Comparison of Amniotic Membrane Transplantation Versus Autologus Stem Cell Transplantation for Recurrent Pterygium

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Abstract

Purpose: To compare the outcome of amniotic membrane transplantation (AMT) versus autologus limbal stem cell transplantation (LSCT) in the management of recurrent pterygium.

Setting: Suez Canal University Hospital, Ophthalmology Department, Ismailia, Egypt.

Methods: This is a comparative prospective case series study included forty two eyes with recurrent pterygia. They were equally and randomly assigned to either amniotic membrane transplantation (AMT) or autologus limbal stem cell transplantation (LSCT). Eyes were analyzed preoperatively and followed for 6 months postoperatively.

Results: The study included 18 males and 24 females. The mean age was 51.09 ± 11.3 years in the AMT group and 43.57 ± 14.9 in the LSCT group.

The mean preoperative best corrected visual acuity was 0.41 ± 0.29 in the AMT and 0.52 ± 0.22 in the LSCT groups upon inclusion into the study. The mean postoperative best corrected visual acuity was 0.68 ± 0.21 in the AMT and 0.79 ± 0.18 in the LSCT groups. There was a highly statistically significant difference between the results.

There were no intraoperative complications. While postoperatively complications including vascularization, cicatrization, chronic inflammation and recurrence were higher in the AMT group.

Conclusion: The data support the efficacy of autologus limbal stem cell transplantation for recurrent pterygium with favorable outcome and less complication.

Key Words: Pterygium – Amniotic membrane – Limbal stem cell transplantation.

Introduction

PTERYGIUM is commonly seen in Egypt as it lies between latitudes 22° and 32° north of the equator, a part of the pterygium belt (located between 37° north and south of the equator) described by Cameron [1].

Although pterygium is not generally considered to be a blinding condition, in many parts of the developing world severe pterygium remains a cause of corneal blindness. In addition to being cosmetically unacceptable, symptoms of pterygium may range from mild ocular surface irritation and dryness, to decreased vision from irregular astigmatism or obscuration of the visual axis [2].

Many researchers have suggested that pterygium is a main manifestation of ocular surface disorders, perhaps as a consequence of ultraviolet light related stem cell destruction [3].

Coroneo (1990) proposed that the initial biologic event in pterygium was an alternation of the limbal stem cell due to chronic ultraviolet light exposure, resulting in concomitant breakdown of the limbal barrier and subsequent conjunctivalization of the cornea [4].

Recurrent pterygium is characterized by hyperproliferation of subconjunctival fibroblasts, resulting in fibrosis with a more accelerated growth than primary pterygium. Excision of fibrous tissue with or without conjunctival flap is often insufficient because the underlying disorder, subconjunctival fibrosis, is not treated [4].

The plethora of surgical and medical measures currently available testifies to that fact that controversies still dominate the literature.

Surgical procedures aimed at replacing diseased epithelium have been developed over the past decade. Since 1995, when Kim and Tseng described amniotic membrane transplantation (AMT) for
ocular surface reconstruction, amniotic membrane transplantation has become the treatment of choice for some pathologies of the ocular surface [5].

In the past 15 years, therapeutic techniques for the reconstruction of the ocular surface have been greatly advanced by the introduction of limbal stem cell transplantation. The therapeutic effectiveness of these procedures lies in their ability to restore the limbal epithelial cell population and the limbal stroma that supports the epithelial cells [6].

Materials and Methods

This is a comparative prospective case series study that aims to compare the outcome of amniotic membrane transplantation (AMT) versus autologus limbal stem cell transplantation (LSCT) in the management of recurrent pterygium.

The study included 42 eyes with recurrent pterygium indicated for surgery that were equally and randomly assigned to either technique with a minimum follow-up of 6 months.

Inclusion criteria: the indications for pterygium surgery were (a) visual impairment; (b) recurrent inflammation; (c) motility restriction; (d) cosmetic disfigurement.

Exclusion criteria included patients with progressive ocular disease that is unrelated to corneal condition and affects visual acuity, gross bilateral complete stem cell deficiency and refusal of the patient to the surgical technique.

All patients underwent complete preoperative evaluation (Complete history & ophthalmological examination). A written consent was taken from all patients.

Surgical technique:
The basic surgical technique was pterygium excision with bare sclera technique.

The autologus limbal stem cell transplantation group:
Surgical technique consisted of translocation of the healthy portion of the limbus from the ipsilateral eye or the contralateral eye, to the compromised area.

Obtaining the donor limbus: The size of donor area from the healthy limbus in the opposite meridian of the damaged limbus or the contralateral eye, varied according to each case. The target area corresponding to 2-3 clock hours and consisting of 2 mm of peripheral cornea, limbus, and 3 mm of bulbar conjunctiva was dissected.

Transplantation of the limbal stem cell: after obtaining the donor limbus, it was carefully transferred to the previously prepared receptor bed and fixed with interrupted 10-0 mononylon sutures.

The amniotic membrane transplantation group:
In all transplantation procedures, the amniotic membrane container was thawed at room temperature and rinsed 3 times in balanced sterile solution. The amniotic membrane was implanted with the surface of the epithelium-basement membrane uppermost and stromal side in contact with the globe. The upper most surface can be detected by blunt forceps since epithelium/basement membrane surface is non sticky while stromal side sticky and not shiny.

Resection of the pterygium and then the fragment of amniotic membrane of the same size as the defect area created was implanted as conjunctival graft (inlay technique). The graft was sutured directly onto the conjunctiva, edge-to-edge, using interrupted 8-0 non-absorbable sutures.

Post operative care:
The following medications was given to all eyes: combined steroid, antibiotic eye drops, combined steroid, antibiotic eye ointment at bedtime, topical cycloplegic eye drops. Systemic Non-Steroidal Anti Inflammatory Drugs (NSAID) was given in cases with severe postoperative pain or inflammation.

Post operative follow-up was scheduled at days 1, 7, 15, 30, and then monthly for six months.

In every follow-up visit the following was done:
Best corrected visual acuity (BCVA) after complete epithelization.

Slit Lamp examination with special attention to:
The conjunctiva for slippage, fibrosis and adhesions.
• The corneal epithelization, vascularization and clarity.
• The donor site for epithelization.
• Presence of anterior segment complications.
• Colored photography for documentation of the ocular surface.

Main outcome measures:
The evaluation of the surgical outcome was made regarding:
• The corneal re-epithelization.
• Improvement in the best corrected visual acuity (BCVA) after complete epithelization.
**Results**

This study included 42 patients who had recurrent pterygium and were randomly and equally divided into two groups, treated by amniotic membrane transplantation and autologous limbal stem cell transplantation (21 eyes in each group).

The study included 18 males and 24 females. The mean age was 51.09 ± 11.3 years in the AMT group and 43.57 ± 14.9 in the LSCT group.

The history of previous treatment among the AMT group revealed excision only (71.4%) and excision + Mitomycin C application (28.6%). While the SCT group revealed excision only (57.1%) and excision + Mitomycin C application (42.9%).

The mean preoperative best corrected visual acuity was 0.41 ± 0.29 in the AMT and 0.52 ± 0.22 in the LSCT groups upon inclusion into the study. There were no statistical differences between the two groups as regarding the age and preoperative best corrected visual acuity. So the two groups were statistically homogenous and comparable.

The mean postoperative best corrected visual acuity was 0.68 ± 0.21 in the AMT and 0.79 ± 0.18 in the LSCT groups. There was a highly statistically significant difference between the results (Table 1).

The follow-up period revealed epithelization in the AMT within mean period of 7.66 ± 3.0 days. While epithelization in the LSCT occurred within mean period of 9.28 ± 5.19 days. There was a no statistically significant difference between the results (Table 1).

Two of our patients were documented in Fig. (1) which illustrate the images of two cases of recurrent pterygium.

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**Fig. (1): Illustrates the images of two cases of recurrent pterygium.**

*Top row:* Case of recurrent pterygium underwent AMT A) after excision of pterygium, B) with amniotic membrane transplantation as a limbal graft in the first week and C) post operative view after one month.

*Bottom row:* Case of recurrent pterygium underwent LSCT D) after excision of pterygium, E) with amniotic membrane transplantation as a limbal graft in the first week and F) post operative view after one month.
There were no intraoperative complications. While postoperatively complications including vascularization, cicatrization, chronic inflammation and recurrence were represented in Table (2).

There was a highly statistically significant difference between the results as regarding the recurrence rate.

Table (2): The complications in the AMT and LSCT groups.

<table>
<thead>
<tr>
<th>Complications</th>
<th>AMT group (%)</th>
<th>LSCT group (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vascularization</td>
<td>14.3</td>
<td>23.8</td>
</tr>
<tr>
<td>Cicatrization</td>
<td>9.5</td>
<td>9.5</td>
</tr>
<tr>
<td>Chronic inflammation</td>
<td>9.5</td>
<td>9.5</td>
</tr>
<tr>
<td>Recurrence</td>
<td>28.6</td>
<td>9.5</td>
</tr>
</tbody>
</table>

AMT: Amniotic membrane transplantation group.  
LSCT: Limbal stem cell transplantation group.

Discussion

In our search for the pathogenesis of pterygia, several important clinical and pathologic characteristics of primary and recurrent pterygia have emerged:

Epidemiological studies have firmly established that UV-B radiation correlates as the etiologic agent for pterygia and limbal tumors.

Pterygia begin growing from limbal epithelium and not from conjunctival epithelium.

A segment of limbal epithelium, the migrating limbus, invades the cornea centripetally followed by conjunctival epithelium.

A distinct type of corneal cells develops at the leading edge of the pterygia tissue.

Vascularization occurs in the conjunctiva adjacent to pterygia.

Bowman's layer is dissolved under the leading edge of the pterygia. Pterygia have a high recurrence rate [7].

Recurrent pterygium is a challenging ocular surface disorder that is often resistant to conventional surgeries. Although various surgical approaches have been advocated, recurrence is still common, with an incidence ranging up to 55% [8].

In our series the mean age was 51.09 ±11.3 years in the AMT group and 43.57 ±14.9 in the LSCT group.

The patient age has been recognized as a risk factor that will affect disease severity and prognosis in patients with ocular surface disease who will undergo amniotic membrane transplantation or limbal stem cell transplantation. A young patient with stem cell disease will typically have more inflammation than an older patient with the same disease process. Increased inflammation will worsen not only the symptoms and prognosis but also the likelihood of any surgical success [9].

In our series there were improvements in the best corrected visual acuity from mean preoperative best corrected visual acuity 0.41 ±0.29 to become 0.68±0.21 in the AMT group and 0.52±0.22 to be 0.79±0.18 in the LSCT group. There was a highly statistically significant difference between the results (Table 1).

Oscar Gris et al. (2000) noted improvement of BCVA in 3 of 7 patients with advanced recurrent pterygium, by two lines on the Snellen chart because of reduced astigmatism and liberation of the visual axis from pterygial encroachment. In the 4 remaining patients the visual acuity was unchanged after limbal-conjunctival autograft transplantation [10].

The follow-up period revealed epithelization in the AMT within mean period of 7.66±3.0 days. While epithelization in the LSCT occurred within mean period of 9.28±5.19 days.

The variability regarding the epithelization following limbal stem cell transplantation among studies could be explained by the different sources of corneal stem cells (autografts or allografts), the preoperative conditions of the ocular surface (partial or total stem cell deficiency) and the effect of the ocular surface environment (tear function, surface cicatrisation and eyelid mobility), all these factors will affect the prognosis of the ocular surface [11].

In our series the success rate was higher in the LSCT (90.5%) group with low recurrence (9.5%),
while in the AMT group success rate was (71.4%) group with recurrence (28.6%).

These results are consistent with the results of Prabhasawat et al. [12] with recurrence rate 37.5% in the recurrent pterygium group.

Luanratanakorn P et al. (2006) have reported in their study (287 eyes with either primary or recurrent pterygium that were randomized to undergo conjunctival autograft or AMT after pterygium excision) a higher recurrence rate with AMT 28.1% (25% and 52.65 for primary and recurrent pterygium respectively) than the conjunctival autograft group 13.3% (12.3% and 21.4% for primary and recurrent pterygium respectively) after 6 months follow-up period. The authors attribute this high recurrence rate to race of patients (Asia), amount of subconjunctival tissue removal, type of sutures used and medication given after surgery [13].

It is believed that the surgical trauma and subsequent postoperative inflammation activates subconjunctival fibroblasts and the proliferation of fibroblasts, vascular cells and deposition of extracellular matrix proteins in turn contribute to the pterygium recurrence [14].

References


