Amniotic Membrane Transplantation In Acute Chemical Ocular Burns

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Abstract :

Aim : To evaluate the role of amniotic membrane transplantation (AMT) in patients with acute Chemical ocular burns. **Material and Methods :** In a prospective study of 15 patients with grade II-IV acute chemical ocular burns (Roper Hall classification) were included. Out of 15 patients 10 eyes had lime burns and 5 eyes had acid burns. There were 3 eyes of grade II, 4 eyes of grade III and 8 eyes of grade IV burns. **Results :** Patients were followed up for 10.14+_4.41 months. All patients had immediate relief of pain postoperatively. Of 15 eyes, nine (60%) showed epithelialization within 1-4 weeks(15.33+_9.91 days).The final visual acuity improved in 10 to 15 eyes(66%). Eyes with burns of grade II and III showed more visual improvement than those with grade IV burns. None of the eyes showed perforation. Symblepheron was seen in 9 of 15 eyes (60%).Of 15 eyes, 12(80%) experienced limbal stem cell deficiency and showed superficial corneal vascularization. **Conclusion:** AMT helps in ocular surface reconstruction, promotes rapid epithelial healing and partially restores limbal stem cell function.

Introduction : Chemical exposure to the external eye can result in trauma ranging from mild irritation to severe damage of the ocular surface and anterior segment with permanent vision loss. Chemical burns constitute between 7.7% and 18% of all ocular trauma and represent one of the "true" ophthalmic emergencies.Injuries are usually work related with the remainder occuring at home or during an assault.[1]

The severity of chemical injury is related to the type of chemical, the volume of direct exposure, the pH of the solution and the duration of exposure. Alkali burns are the most common cause of ocular burn and also tend to cause the most ocular damage.[2,3] The goal of treatment is to minimize further damage to ocular surface and ultimately restore a normal ocular surface anatomy and visual function. Limbal stem cell transplantation, amniotic membrane transplantation, and ultimately keratoprosthesis may be indicated depending on the patients' needs.[4]

Damage to limbal stem cell results in corneal conjunctivalization, vascularization, chronic inflammation, and recurrent or persistent epithelial defects. Severe damage to conjunctival cells causes mucus deficiency and persistent subconjunctival inflammation resulting in severe dry eye and fibrosis of subconjunctival tissue. The successful management of chemical burns demands reducing the severity of damage to both limbal stem cells and conjunctival cells besides reducing inflammation and preventing progressive tissue melting.

Recently, there have been several reports of successful treatment of acute ocular burns using amniotic membrane transplantation. Meller et al[5] reported that AMT alone was sufficient to restore corneal and conjunctival surface in mild to moderate burns. In severe burns, it restored the conjunctival surface without symblepharon and reduced limbal stromal inflammation but did not prevent limbal stem cell deficiency that required further limbal stem cell transplantation.

Aim : To evaluate the role of amniotic membrane transplantation in patients with acute ocular burns.

Material & Methods : In a prospective study of 1 year amniotic membrane transplantation was performed in 15 patients with acute chemical ocular burns. The age ranged between 6–53 years. The male: female ratio was 10:4 with a mean age of 20.60 ± 11.93 years for the males and 16.25 ± 8.42 years for females. The severity was classified as grade II in 2 eyes, Grade III in 6 eyes and Grade IV in 7 eyes based on the criteria defined by the Roper-Hall.[6] Out of the 7 eyes in grade IV burns, five eyes had total limbal

ischaemia(LI). A total of five eyes had conjunctival ischaemia between 80 and 100%. All eyes had epithelial defect at presentation.

All patients received a detailed ophthalmic examination, including visual acuity, slit lamp biomicroscopic examination, tonometry, and fundus examination (wherever possible). The Schirmer test with and without anaesthesia was used to evaluate tear function. A detailed assessment of limbal ischaemia and conjunctival involvement in the form of necrosis, lime deposits, and ischaemia was made. Cases with lid involvement were excluded from the study.

All the patients were initially treated with medical therapies consisting of copious saline irrigation, topical antibiotics, lubricants, cycloplegics, 10% citrate and systemic vitamin C.All patients had persistent inflammation, epithelial breakdown and limbal ischaemia without any progress at presentation before amniotic membrane transplantation (AMT). AMT was performed within 3 weeks after injury. Informed consent was obtained after explanation of the procedure being undertaken.

In 7 eyes amniotic membrane was used as a circular patch covering the cornea and limbus and sutured to the less damaged conjunctival surface (so that the damaged area was covered). In the remaining 8 eyes, amniotic membrane covered the whole ocular surface from lid margin to lid margin. Amniotic membrane was spread on the surface of eye stromal side down.Edges of amniotic membrane after trimming were sutured to lid margins with 8/0 vicryl. Bandage contact lens was applied to all eyes after the surgery.

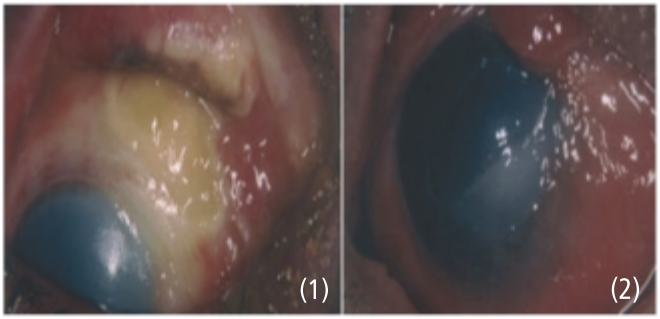
Postoperatively all patients received moxifloxacin eye drops 0.5%, tear substitutes and topical ascorbate (10%) four times daily. Drops were tapered and discontinued after 2–3 months.

Results : In all, 11 patients were men (73.33%) and 4 were women (26.66%). The average age at the time of surgery was 19.35 ± 10.91 years. (range 6–53 years). The most common etiological agent was lime (9 eyes). Injury was accidental in all the eyes (15 eyes) and most injuries were incurred at home (8 eyes). The mean follow-up after the surgery was 10.14 ± 4.41 months (range 4–15 months). Amniotic membrane transplantation was performed within 3 weeks (9.93 ± 3.8 days) after the injury (range 3–16 days). Amniotic membrane disintegrated on its own over a period of 7–20 days.

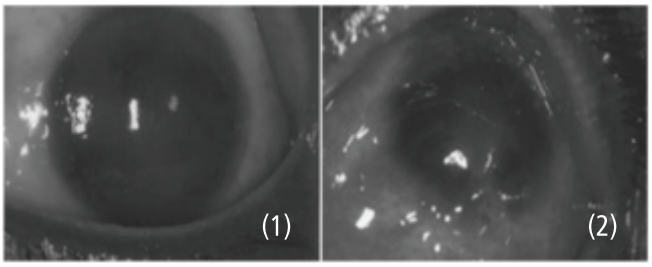
Notably, the pain was dramatically relieved after the AMT in all patients. All the patients were completely free from any pain or discomfort after AMT. Epithelial defects of nine eyes (60%) healed within 1–4 weeks (15.33 ± 9.91 days). Two eyes healed between 2 and 2.5 months and four eyes had persistent epithelial defects at the end of 3 months that took another 1 month to heal. The duration of epithelial defect healing was significantly faster in grade II and III burns compared with the group with grade IV burns. None of the patients developed corneal perforation.

For a follow up period of 10.14± 4.4 months, improvement in visual acuity was seen in 10 of 15 eyes (66.66%). All eyes with Grade II (three eyes) and Grade III (four eyes) showed visual improvement. Whereas in Grade IV burns, out of eight eyes only three eyes had visual improvement, in two eyes it remained same, and three eyes it deteriorate. One eye became PR inaccurate because of development of secondary glaucoma and uveitis.

Superficial corneal vascularization as an indicator of limbal stem cell deficiency was seen in 11 of 15 eyes (73.33%). In Grade II burns 3 eyes had 2 clock hours, in grade III burns, 1 eye showed 3-clock hour of peripheral superficial corneal vascularization. One eye of Grade III burns had 6 clock hour and all eyes of grade IV burns 8–12 clock hour of superficial corneal vascularization encroaching till the center. The severity of corneal vascularization was related to the severity of chemical burn.



Patient 4 Grade IV lime burn : (1) At presentation, right eye had total limbal ischemia, 100% epithelial defect and superior conjunctival necrosis was noted, (2) After 2 months of AMT granuloma pyogenicum, PED, corneal vascularization, and symblepharon were noted



Patient 8 Grade IV lime burn. (1) Before surgery total LI with 50% conjunctival involvement and 100% epithelial defect were noted. (2) After 4 months of AMT, corneal vascularization was noted.

Discussion : Ocular chemical burns cause extensive limbal and conjunctival cell destruction. But it is conceivable that there remain some conjunctival and corneal stem cells at the basal level, even though flourescein depicts large ocular surface defects. Persistent inflammation with leucocytic infiltration in the acute stage causes further gradual stem cell loss. Persistent inflammation prevents epithelialization and accelerates ulceration and melting with globe perforation. It also contributes to scarring sequelae like symblepharon and lid shortening, tear film deficiency, and inflammatory granuloma in the chronic stage. In addition, in severe burns ischaemic changes result in anterior segment necrosis and sterile corneal ulceration at an early stage after the injury.

Amniotic membrane transplantation (AMT) can be used both as a graft which can provide a basement membrane for epithelialization and/or as a patch where it acts as a biological bandage contact lens.[7] It is believed that when used at an early stage, AMT would promote healing of ocular surface by preventing leucocytic infiltration, decreasing the duration and severity of inflammation and protecting the proliferating epithelial stem cell.

AM rapidly restored the ocular surface in Grade II burns. Grade II burns, that involve partial stem cell loss usually have a good prognosis with conventional treatments. AMT was effective to a certain extent in Grade III burns also. AMT promoted epithelialization and none of the eyes had persistent epithelial defects, and improvement in visual acuity was noted in all eyes. None of the eyes developed ulceration or perforation.

It was shown that cryopreserved amniotic membrane transplantation to the entire ocular surface within two weeks of a chemical or thermal burn results in immediate pain relief and healing of epithelial defects in patients with grade II-III burns.[8]

In 2003,A study of cryopreserved amniotic membrane patching (AMP) for an acute ocular chemical injury documented based on a three-center study out of Japan and Miami. Of the five cases in this study, four were grade II epithelial defects, the fifth was grade III. All cases experienced rapid pain relief after AMP, epithelialization of the cornea and improved visual acuity within two weeks after surgery. In the mean follow-up of 19.6 months, the ocular surface remained stable with no cicatricial complications.[9]

Meller et al[5] treated 13 eyes of acute burns with AMT within 2 weeks after the injury. A total of seven eyes had grade II–III burns and six eyes had grade IV burns. Epithelial defects of all but two patients healed in 2–5 weeks. Only one patient developed a symblepharon. All eyes with grade IV burns experienced limbal stem cell deficiency.the results co-relates with the results of our study.

Although AMT was not totally effective in preventing symblepharon and corneal vascularization, their severity was mild to moderate. The utility of AM in grade IV was found to be highly limited. Symblepharon and corneal vascularization were noted in all eyes. In all, 2 eyes developed ankyloblepharon and 1 eye went into phthisis. It thereby suggested that in severe burns with extensive conjunctival damage it does not completely restore the conjunctival surface and with associated extensive limbal stem cell damage it does not prevent the sequelae of limbal stem cell deficiency.

Conclusion: AMT helps in ocular surface reconstruction,promotes rapid epithelial healing and

partially restores limbal stem cell function.

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