

## Amniotic Membrane Transplantation in the Eye

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### Abstract

### Review Article

Amniotic membrane transplantation (AMT) has a long tradition in eye surgery and become popular because of newly developed of tissue preservation. Amniotic membrane transplantation used successfully as either a graft or a bandage. Amniotic membrane has been used in treatment of a number of ophthalmolog conditions, such as pterygium and Stevens-Johnson syndrome;; with ulceration in persistent epithelial defects; chemical and thermal burns. Amniotic membrane anti-microbial properties and low immunogenicity and has anti-inflammatory, which can be beneficial to eye patent. The clinical use of membrane has further expanded. Amniotic membrane has anti-scarring effects and anti-inflammatory and contains growth factors that promote epithelial wound healing on eye. Amniotic Membrane Transplantation good for conjunctival and corneal reconstruction in many situations, like conjunctival scarring and acute burn.

**Keywords:** Eye, Amniotic membrane transplantation, cornea, conjunctiva, ocular scar.

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### Amniotic membrane (AM) Procurement and histology

The Amniotic membrane is the innermost layer of the placenta, biological properties of Amniotic membrane are retained, and as a result this natural

matrix can be used to replace damaged stromal tissue of the surface of the eye.

Amniotic membrane is the innermost layer of the fetal membranes see Fig-1.

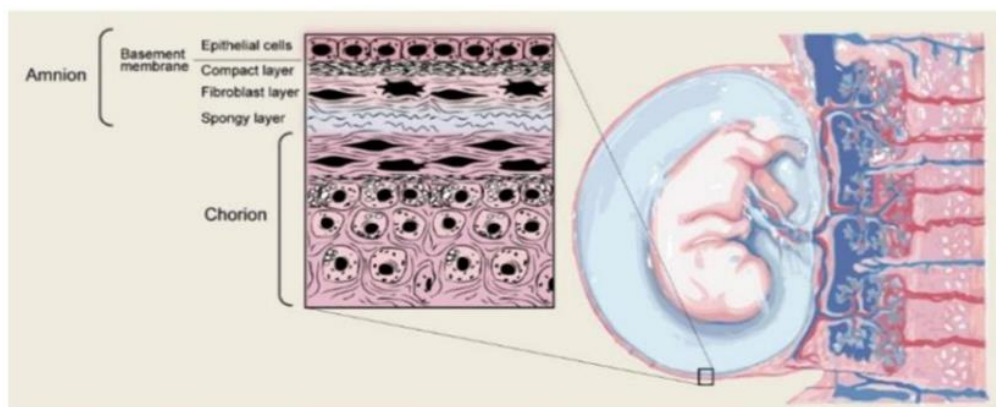


Fig-1: Show amniotic membrane

It consists of:

- A single layer of epithelial cells.
- Thick basement membrane.
- Avascular stromal matrix

The stromal side of the amniotic membrane is covered by a mucinous material and is called the 'spongy layer'. When the membrane is spread on a

piece of paper, fine non-toothed forceps is used to gently pinch the surface of the membrane with the forceps lightly touching the membrane. If a strand of jelly (vitreous) like material is drawn as the forceps is lifted it indicates the stromal side.

Human amniotic membrane Transplantation considered one of the major new surgery of the eye

surface. At the first ophthalmology use of amniotic membrane Transplantation since almost 70 years ago, amniotic membrane transplantation has performed in larger numbers of patients since 1995, with promising results.

Most disorders of the ocular surface, like persistent epithelial defects of the cornea, chemical burns still pose a clinical challenge in eye surgery.

### Preparation of AM

- The membrane is soaked in balanced salt solution for 30 minutes, which allowed the spongy layer to swell considerably and facilitated its removal as a single sheet.
- Before using Membranes is washed.
- Square pieces of amniotic membrane in 2 mL PBS with dimethyl sulfoxide (DMSO) and frozen at  $-80^{\circ}\text{C}$ .
- In Stored amniotic membrane segments were thawed and thoroughly cleaned by three washes in 5mL saline for 10 minutes containing protease inhibitor.
- TGF-1 release not typically detectable was reduced
- After the third wash. They were stored at  $-80^{\circ}\text{C}$  for a minimum of 6 months to window period of HIV infection covered the before use.

### Types of Amniotic Membrane

2 main types of amniotic membrane are commercially available for use: dehydrated and cryopreserved both is come in a variety of sizes and tissue thicknesses, depending on using.

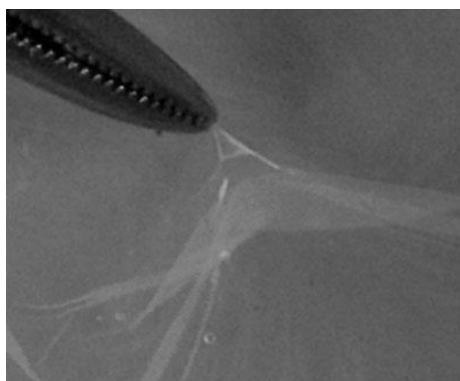


Fig-2: Amniotic Membrane graft

### GRAFT Amniotic Membrane

The membrane is applied such that healing /reepithelization was expected to occur over the membrane. The membrane became into the ocular surface tissue. When used as Amniotic Membrane graft the membrane side is placed facing upwards

### PATCH Amniotic Membrane

The membrane is applied as a layer over the affected area. The expectation that healing/re-

epithelization would occur under the membrane. The basement membrane side of the amniotic membrane facing down. On occasions two membranes is applied, one as a 'graft' and the other as a 'patch' over it.

### When Used As Both Graft And Patch

The membrane in contact with the eye is placed with its basement membrane facing up. The second membrane is placed, covering the first, with its basement membrane side facing down. On occasions two membranes is applied, one as a 'graft' and the other as a 'patch' over it. When used as both graft and patch: The membrane in direct contact with the eye is placed with its basement membrane facing up. The second membrane is placed, covering the first, with its basement membrane side facing down.

### MECHANISM OF

- Membrane,
- Promotes epithelialization of denuded areas of the ocular surface.
- Many of these effects are likely affected by the methods used for handling the membrane.
- Facilitate wound healing.
- Inhibit inflammation.

### ANTI INFLAMMATORY EFFECT

- Modulation of the production of activin.
- Lactoferrin.
- Interleukin-1 receptor antagonist.
- Hyaluronic acid plays an important role in the adhesion of inflammatory cells.

### ANTI SCARRING EFFECT AND NEUROTROPHIC FACTORS

- Transforming growth factor signaling in the fetus, so inhibiting scar formation.
- Supports nerve growth.
- Synthesizes various neurotransmitters, neuropeptides, and neurotrophic factors.

### ANTI ANGIOGENIC EFFECT

Proteins inhibit vascular endothelial cell proliferation by amniotic membrane while promoting epithelial cell of cornea growth.

### Current uses of amniotic membrane

- Limbal cell deficiency (Partial –Total)
- Limbal stem cell autograft or allograft
- Ulcers/perforations
- Bullous keratopathy
- Conjunctival reconstruction
- Pterygium
- Tumors
- Symblepharon
- Band keratopathy
- Vernal conjunctivitis (shield ulcer).

## CORNEAL ULCERS AND PERFORATIONS

Multilayer amniotic membrane transplantation for treating corneal is effective perforations with diameters less than 1 mm. Amniotic membrane used with fibrin glue for treating perforation up to 3mm.

### Persistent Epithelial Defects and Ulceration of the Cornea

Disorders of the cornea are one of the most common indications of AMT in the USA, accounting for 41% of cases. The treatment of corneal ulcers be a major challenge for eye treatment, amniotic membrane clinically is used as amembrane in patients with epithelial defects with and without corneal ulceration. After a median follow-up time of 18 months, Seitz *et al.*, [1] achieved epithelial closure with no recurrence in 65% of cases. The rate of Amniotic membrane transplantation can be significantly improved using

subsequent measures such as inducing upper eyelid ptosis via Botox injection or tarsorrhaphy. The reoperation rate then falls from approx. 44% to 30%.

A multilayer technique is used to treat deep corneal ulcer and small corneal perforations and descemetocoele. Solomon *et al.*, [2] report stable wound closure in 28 of 34 eyes (82%) with these corneal disorders in a retrospective analysis. Kruse *et al.*, [3] also achieved stabilization of the corneal surface in 9 of 11 patients with deep ulceration of the cornea, within a follow-up time of 12 months. After amniotic membrane transplantation, transplantation of cornea is required for vision. Turning to complications, calcification is observed in 12% of cases if eye drops containing phosphates are used, and infections in less than 1% of cases Fig-3.



Fig-3: AMT in infectious corneal ulceration (a) before surgery (b) three days after (c) three months after

### Keratitis

There are several type of keratoconjunctivitis and keratitis, which well be broken into infectious and noninfectious. Infectious etiologies include many types of microbial involvement such as viral, fungal and bacterial.

Infectious keratitis before before use of amniotic membrane transplantation most always be treated with the antimicrobial medication.

Noninfectious causes of keratitis include over wear of contact lens and dry eye-related inflammation and Neurotrophic keratitis is a serious condition that can result from corneal nerve damage, which caused by herpetic infection and trauma.

Mechanical injury and degeneration of the corneal epithelium secondary to dryness cussed Sensory nerve impairment and this keratitis difficult to manage by topical therapies.



Fig-4: Corneal Ulcers and Perforations

### Acute Chemical Burns

Chemical burns to the ocular surface are a common problem in acute ophthalmological care. These can lead to blood vessel rupture the limbus and thro conjunctiva and corneal erosion. The aims of treatment are to prevent scarring and necrosis and to amniotic membrane transplantation early is improves functional after chemical burns. In a prospective randomized controlled trial Tamhane *et al.*, [4] documented that amniotic membrane transplantation in the first week significantly higher in patients treated with an. For severe chemical burns, to prevent loss of visual acuity.

## Amniotic Membrane for Tissue Engineering of Limbal

Very important to eyesight clearance of corneal surface. Maintaining a functional corneal epithelium is therefore essential to vision in the limbus we find Epithelial stem cells of the corneal epithelium, which make bridge between the cornea and the conjunctiva disorders of the surface of the eye can lead to limbal stem cell. Limbal stem cell deficiency is characterized by formation of fibrovascular pannus tissue on the corneal surface, increased glare sensitivity, and loss of vision.

### The Conjunctival Surface Reconstruction

Excision of a melanoma or a squamous cell carcinoma or of the conjunctiva, causes major surface defects. And After removal tumor, defects can be covered by amniotic membrane transplantation then we can follow radiation or local chemotherapy. When the amniotic membrane functions as a basement membrane and aids fast, the migration of neighboring conjunctival epithelial cells also fast and no scar happened and promoting of the recipient then wound healing at last.

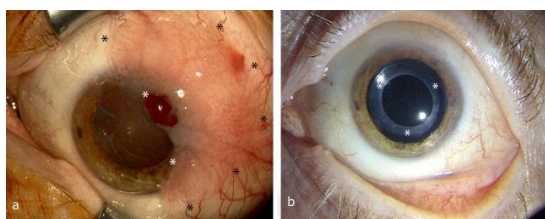


Fig-5: Conjunctival intraepithelial neoplasia (a) before surgery (b) 4 years after tumor excision and AMT



Fig-6: Pterygium before surgery



Fig-7: After one week AMT

### LIMBAL STEM CELL DEFICIENCY

- Excellent results with the amniotic membrane transplantation for limbal stem cell deficiency.
- Low rate success for total limbal stem cells deficiency.

- Allo or auto stem cells transplantation with amniotic membrane may improve the results.

### TREATMENT OF INFECTIOUS KERATITIS

- Many studies showed that amniotic membrane transplantation, when used as medical therapy, has a effect on the healing process of the infected corneas.
- Amniotic membrane transplantation evidently reduces opacity and, corneal neovascularization, by improving the clinical outcome.

### RECURRENT CORNEAL ERROSION

Amniotic membrane transplantation has a high rate success in treating responding corneal erosions as in:

- Anterior corneal dystrophy.
- Persistent epithelial defect after corneal transplantation.
- Sterile geographic ulcer.
- Bullous keratopathy.
- After PRK.

## CONCLUSION

Amniotic membrane transplantation is help in acute ophthalmological care and treatment of chronic diseases of the eye surface including cornea and conjunctiva, tissue engineering, for the ocular surface as a biomatrix to treat deficiency of the stem cell.

Amniotic membrane transplantation provides ophthalmologists with a particularly multifaceted instrument to the surface of the eye which has been documented in many case studies.

**Conflict of Interest:** The authors declare that no conflict of interest exists.

## REFERENCES

1. Seitz B. Amnionmembrantransplantation. *Der Ophthalmologe*. 2007 Dec 1;104(12):1075-1079.
2. Bernstein B, Solomon J. 'Pedagogy, identity and the construction of a theory of symbolic control': Basil Bernstein questioned by Joseph Solomon. *British journal of sociology of education*. 1999 Jun 1;20(2):265-79.
3. Seitz B, Resch MD, Schlötzer-Schrehardt U, Hofmann-Rummelt C, Sauer R, Kruse FE. Histopathology and ultrastructure of human corneas after amniotic membrane transplantation. *Archives of Ophthalmology*. 2006 Oct 1;124(10):1487-90.
4. Tamhane UU, Aneja S, Montgomery D, Rogers EK, Eagle KA, Gurm HS. Association between admission neutrophil to lymphocyte ratio and outcomes in patients with acute coronary syndrome. *The American journal of cardiology*. 2008 Sep 15;102(6):653-7.