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Amniotic membrane lowers chance of pterygium recurrence

Complete excision is recommended to address main pathology hidden under conjunctiva

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Reviewed by Arun Gulani, MD

Jacksonville, FL–The chances of pterygium recurrence can be decreased substantially by removing the entire pterygium, not simply the head. In cases of extensive excision, amniotic membrane transplantation seems to provide excellent results, according to Arun Gulani, MD.


Dr Gulani

"The part of the pterygium that is visible is only the tip of the iceberg," said Dr. Gulani, chief of cornea external disease and director, refractive surgery, University of Florida, Jacksonville. "Removing only this visible portion may confuse our understanding of extension of the same pterygium as opposed to true recurrence and lead to baffling recurrence rates.

"By removing only this visible portion, the main pathology with its tentacles is not addressed and remains hidden under the conjunctiva," he said. "Pterygium is one of the oldest ocular pathologies known and its cause and effective management are still being debated."

Theories about the etiology of pterygia are diverse and range from hereditary, neurotrophic, angioplastic, and immunologic causes to ultraviolet light exposure. Regardless of the cause, the result is elastotic degeneration with vesiculation of Bowman's membrane in the cornea and the formation of epithelial islets (Fuchs' patches) as cysts around the pterygium (seen as glovefinger appearance on histopathologic study), according to Dr. Gulani.

He said that the expression of vimentin (indicator of migration) by the keratoblasts and increased P53 (protein accumulation due to defective tumor suppression gene) make one think of the concept of a migrating limbus.

Anatomically, the pterygium is composed of several segments, including Fuchs' patches and Stocker's line (the iron line), the hood, the head, the body, and the superior and inferior edges.

Pterygia can be classified into three types, Dr. Gulani explained.

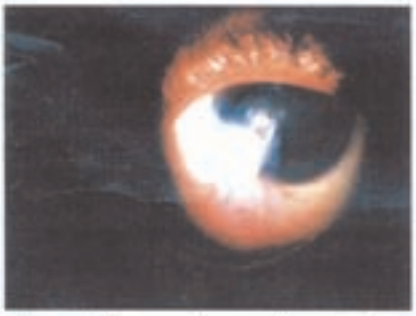

Figure 1 A pterygium may have to be excised if it infringes on vision either directly or by causing astigmatism or tear film abnormalities.

Figure 2 The postoperative amniotic membrane graft following advanced pterygium excision.

Type 1 is the classic peripheral formation, type 2 involves the optic zone and can infringe on vision directly or indirectly by causing astigmatism or tear film abnormalities, and type 3 has tentacles and scar-ring that produce oculomotor symptoms and fibrosis.

Dr. Gulani also suggested an addition to this classification of a type 4 that is recurrent and aggressively malignant.

Amniotic membranes, which are composed of a monostratified epithelial (nonsticky) surface, a basement membrane, and a stromal (sticky) side, have been used in medicine for about 60 years. The advantages of the commercially available membrane are that there is no immune reaction and it has anti-inflammatory functions, is anti-adhesive and anti-bacterial, encourages epithelial differentiation and growth, and has an anti-tissue growth factor effect, Dr. Gulani explained.

"The basement membrane is a type 4 collagen with laminin," he said. "The beauty of this structure is that it is similar to the basement membrane of the conjunctiva. The epithelium has growth factors that encourage growth and differentiation into conjunctiva and corneal epithelium. We apply the membrane in a double-folded form, so that there is smooth epithelium on both sides, superiorly for epithelialization and below for smooth movement of the underlying extraocular muscle."

He uses three different criteria to determine surgical intervention:

- The extent of the pterygium.
- Density of the pterygium.
- Involvement of adjacent structures.

Further, each of the four types can be stationary or active; the knowledge of this also guides treatment.

Because of the complex structure of the pterygium, dissecting only the head is ineffective. The underlying structures are the ones that actually grow and move the head into the cornea, Dr. Gulani pointed out.

Thus far, most treatments, such as copper sulfate, silver nitrate, mitomycin-C, thiotepa, and 5-fluorouracil, have been ineffective and associated with major side effects. Argon laser treatment has been used to contract conjunctival tissue and treat blood vessels. Radiation with strontium 90 has been used postoperatively, but patients must be followed for years because of the potential side effects such as scleral/corneal melting.

Indications for surgery include correction of cosmetic defects; visual effects such as location within the visual axis and induction of astigmatism or dry eye; and recurrence of the pterygium in which patients present with scars and extremely aggressive pterygia. Atrophic pterygia do not require surgery.

After measuring corneal pachymetry and refraction, Dr. Gulani also uses a special slit-lamp video system along with the Orbscan to determine three-dimensional involvement of the cornea along with the astigmatic component. This also helps to educate the patients visually. The surgeon can determine both if the pterygium is progressive and how far it has pulled in the medial fold in the conjunctiva.

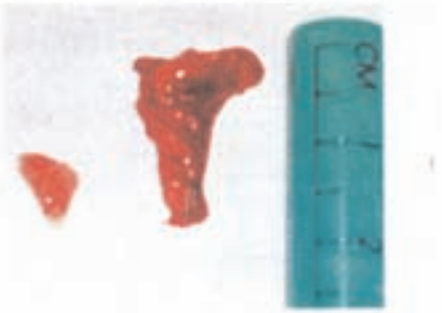

Figure 3 Iceberg concept: The pterygium visibly removed (smaller piece) during pterygium surgery and the real amount of pterygium that actually needs to be removed. This picture shows the discrepancy in what actually should be entirely dissected and removed as visualized on the scale.

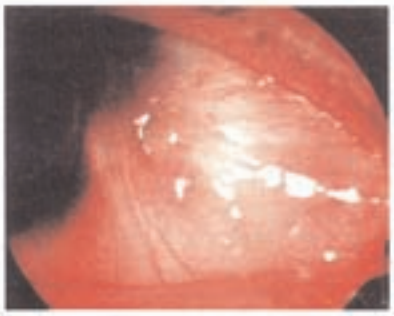

Figure 4 Aggressive recurrent pterygium referred for re-operation. Stage 4 with muscle involvement.

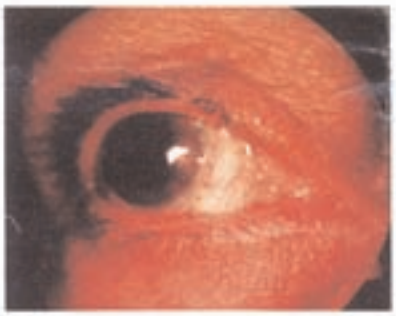

Figure 5 Postoperative results with freely mobile, clear eye with 20/20 uncorrected vision. (Photos courtesy of Arun Gulani, MD)

Also, the extraocular motility will help determine whether the pterygium is in stage 3 or 4.

Iceberg concept

At the start of the procedure, the head of the pterygium is lifted off the cornea. After smoothing the cornea, topical epinephrine is used to create vascular hemostasis.

"The most important stage is dissecting the pterygium," Dr. Gulani said. "The whole plane of the pterygium is delineated subconjunctivally. When it is removed, it resembles a spreading mass of tentacles. It is important to remove the entire mass to avoid recurrence."

The pterygium is dissected carefully superiorly, to avoid buttonholing the conjunctiva and invading the orbital septum, and inferiorly, to avoid cutting the underlying muscles, which is rechecked after the pterygium is removed. He uses sharp dissection superiorly and resistive separation inferior to the pterygium.

He has designed the Gulani-Tseng instrument set for this surgery.

Weck cell sponge pieces are soaked in mitomycin-C 0.04% and placed under the conjunctiva (rolled over these pieces) in the area of the dissection and left in place for 1 to 2 minutes to prevent fibrosis as well as recurrence from the subconjunctival tissue. After removing the sponges, the area is flushed with balanced salt solution.

Dr. Gulani uses the cornea as an illuminated receiving table to drape the amniotic membrane as he receives it with a two-handed technique from the nitrocellulose paper before folding it in a controlled fashion. At the same time, with the retroillumination through the cornea (pupil is dilated by now due to topical use of epinephrine for hemostasis) he can, in cases of dehydrated amniotic membrane (such as Ambiodry), use this to confirm readiness of application by looking for the disappearance of what he calls "the waffle board sign."

"After folding the amniotic membrane over a specially designed instrument, both the stromal sides come together and the epithelial sides are facing up and down," he said. "The central closed portion with the edges positioned medially is then aligned to the limbus."

Dr. Gulani said he may fashion slits at this juncture to milk any active folds for uniformed draping.

Excessive membrane is then removed. Suturing with 10-0 nylon is started after the membrane has been smoothed. Using a nonholding technique, both layers of the amniotic membrane are engaged and the needle is pushed through the sclera and episclera in a long central bite close to the limbus. Dr. Gulani has designed a new needle to facilitate this step. When this is anchored well, the process is completed along the limbus and the stitches are buried in the sclera, according to Dr. Gulani.

The next step is spreading the edges of the membrane under the conjunctiva. The bite goes through the conjunctiva, both amniotic membrane layers, episclera and superficial sclera, and then out in the same order; this is anchored with 8-0 Vicryl. On the medial side, the membrane is stitched to the conjunctiva and temporally to the limbus. After smoothing the membrane and rechecking hemostasis, the procedure is finished.

He emphasized the importance of long follow-up periods, minimally 2 years. He pointed out that in addition to detecting a recurrence, one should also watch out for any long-term complications.

Dr. Gulani has taught his technique internationally and trains surgeons in this advanced level of care.

"The procedure of amniotic membrane transplantation has a wide spectrum of applications in ocular surface correction," Dr. Gulani said. "It acts like a natural contact lens; it replaces tissue, acts as a scaffold for tissue to grow, and is protective physically and chemically. Amniotic membrane could literally be woven into a contact lens or grown into a contact lens that could be used for an emergent situation."

Bibliography

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