

Chorion layer subretinal placement in amniotic membrane transplantation for retinal detachment

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Dear Editor,

We present a modified surgical technique to verify the chorion layer of the human amniotic membrane (hAM) in treating retinal detachment (RD) with vitrectomy. RD patients with pathological myopia where the tear is located within the posterior pole choroidal atrophy area are difficult to treat. Surgical procedures such as laser treatments, diathermy, cryopexy applications or long-term silicone oil endotamponade may not only be ineffective but also harmful in these cases^[1]. Amniotic membrane transplantation (AMT) is an effective technique in case of RD recurrences to seal retinal holes over high myopic chorioretinal atrophy^[2]. However, there may be errors in confirming the chorionic surface of the hAM within the vitreous cavity, which may lead to surgical failure^[3]. Herein, we introduce a new method to verify the chorionic surface of the hAM, which can ensure a higher success rate for AMT in vitrectomy. We obtained the written informed consent from the patient, and this case study is in accordance with the tenets of the Declaration of Helsinki. This study was approved by the Ethics Committee of West China Forth Hospital (HXSJ-EC-2024092).

An elderly highly myopic patient came to our hospital for examination due to a feeling of occlusion in her right eye for a week. Preoperative ophthalmic examination included refraction with the assessment of best corrected visual acuity, equal 0.001 decimal scale (3.0 logMAR), and intraocular pressure

of 18 mm Hg. Seven years ago, before cataract surgery, the A-scan showed an axial length of 27.32 mm. The patient was pseudophakic. The preoperative fundus image was shown in Figure 1A, and the preoperative optical coherence tomography (OCT) image was shown in Figure 1C.

Due to the inefficacy of conventional treatments, we suggested an hAM plug to close the hole. Triamcinolone-acetonide-assisted pars plana vitrectomy was performed to remove both vitreous and epiretinal membranes. The inner limiting membrane (ILM) within the posterior pole vascular arch and around the hole was peeled off after indocyanine green staining. Consistent with preoperative assessment, the ILM flap was not obtained due to posterior pole retinal thinning and choroidal atrophy. A piece of lyophilized hAM was utilized to make an amniotic plug. The hAM plug was trimmed into a circular shape with a pedicle, slightly larger than the diameter of the hole (Figure 2). Due to posterior choroid atrophy and the lack of intraoperative OCT equipment, 0.25% indocyanine green staining of hAM was performed to identify the location of the amniotic plug. The hAM plug was inserted into the vitreous cavity through a trocar. The relationship between the circle and the pedicle was evaluated to ensure that the chorionic layer was located in front of the retinal pigment epithelium. The plug was implanted into the subretinal space through a slit using light-guiding fiber and a micro tweezer. After the fluid-air exchange, an air-silicone oil exchange was performed. The patient was instructed to keep a face-down position for 30d after the operation. Silicone oil extraction was performed after 3mo for 6mo without any recurrence (Figure 1B). The retina was attached and the final best corrected visual acuity was 0.02 decimal scale (1.7 logMAR). The measured macular thickness after surgery was 264 μ m. Due to the myopic macular degeneration, the patient has a defect in the ellipsoid zone of the macular region (Figure 1D). No occurrence of high intraocular pressure or uveitis during follow-up.

Standard treatment approaches yield limited therapeutic benefits for these patients. Dinah *et al*^[4] reported three cases of such patients who underwent silicone oil filling, and in two eyes the silicone oil was not removed. Notably, ILM coverage or the tamponade technique has achieved certain

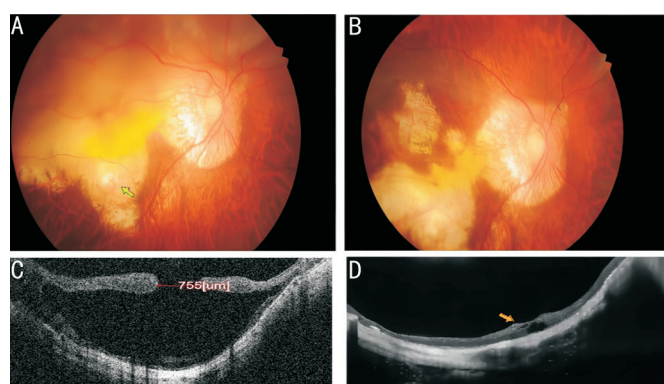


Figure 1 A case of retinal detachment with the hole locating within the area of choroidal atrophy A: Preoperative fundus image showed the superior retinal detachment accompanied by epiretinal membrane; B: Fundus image 6mo after silicone oil extraction indicated that the retina was reattached; C: OCT showed the retinal detachment and an associated posterior pole retinal hole locating within the area of choroidal atrophy (arrow in A); D: OCT image 1mo after silicone oil extraction surgery showed the retinal layer over hAM plug (arrow). OCT: Optical coherence tomography; hAM: Human amniotic membrane.

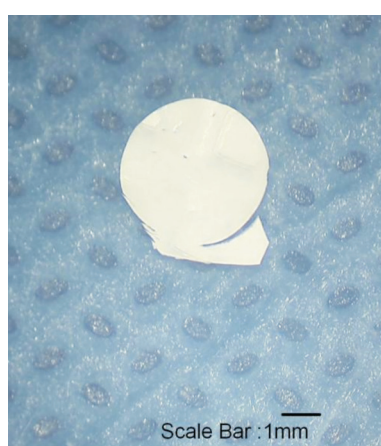


Figure 2 An hAM plug When the chorionic layer was downward and the pedicle was below the circle, the line connecting the pedicle and the center of the circle to the root of the pedicle formed an “L” shape. The graft preparation is assisted by a corneal trephine with a diameter of 4 mm. hAM: Human amniotic membrane.

effects on RD due to paravascular retinal breaks over patchy chorioretinal atrophy in pathological myopia^[5]. However, increased axial length, histopathological changes of ILM, posterior staphyloma, and chorioretinal atrophy may lead to difficulties in ILM peeling^[6]. The ILM plug method is also unfeasible in the case of extended ILM peeling during the first surgery or ILM remnants are difficult to harvest^[7]. In addition, ILM flap technique has a higher incidence of gliosis in the treatment of high myopia macular hole RD^[8]. In our case, there was extensive atrophy of the choroid in the posterior pole, making it difficult to obtain the ILM. Allogeneic Descemet's membrane may be a promising material^[9], but it's not as easily obtainable as hAM.

In 2019, Rizzo *et al*^[10] first reported a new technique that uses a subretinal placement of an hAM plug for a recurrent macular hole, complex RD with posterior breaks, and proliferative vitreoretinopathy. Anatomical success was reached in all cases. Intriguingly, the OCT scan revealed the macular hole closure without the glial process but with a fully stratified retinal layer over the hAM patch. Subsequent studies also confirmed that hAM transplantation achieved good anatomical results and improved vision in the treatment of recurrent high myopia macular hole and high myopia-related RD^[3,11]. As in previous cases where AMT was used in vitreous surgery^[12], there was no inflammation, graft infection or rejection after surgery. The reported AM grafts are mostly placed under the retina. Some doctors also cover the retinal hole with an AM^[13]. This method may have a higher risk of implant dislocation than the former. In the present case, we used a pedicled AM placed under the retina, and there was no wrinkling or shrinkage of the membrane after surgery. The postoperative hole was closed and the patient's vision improved. Postoperative OCT examination revealed phenomena similar to those reported in previous studies: a stratified retinal layer over the hAM plug^[10]. The currently reported method of vitrectomy combined with AMT often applies this approach to recognize the chorion layer: the sticky side of the hAM plug was detected with the vitreous forceps^[1-3,11,14]. However, this method relies on the experience of doctors and may result in incorrect confirmation of the chorionic surface of the hAM, which may lead to surgical failure and require re-fixation of the graft^[3]. The chorion layer can be marked by a type of blue colorant^[2]. However, obtaining this special dye in many units is difficult. An AM graft is made into a circular shape with a pedicle. After the graft is inserted into the vitreous body, even if the surgeon lacks experience and cannot perceive the viscosity of the AM, the relationship between the AM graft and the pedicle can still help doctors to confirm the chorionic surface.

The successful surgery confirmed the feasibility of our method in verifying the chorionic surface of the AM. To the best of our knowledge, this is the first study to describe this technology. This approach is not only suitable for cases of high myopia with RD where the hole is located within the choroidal atrophy area but also applicable to other situations that require AMT combined with vitrectomy surgery. In the future, it is necessary to increase the sample size to observe the long-term effects of this new method.

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