

Triple procedure for management of traumatic aphakia, glaucoma and mydriasis

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Dear Editor,

We report a relatively safe and effective triple procedure for traumatic aphakia, glaucoma, and mydriasis. Blunt eye trauma can lead to various anterior- and posterior-segment conditions^[1], that often occur simultaneously. Closed-globe injuries can damage one or more ocular structures. Trauma-related complications, whether immediate or delayed, are often complex and challenging to manage^[2], and frequently require one or more surgical interventions. Combined surgery can effectively enhance visual function and cosmetic outcomes, providing convenience and satisfaction for both patients and society.

Ethical Approval Written informed consent was obtained from the patient, and this case study adhered to the tenets of the Declaration of Helsinki.

Case Presentation A 64-year-old man presented to Suzhou ENNT Hospital in April 2023 with severe pain and vision loss in the right eye that had persisted for approximately 2wk. The patient was diagnosed with secondary glaucoma due to lens dislocation and was initially treated with anti-glaucoma eye drops, including carteolol hydrochloride, brinzolamide, brimonidine tartrate twice a day, and intravenous infusions of 20% mannitol, all of which were ineffective. Prior to this condition, the patient had a history of blunt trauma to the right eye but did not seek medical attention because of the absence

of noticeable vision impairment. The patient denied having any systemic diseases.

The visual acuity in the right and left eyes was 3.07 and 0.4 (logMAR), respectively. Slit-lamp examination revealed mixed conjunctival congestion, severe corneal edema, and lens dislocation, resulting in a flat anterior chamber (Figure 1A1); therefore, corneal endothelial and fundus examinations could not be performed in the right eye. The left eye was normal, except for a posterior polar cataract. The no-contact intraocular pressure (IOP) was >60 mm Hg in the right eye and within the normal range in the left eye.

As an emergency, pars plana vitrectomy and lens removal were performed. One day postoperatively, severe corneal edema persisted; however, the IOP had normalized to 20 mm Hg. After 1wk, IOP increased to 37 mm Hg, necessitating the use of three anti-glaucoma eye drops. Approximately 1mo postoperatively, the cornea began to clear, and IOP reduced to 29 mm Hg. The left eye remained stable throughout the follow-up period.

Two months postoperatively, the patient required a second surgery because of symptoms including blurred vision and photophobia caused by mydriasis and aphakia and side effects of anti-glaucoma drops such as redness and discomfort. Comprehensive pre-operative examinations revealed a best-corrected visual acuity (BCVA) of 0.4 (logMAR) with a refraction of +10.00 D. The patient exhibited drug-induced eyelid and conjunctival hyperemia, clear cornea, and aphakia. The pupil diameter and number of corneal endothelial cells were 8 mm (Figure 1A2), and 3257/mm², respectively. Optical coherence tomography revealed a normal macular morphology, and the retinal nerve fiber layer thickness was within the normal range (Figure 1B2-1B3). The patient was diagnosed with traumatic aphakia, glaucoma, and mydriasis. Therefore, combined surgery was planned.

Surgical Procedure First, a pair of 5-0 nonabsorbable sutures were placed approximately 10 mm behind the limbus for the glaucoma valve. Next, assisted by an anterior maintainer, an intraocular lens (IOL; AMO, AR40e, USA) was implanted in the posterior chamber using scleral fixation, approximately 2 mm behind the limbus. Subsequently, pupil cerclage was performed to reduce the pupil diameter to approximately 2.5 mm. Finally, a glaucoma valve (Ahmed FP7) was secured to the

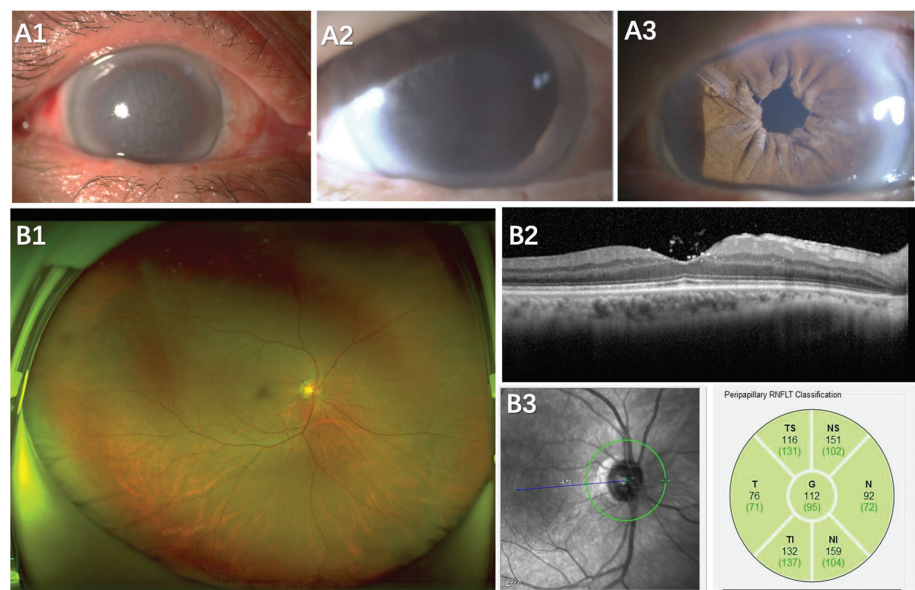


Figure 1 Pre- and post-examinations of the triple surgery The anterior segment of the initial hospital presentation (A1) revealed mixed conjunctival congestion, severe corneal edema, and lens dislocation resulting in flat anterior chamber. Before the triple surgery, it revealed clear cornea, mydriasis and aphakia (A2). After the triple surgery, it illustrated that the cornea was clear and glaucoma valve tube was clearly visible and the pupil size was approximately 2.5 mm, with a nearly round shape (A3). Before the triple surgery, the fundus examinations (B1) showed a normal appearance in the left eyes and OCT images illustrated a generally normal macular morphology (B2) and retinal nerve fiber layer thickness was within normal range (B3). RNFL: Retinal nerve fiber layer thickness; OCT: Optical coherence tomography.

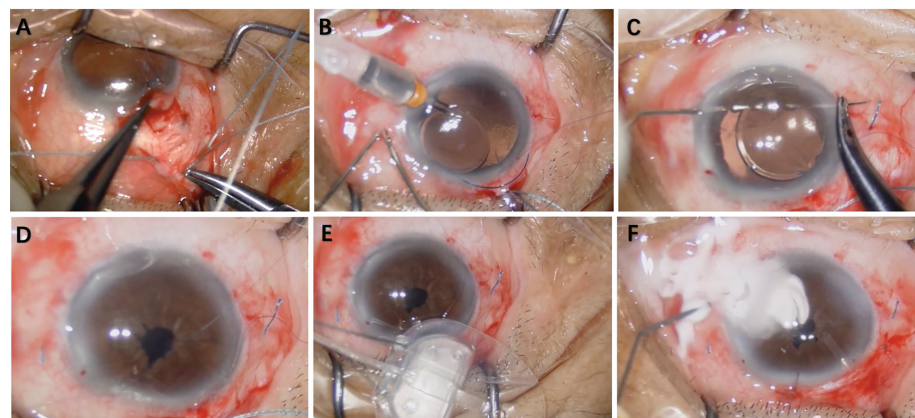


Figure 2 Surgical procedure A: A pair of 5-0 nonabsorbable sutures for glaucoma valve about 10 mm behind limbus; B: Assisted by anterior maintainer, an intraocular lens (AMO, AR40e, USA) was implanted in the posterior chamber using scleral fixation about 2 mm behind limbus; C-D: Pupil cerclage was performed to reduce the dilated pupil to approximately 2.5 mm; E: Glaucoma valve (Ahmed FP7) was secured on sclera; F: Triamcinolone acetonide (TA) was injected into the anterior chamber at last.

sclera, and triamcinolone acetonide (TA) was injected into the anterior chamber (Figure 2).

One week after surgery, the patient's uncorrected visual acuity was 0.52 (logMAR). The cornea was clear and the anterior chamber reaction was mild. The glaucoma valve tube was clearly visible with adequate depth. The pupil size was approximately 2.5 mm, with a nearly round shape (Figure 1A3). The IOL was well-positioned, and IOP was within the normal range. However, TA residue remained. BCVA and IOP at the three-month and one-year follow-up examinations were 0.3 and 0.22 (logMAR) and 14 and 16 mm Hg, respectively. The number of corneal endothelial cells was $>3200/\text{mm}^2$. The eye

condition was stable, with nearly complete absorption of TA, a clean vitreous cavity, and a normal fundus. Approximately one year after surgery, astigmatism of -1.50 D was observed. Few complications occurred during the study period.

DISCUSSION

Blunt ocular trauma refers to an injury to the eye caused by a blunt force, such as a punch, impact from a ball, or an accident. Our patient experienced blunt trauma, resulting in lens dislocation and secondary glaucoma. After the immediate critical issues were addressed and initial recovery was achieved, more complex lesions emerged. Considering the patient's condition, we used a combined surgical approach.

Because the pupil diameter was approximately 8 mm, iris cerclage was performed to create a round pupil. Among several surgical methods of pupilloplasty, the Siepser slip-knot technique is commonly used^[3-4]. However, iris cerclage, described by Ogawa^[5] in 1998, provides better cosmetic and functional outcomes without distortion the natural round shape of the pupil^[6]. This technique involves a continuous suture along the pupillary margin, allowing adjustment of the pupil by tightening the two ends of the suture. This can minimize the stress on the iris while effectively reducing glare.

Secondary IOL implantation in aphakic eyes without capsular support can be challenging, and scleral fixation is the preferred technique. With this method, the IOL is typically fixed to the sclera, approximately 2 mm from the limbus, to avoid major vascular and nerve damage and reduce the risk of retinal detachment. The technique is safe and allows for fast recovery with higher refractive predictability^[7]; in our patient, the final refraction error was an astigmatism of -1.50 D.

Trauma-related glaucoma is a type of refractory glaucoma commonly treated with glaucoma drainage device implantation. The Ahmed glaucoma valve, developed in 1993^[8], is among the most frequently used valves in refractory glaucoma surgeries and has been proven to be effective^[9].

In this patient, implantation of a glaucoma drainage valve, scleral fixation of an IOL, and pupil cerclage were performed simultaneously rather than sequentially. Lumi *et al*^[10] and Guo *et al*^[11] performed iris cerclage pupilloplasty and IOL implantation for traumatic mydriasis and aphakia after blunt trauma. Although this case was more complex, promising results were achieved.

This study had some limitations. First, the triple procedure requires more clinical skills. Second, the higher number of concurrent procedures results in more postoperative complications. Fortunately, in this initial exploration of a combined surgical approach for complex lesions, favorable outcomes were achieved. Further studies involving more patients and long-term follow-up are necessary.

To the best of our knowledge, this is the first case of a triple

procedure involving iris cerclage, IOL scleral fixation, and glaucoma drainage valve implantation in a patient with complex blunt trauma. Combined surgical treatments may be safe and feasible; effectively address symptoms; reduce patient burden; and provide significant benefits to patients, hospitals and society.

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Conflicts of Interest: Chen B, None; Li YT, None; Lu YF, None.

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