard sterile manner. Using toothed forceps, the pterygium head was extracted from the cornea. After that, the subconjunctival tissue was separated from the scleral bed underneath and the conjunctival epithelium above, and it was removed at the base.

1. Conjunctival autograft: The cornea was polished after the subconjunctival fibrovascular tissue covering the sclera in the exposed area was cut away using scissors. The bare sclera was measured using a calliper, and a conjunctival graft of the same size was taken from the superotemporal bulbar conjunctiva. The graft was put on the bare sclera with the limbal side of the graft oriented towards the limbus after careful dissection around the limbus to harvest conjunctiva without harming the limbus.
2. Amniotic membrane graft: Processed AMG that is 0.5 mm bigger than the bare sclera was taken. The edges of the graft were buried beneath the conjunctiva, and it was placed over the exposed sclera and hydrated with saline.
3. Postoperative care: The eye was bandaged for 24 hours, and for the next four weeks, topical antibiotic-steroid eye drops were applied six times a day, tapering off gradually. Patients were checked on the first post-operative day, one week later, one month later, three months later, and six months later.

The assessment included visual acuity and ocular symptoms like redness, slit lamp examination of graft position, graft retraction, graft rejection, graft edema, and recurrence of pterygium. Graft edema was defined as the swelling of the graft which was mainly due to the residual Tenon's tissue associated with the graft.[24] Graft retraction refers to a complication that occurs when the transplanted graft fails to take hold and shrinks away from the sclera.

Recurrence was defined as the reactivation of the inflammatory process, which when present in the primary form, there is an acceleration of fibrovascular proliferation and an increase in metalloproteinase synthesis that destroys the Bowman membrane and the stromal collagen that may increase the progression of pterygium.[25]

2.5. Statistical analysis

Patient demographics, presenting symptoms, and preoperative visual acuity (LogMAR) were summarized for

each group using descriptive statistics, including means, standard deviations, and frequencies. To assess between-group differences in these characteristics, independent-sample t-tests were employed for continuous variables (age, LogMAR), while categorical variables (gender, occupation) were compared using chi-square tests. The effectiveness of each surgical technique and postoperative outcomes (e.g., final LogMAR, recurrence rates) were then evaluated using similar inferential statistical methods (independent-sample t-tests and chi-square tests) to compare between the AMT and PECAT groups. Data analysis was performed using Microsoft Excel 2019, with a significance level set at $p < 0.05$.

3. Results

Our study consisted of 80 patients of which 40 patients underwent PECAT and 40 patients were grafted with AMT.

In the PECAT group, 14(35%) patients were males, and 26 (65%) patients were females. 5 (12.5%) patients were in the 21-40 years age group, most of the patients 20 (50%) were in the 41-60 years age group, while 15(37.5%) patients were above 61-80 years of age. 36 (90%) patients in this group were from rural areas and 4 (10%) patients were from urban areas. 22 (55%) patients had pterygium in the right eye and 18(45%) patients had pterygium in the left eye. About 38 (95%) patients had nasal pterygium, while 2 (5%) patients had temporal pterygium none of the patients had biheaded pterygium in this group. Most of the patients 36(90%) had grade II pterygium and 3 (7.5%) patients had grade III pterygium, while 1 (2.5%) patient had grade I pterygium.

In the AMT group, 20 (50%) patients were males and 20(50%) were females. 1 (2.5%) patients were in the 21-40 years age group. 31(77.5%) patients were in the 41-60 years age group, while 8 (20%) patients were 61-80 years age. 32(80%) patients were from rural areas, while 8 (20%) patients belonged to urban areas. 20 (50%) patients had a pterygium in the right eye and 20 (50%) patients had a pterygium in the left eye. 37 (92.5%) patients had nasal pterygium, 3(7.5%) patients had temporal pterygium and none of the patients had bipolar pterygium in this group. 35 (87.5%) patients had grade II pterygium, 4 (10%) patients had grade III pterygium and 1(2.5%) patients had grade I pterygium. There was no statistical significance between gender, demographic location and preponderance of pterygium in our study. However, there was a statistically significant difference (chi-square: 7.170, p-value: 0.028) in the age distribution. People between 41-60 years old are more likely to be included in the study compared to the younger (21-40) and older (61-80) age groups. The composition of the study group with regards to occupation leaned towards outdoor professions (82.5%), compared to indoor ones (17.5%). However, a chi-square test revealed no statistically significant difference between these groups ($\chi^2 = 0.92$, $p = 0.762$). (Table 1)

Comparison of the mean logMAR of BCVA before and after surgery showed significant differences between both the groups ($p<0.001$) (Table 2).

Complications were almost equal in both groups. In the PECAT group, 1 (2.5%) patient had graft recurrence, 7 (17.5%) patients had graft oedema, 3 (7.5%) patients had dryness, 8(20%) patients had graft retraction, granuloma was seen in 2(5.0%) patients and other complications like dellen, epithelial cyst were not observed. In the AMT group, 3(7.5%) patients had graft recurrence, 9(22.5%) had graft oedema, 2 (5.0%) patients had dryness, 6 (15%) patients had graft retraction, dellen was seen in 1 (2%) patient and there were no granulomas or epithelial cysts found. (Table 3)

4. Discussion

The perfect pterygium surgery is free from complications. It is safe and efficient with a low recurrence rate and perfect cosmesis. PECAT, or AMTs, have acquired recognition as a viable treatment option for pterygium with favourable postoperative outcomes, even though numerous surgical procedures have been reported over the years to lessen the difficulties following pterygium removal. Because of its many biological qualities, such as its antiangiogenic, anti-inflammatory, and anti-scarification capabilities, AM is a perfect graft for reconstructing the ocular surface.

In our investigation, we found that older men who engaged in outdoor activities 83% had a greater incidence of pterygium since exposure to UV radiation is one of the risk factors for the condition. Srinivas Marmula et al. reported similar results (59 percent above 55 years and 46.4 percent of males had more prevalence of pterygium.[26] The percentage of people who work outside who have pterygium was 74.8 percent, 16.2 percent, and 80% in Zhong H et al, Asokan R et al, and Salagar K M et al, respectively.[27–29]

Moreover, we found no association between recurrence rate, and pterygium size, and patient age which is in line with previous studies[30] although some other studies reported different recurrence rates according to patient's age.[31]

4.1. Graft oedema

This was noted as the most common complication, affecting 17.5% (7 participants) compared to 9 (22.5%) experiencing graft oedema in our study. Immediate post-surgical problems found in our study were graft oedema which resolved without any adverse effects. Mutla et al. observed that graft edema was the most frequent complication in limbal conjunctival autograft transplanting. Rao KVM et al.[32] which also reported graft oedema as a frequent complication following pterygium surgery. A similar observation was made in our study graft oedema in PECAT

Table 1: Demographic data of the study group

Variables		PECAT	AMT	Chi-square	P value
Sex	Male	14(35.0%)	20(50.0%)	1.841	0.175
	Female	26(65.0%)	20(50.0%)		
Eye	Right	22(55.0%)	20(50.0%)	0.201	0.654
	Left	18(45.0%)	20(50.0%)		
Age	21 -40	5(12.5%)	1(2.5%)	7.17	0.028
	41-60	20(50.0%)	31(77.5%)		
	61-80	15(37.5%)	8(20.0%)		
Geographical distribution	Urban	4(10.0%)	8(20.0%)	1.569	0.21
	Rural	36(90.0%)	32(80.0%)		
Type of pterygium	Nasal	38(95.0%)	37(92.5%)	0.213	0.644
	Temporal	2(5.0%)	3(7.5%)		
Grading	Grade 1	1(2.5%)	1(2.5%)	0.157	0.925
	Grade 2	36(90.0%)	35(87.5%)		
	Grade 3	3(7.5%)	4(10.0%)		
Occupation	Outdoor	33(82.5%)	34(85.0%)	0.92	0.762
	Indoor	7(7%)	6(15.0%)		

Table 2: BCVA in logMAR

BCVA in logMAR		Mean±standard deviation	p value
PECAT	Preoperative	0.41±0.2	<0.001
	Postoperative	0.28±0.04	
AMT	Preoperative	0.45±0.203	<0.001
	Postoperative	0.28±0.069	

Table 3: Complications of pterygium excision

Complications	PECAT	AMT
Graft oedema	7(17.5%)	9(22.5%)
Dryness	3(7.5%)	2(5.0%)
Graft retraction	8(20%)	6(15%)
Epithelial cyst	0(0%)	0(0%)
Granuloma	2(5.0%)	0(0%)
Dellen	0(0%)	1(2.5%)
Recurrence	1(2.5%)	3(7.5%)

group. A study by Sheppard JD et al had similar findings and observed that mild complications had little effect on graft survival.[33]

4.2. Graft retraction and recurrence

These complications seem to occur at a moderate rate, with 20% (8 participants) in PECAT and 15% (6 participants) experiencing retraction. This aligns with Rao KVM et al.[31] study which also reported similar results and 7.5% (3 participants) experiencing recurrence. Zheng K, et al and Ozer A et al observed fewer recurrences with the conjunctival autograft approach.[34,35] We noted 1 (2.5%) recurrence in the PECAT group and 3 (7.5%) in the AMT group. These rates were less than those found in prior studies by Jose B. Barbosa Jr. et al. where recurrence rates were 17.9% in patients who underwent consecutive AMT procedures and 9.75% in patients having PECAT. Only a few modest, temporary postoperative problems were noted in the present study for each surgery. Significant issues that could have affected vision were not reported. All individuals with grade III pterygium who also may be at risk for glaucoma should also have amniotic membrane grafting taken into consideration.

4.3. Epithelial cyst, granuloma, and dellens

These complications were not observed in any participants (0%).

An analysis of post-procedural complications revealed graft oedema (17.5%) as the most frequent, followed by dryness (22.5%), graft retraction (20%), and recurrence (7.5%). Notably, epithelial cysts, granulomas, and dellens were not observed in any participants.

In our study both of the study groups had satisfactory cosmetic results, negating the need for additional surgery as compared to Kucukerdonmez et al.'s study which found that conjunctival autografting produced superior final appearance outcomes compared to AMT.[36]

Amniotic membrane transplantation and split conjunctival autograft, a horizontal/vertical conjunctival tissue graft from the pterygium, are two common treatment options for double-headed pterygium.[37] Elhamaky et al.'s study suggests that in cases of double-head pterygium, splitting the free conjunctival autograft into two sections and suturing in place of the excised pterygium on both sides of the corneas would be an appropriate choice.[38] To treat double-headed pterygium, Yeung SN et al.'s study[39] used successive pterygium removal with CAT. Sequential CAT treatment for double-headed pterygium is safe and effective, and CAT from the same site several months later does not seem to increase the rate of recurrence. There were no cases of double-head pterygium in our study.

We did not combine pterygium and cataract surgery in our study. However, pterygium excision can be carried out either in conjunction with or prior to cataract surgery, as per the research by Sharma et al. It is important to wait for corneal stabilization after sequential surgery, which may take four to twelve months. Because single-step combined pterygium excision and cataract surgery offer quick visual recovery, fewer hospital visits, and is more cost-effective, many patients choose it.[40]

Due to the limited sample size and the low prevalence of some complications, statistical analysis using chi-square might not be reliable for a definitive conclusion which is a limitation of this study.

Several strategies have been tried to reduce fibrovascular activity to reduce the rate of recurrence, including B-irradiation, conjunctival and limbal auto-grafting, anti-mitotic medications, and amniotic membrane transplantation.[41] Recurrence is a common complication following pterygium excision and represents a significant surgical problem. The recurrence rate was not statistically significant across the groups in our study.

5. Conclusion

In conclusion, managing pterygium can be difficult, particularly for those who also have an ocular surface condition. Our study concludes that both procedures are equally effective in terms of efficacy and outcome. Amniotic membrane grafting is a feasible option for the patients, due to the rising prevalence of glaucoma, preserving the conjunctiva for individuals who may require filtering procedures in the future. If pterygium excision is performed correctly, there is extremely little chance of recurrence with any treatment.

6. Source of Funding

Nil.

7. Conflicts of Interest

Nil.

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