

SURGEON'S CORNER

Transocular Removal of a Retrobulbar Foreign Body and Internal Patch of the Posterior Exit Wound With Autologous Tenon Capsule

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A case of perforating ocular injury with a retrobulbar foreign body and a large full-thickness posterior pole defect near the optic disc was scheduled for vitrectomy after primary corneal suturing. Because it was difficult to remove the retrobulbar foreign body by orbitotomy and perform the outside suture, the retrobulbar foreign body was removed through the posterior hole by a transocular approach, and an autologous Tenon capsule flap was used to internally patch the large full-thickness posterior pole defect, thus enabling silicone tamponade. After 3 months of follow-up, there was no immune response around the patch. The retina remained mostly attached with a maintained peripheral visual field, normal intraocular pressure, and good cosmetic appearance. This surgical technique may be valuable in patients with a perforating retrobulbar foreign body and a large full-thickness posterior pole defect.

Arch Ophthalmol. 2012;130(4):493-496

The surgical goal in eyes with perforating injuries¹ is to maintain function and integrity of the globes.² To achieve this, it is important to get a waterproof closure of both the anterior and posterior perforation, leaving an eye with good cosmetic appearance that maintains normal intraocular pressure (IOP).³ However, it can be complicated to suture the posterior wound, especially when it is located near the macula or optic disk area.⁴ In cases with small posterior penetrations, the wound can seal itself and additional suture is not needed.⁵ Yet, if the posterior defect is large, the eyeball may suffer hypotony or even phthisis bulbi without a sufficient wound closure. In a patient with a large full-thickness posterior pole defect due to a perforating ocular injury with a retrobulbar foreign body, we describe herein a surgical technique for removing the foreign body by transocular approach and internally patching the posterior wound by autologous Tenon capsule.

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REPORT OF A CASE

A 38-year-old man had an accidental perforating ocular injury while working in a factory. A primary corneoscleral wound closure was immediately performed. The following day, the eye was hypotonous and ultrasound examination showed retinal detachment and combined vitreous and subretinal hemorrhage. Computed tomographic imaging and x-ray examination demonstrated a retrobulbar foreign body with intensity of iron that had passed through the globe and was located in the retrobulbar space close to the optic nerve (**Figure 1**). Four days later, we performed a comprehensive reconstruction by 20-gauge vitrectomy although the surgery was constrained by corneal opacification. After clearing of the vitreous cavity, we observed a combined retinal and choroidal detachment and a gaping round hole at the temporal papillary border with a 1 disc diameter (**Figure 2A** and **C**). Because it was difficult to remove the retrobulbar foreign body by orbitotomy owing to its posterior orbital location and because the posterior eye-wall defect was large enough, we decided to remove the retrobulbar foreign

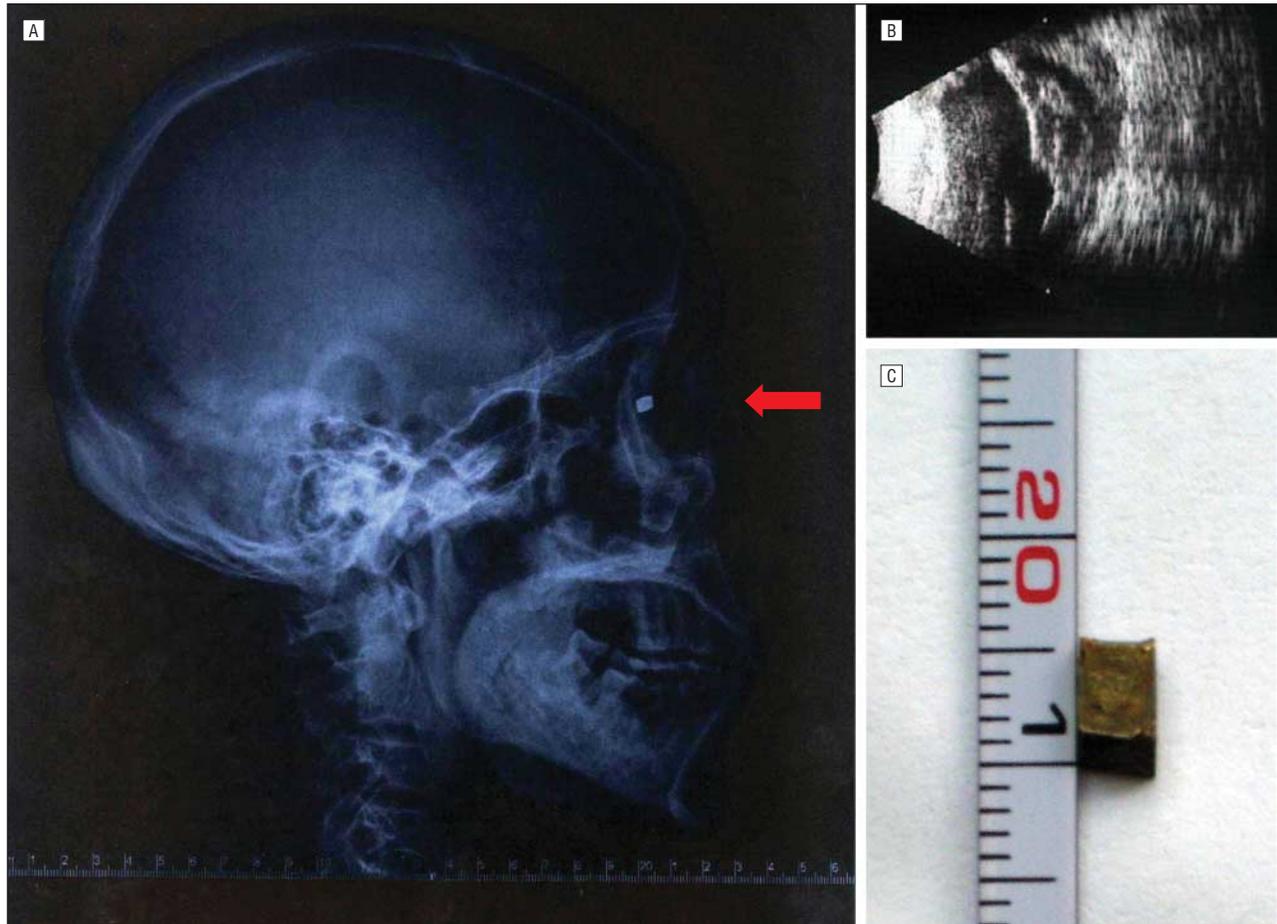


Figure 1. A 38-year-old man with an accidental perforating ocular injury. A, Lateral x-ray of the patient with a retrobulbar foreign body (arrow). B, Preoperative ultrasound examination reveals retinal detachment and combined vitreous and subretinal hemorrhage. C, The cubic iron foreign body measuring $6 \times 3 \times 3$ mm.

body through the posterior hole by a transocular approach (Figure 2D). We gradually put the tip of a light pipe and a back-flush into the orbit through the posterior hole and moved the retrobulbar foreign body bimanually into the eyeball. Inside the eye, the foreign body was put on the surface of a thick preretinal blood clot. Finally, the intraocular foreign body was removed by pars plana sclerotomy in a circumferential direction and the enlarged sclerotomy was sutured.

After retrobulbar foreign body removal, the eye was hypotonic owing to fluid exiting from the large posterior pole defect. However, the location of the wound made suturing from the outside difficult. The Tenon capsule was chosen as a suitable substitute for a plug in the posterior hole, as it had been expanded by the flow of fluid exiting from the posterior wound. The Tenon capsule was isolated from the conjunctiva to the depths of the fornix in the supero-

temporal quadrant. First, a flap with the diameter of the wound was chosen (Figure 2B). However, the Tenon capsule flap was too soft to completely patch the hole and was washed away into the orbit by the flow of fluid. Thus, we used a larger flap with twice the size of the first one and achieved a final closure after reducing the infusion pressure. Subretinal hemorrhages as well as all incarcerated tissue and debris were removed. Remaining retina reattached after drainage of the subretinal liquid, endotamponade with silicone oil, and endolaser at the edges of the wound. There was no silicon oil leakage from the hole and IOP returned to normal. The metallic nature of the foreign body was confirmed using a magnet. There were no signs of iron accumulation in the patient's eye. Postoperative antibiotics and corticosteroids were administered.

On the first postoperative day, the enlarged pupil area was covered by a thick fibrinous membrane with exu-

dates, and fundus details were not visible owing to the media opacities (Figure 3A). After 2 months, there was partial resolution of the fibrinous membrane and sutured corneal opacities, enabling visualization of the fundus. The full-thickness posterior pole defect was closed and anatomical reattachment was mostly achieved. The pale, pink plugged Tenon capsule was firmly located to the posterior wound and was gradually absorbed and fiberized over time (Figure 3C). Three months later, a white fibrous lesion was still seen at the site of the penetrating wound under the retina, and the size of the patched Tenon capsule had decreased significantly. There were a few subretinal membrane proliferations causing traction with fixed retinal folds around the patch (Figure 3D). The visual acuity was always limited to hand motion perception. The IOP was 9 mm Hg, 8 mm Hg, 10 mm Hg, 16 mm Hg, 15 mm Hg, and 16 mm Hg after 1 day, 1 week, 2 weeks,

1 month, 2 months, and 3 months postoperatively, respectively.

COMMENT

In our case report, the patient had a perforating injury of the eyeball where we were unable to suture the posterior wound from the outside. Although a good result can be achieved in some cases by leaving the second posterior penetrating wound unsutured,² this was not an option because the full-thickness defect was too large to seal itself or maintain sufficient silicone oil endotamponade. In previous studies, the ab interno intravitreal suturing of a large traumatic posterior scleral perforation at the posterior pole has been used.^{6,7} Still, it is controversial because of the serious damage it causes to the retina and choroid. Thus, we decided to use a substitute material as a patch for the large posterior wound. In another study, an absorbable gelatin sponge was placed as a plug over the tissue defect. However, gelatin sponges are synthetic, artificial substrates and could induce immune response when used as an intraocular plug substitute.⁸ Thus, it would be better to repair the posterior eye-wall wound with autologous tissue such as the Tenon capsule as performed in our case. It was a simple and effective surgical performance with no extra wound suturing needed, and damage to the eye-wall tissue was avoided, leaving an eye with a good cosmetic appearance, normal IOP, and maintained hand motion visual acuity.

As epithelial cells only exist on the surface of the conjunctiva,⁹ a meticulous surgical separation between Tenon capsule and the conjunctiva is necessary to avoid the placement of epithelial cells into the eyeball during a surgical procedure. Care was also taken not to damage the conjunctival layer, as this is important for ocular surface repair or reconstruction. The Tenon capsule is a thin layer of elastic connective tissue,¹⁰ and it is not suitable to serve as a patch substitute for closure of large full-thickness posterior pole defects unless saturated with fluid, which leads to swelling and expansion as in this case. Owing to its flexible character, the trans-

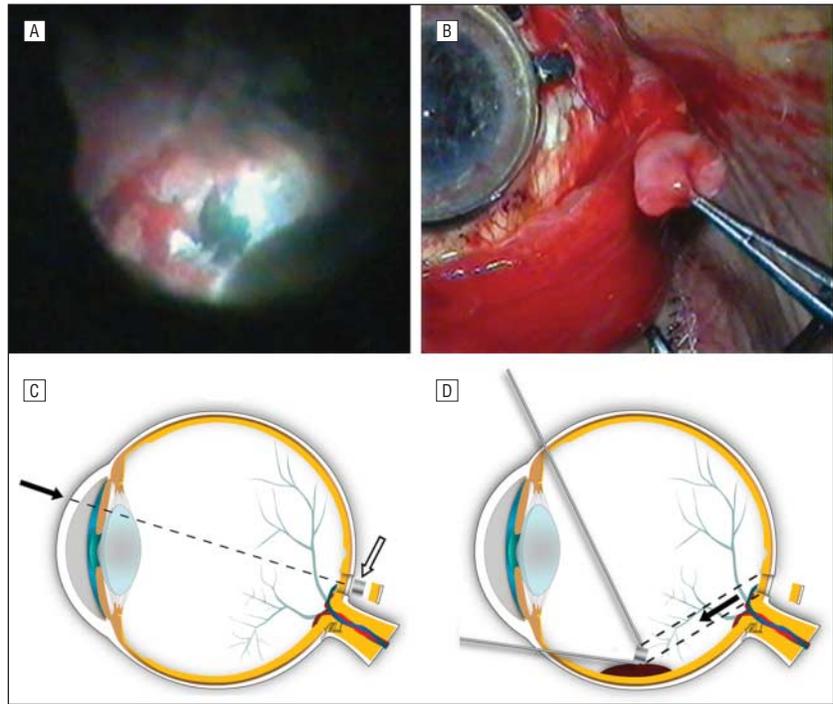


Figure 2. Temporal papillary border. A, A large posterior wound was found during vitrectomy. B, After removing the retrobulbar foreign body in a transocular approach, a Tenon capsule flap was isolated and used as an internal autologous patch of the large posterior pole wound. This is the initial flap that was too small to patch the wound and was flushed into the orbit. Schematic illustration of the perforating ocular injury (C) and the transocular approach with the retrobulbar foreign body (arrow) moved into the eye and placed on a preretinal blood clot (D).

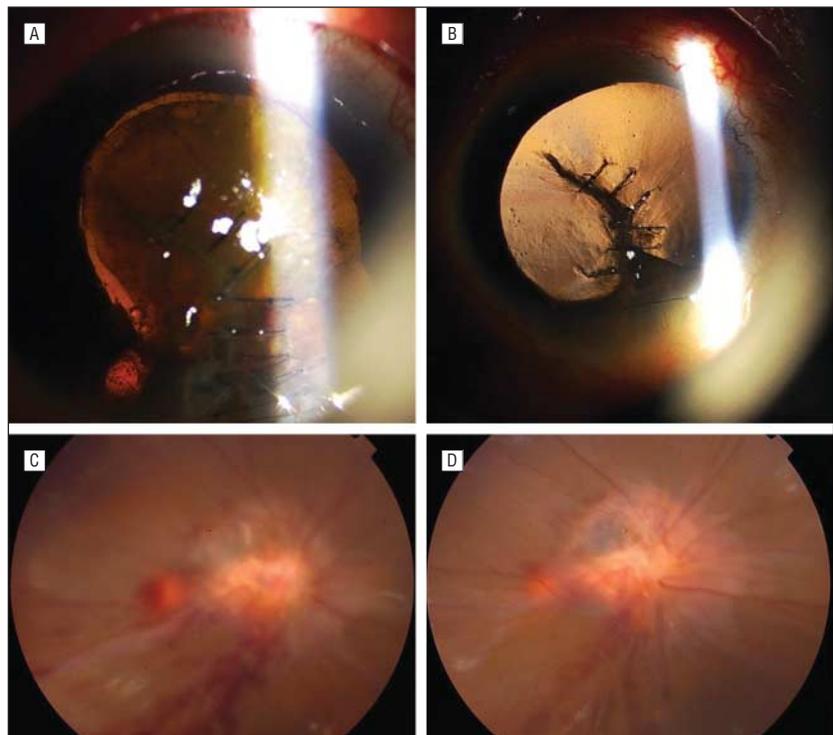


Figure 3. Enlarged pupil area. A, On the first postoperative day, a thick fibrinous membrane covered the entire pupillary area, disabling view to the fundus. B, Three months later, this fibrinous membrane was fully absorbed. C, Fundus examination 2 months after the vitrectomy. The Tenon capsule patch in the posterior pole wound remained stable. D, Fundus examination 3 months after the vitrectomy. The Tenon capsule flap was significantly absorbed. A subretinal peripapillary proliferation occurred. Fundus details were obscured owing to optical media opacities (C and D).

ferred Tenon capsule should be significantly larger than the full-thickness posterior pole defect. Because the Tenon capsule is an extraocular tissue, it could stimulate fibrous proliferation around the plug. At the end of the follow-up period, we observed local subretinal bands causing traction with fixed retinal folds. However, with the effective silicon oil endotamponade, most of the retina remained attached. Despite achievement of watertight closure of both anterior and posterior perforations, the IOP was still less than 10 mm Hg in the early postoperative stage. This was probably owing to temporary ciliary body shutdown by the severe perforating injury combined with complicated surgical intervention.

Although it is not necessary to surgically remove inert extraocular foreign bodies,¹¹ based on the risk of an iron foreign body and its close proximity to the optic nerve, we decided to remove the retrobulbar foreign body. Lateral orbitotomy, one possible surgical choice, does not afford a good view of the retrobulbar foreign body and might apply excessive pressure to the perforated eyeball when attempting to localize the foreign body.¹² Others have reported a transcranial approach in removing a retrobulbar foreign body,¹³ but this calls for neurosurgical competence and increases the risk for serious intracranial compli-

cations. Thus, the transocular approach was a more feasible and effective method for removal of a retrobulbar foreign body that was difficult to reach.

Although there were significant fibrous proliferations and scarification around the plug and limited hand-motion perception acuity in this case, the surgical result is still positive; the retina remained mostly attached and the patient had a good cosmetic appearance and normal IOP as well as maintained peripheral visual function.

Submitted for Publication: April 22, 2011; final revision received June 8, 2011; accepted June 20, 2011.

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Financial Disclosure: None reported.

Funding/Support: This work was supported by grant J20080843 from the National Natural Science Foundation of China, grant J20050897 from the Zhejiang Provincial Natural Science Foundation of China, and grant 2004A047 from the Medical Scientific Research Foundation of Zhejiang Province, China.

Additional Contributions: We thank Geir Qvale, Center for Eye Research, Oslo University Hospital, for providing technical assistance.

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