

Case report

Femtosecond laser-assisted cataract surgery in management of posterior capsule tear following blunt trauma: Case report and review of literature



Alisa J. Prager*, Surendra Basti

Department of Ophthalmology, Northwestern Feinberg School of Medicine, Chicago, IL, USA

A B S T R A C T

Purpose: To describe the diagnosis and management of a patient with rupture of the posterior capsule (PC) following blunt trauma to the left eye.

Observation: 68 year-old man presented with complaints of left eye pain, blurry vision and photophobia after getting hit in the left eye with a baseball. He was found to have a posterior capsule rupture, as well as mydriasis and zonular dialysis without formation of intumescent traumatic cataract. Femtosecond laser associated cataract surgery (FLACS) was performed to facilitate creation of an anterior capsulotomy and segmentation of the nucleus without additional strain on the posterior capsule, facilitating placement of a capsular tension ring segment and a 3-piece IOL in the sulcus. At three-month post-operative visit, his BCVA was 20/30 in the left eye with a well-centered IOL.

Conclusions and Importance: Isolated PC tear following high-speed blunt trauma is relatively rare and prior reports have managed these cases using standard phacoemulsification and IOL insertion. Our case highlights the advantages of using FLACS in management of traumatic PC tears and outlines modifications to this technique for such cases.

1. Introduction

Blunt ocular trauma is an important cause of blindness and visual impairment worldwide.¹ Blunt injury to the anterior segment can result in variety of findings, including corneal endothelial changes, angle recession, sphincter or iris tears, hyphema, traumatic cataract and lens dislocation.² Posterior capsular rupture can sometimes be found in the setting of traumatic cataract or lens dislocation following blunt trauma,^{3–7} but is rarely seen in isolation.^{8–11} Posterior capsule tears (PCT) are also associated with congenital cataracts (possibly due to intrauterine injury) and posterior polar cataracts (as a result of inherent weakness of the capsule or traction exerted on the opacity adherent to the posterior capsule during surgery).^{12,13,14}

In this case report, we present the management of a patient who developed an isolated PCT following high-speed blunt trauma. The femtosecond laser greatly facilitated management of this case. We present the technique and also summarize critical preoperative and surgical management strategies from a review of literature as well as our own experience.

2. Case report

A 68 year-old man with no significant past medical or past ocular history presented to the emergency room with complaints of left eye pain, blurry vision and photophobia after being hit by a homerun

baseball while sitting in the outfield at a Major League Baseball game. The patient reports the baseball deflected off someone else's glove and hit his glasses, which popped out but did not shatter. He denied pain with eye movements, diplopia or vision loss.

His visual acuity (without correction) was 20/25 in the right eye and 20/100 pinhole 20/40 in the left eye. His intraocular pressures (IOP) were 13 mmHg and 15 mmHg. His right pupil was normal but his left pupil was 7mm, fixed and unreactive. There was no RAPD by reverse. Confrontation visual fields and extraocular movements were full. He had significant left periorbital swelling, erythema and ecchymosis but no tenderness around orbital rim or globe displacement.

Anterior segment biomicroscopy was normal in the right eye except for a 1+ nuclear sclerotic cataract in the right eye. The left eye showed subconjunctival hemorrhage, clear cornea, and a deep anterior chamber without hyphema but with 4+ pigment/RBCs and 1+ white blood cells and flare suggestive of traumatic iritis and microhyphema. His left pupil was oval and mid-dilated. The anterior capsule was intact with 2+ nuclear sclerosis but there was a wedge-shaped tear in the posterior capsule with a superiorly folded flap (Fig. 1). There was no evidence of phacodonesis or vitreous in the anterior chamber. Gonioscopy of the left eye revealed widened ciliary body band in all 4 quadrants consistent with angle recession. The dilated fundus exam was limited but appeared grossly normal; there was no ultrasonographic evidence of retinal detachment or tear.

Ultrasound biomicroscopy using 50Hz probe and anterior segment

* Corresponding author. 645 N Michigan Avenue Suite 440, Chicago, IL, 60611, USA.

E-mail address: alisa.prager@northwestern.edu (A.J. Prager).

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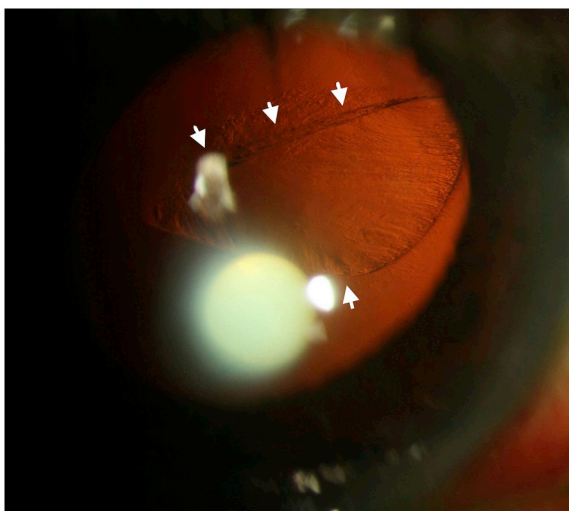


Fig. 1. Slit lamp biomicroscopy of the left eye with retroillumination of the lens showing a wedge shaped disruption of the posterior capsule (with arrows demarcating the tear).

OCT (Avanti; Optovue Inc, Fremont, USA) were both used to try to visualize the posterior capsule without success. CT scan of brain and orbits showed acute fracture of left orbital floor with herniation of extraconal fat and inferior rectus muscle into superior aspect of maxillary sinus with possible involvement of left infraorbital canal. However, he did not have any clinical signs of muscle entrapment and was managed conservatively. For management of hyphema and traumatic iritis, he was started on prednisolone acetate and atropine, and was closely followed with frequent IOP checks. Two weeks after presentation, the eye was quiet and a decision was made to proceed with cataract surgery.

Biometries were performed for both eyes. The left eye had an axial length of 26.28mm, which was similar to the right eye (axial length 26.21mm). The anterior chamber was slightly deeper in the left eye (3.87mm) compared to the right (3.61mm). The lens thickness was similar between the two eyes, with the left lens measuring 4.79mm and the right lens measuring 4.75mm.

Surgery was started with femtosecond laser-assisted capsulotomy using the Catalys femtosecond laser (Johnson and Johnson Vision, Santa Ana CA), which was performed without any modification from the routine case. The capsulorrhexis was 5.0mm in diameter centered on the capsular bag. Laser of the nucleus was modified to increase the posterior capsule safety margin to 800 μ m. Hexagonal segmentation was performed with application of laser energy once. These modifications were aimed at minimizing intralenticular gas bubble formation and preventing enlargement of the PCT. Signs of zonular weakness were not detected during the femtosecond laser part of the surgery. The patient was then placed under the operating microscope and the paracentesis and main wounds were created. Careful hydrodelineation and standard phacoemulsification were carried out. As nuclear removal was being performed, he was found to have 4 clock hours of zonular dialyses temporally. Vitreous was present at the area of the PCT. A thorough anterior vitrectomy and removal of cortex were performed using a vitrector alternating with bimanual aspiration. Then, a Type 6E capsular tension segment (CTS; Morcher GmbH, Stuttgart, Germany) measuring 10mm in diameter was inserted in the area of dialysis and anchored with CV-8 Gore-Tex suture (W. L. Gore & Associates, Newark, DE) through the eyelet and tied superotemporally exiting in the bed of a partial thickness scleral flap (Fig. 2A). A 18.0 Diopter MA50BM intraocular lens (IOL; Alcon Laboratories, TX) was implanted in the sulcus with the IOL haptics oriented 90° away from the area of zonular dialysis (Fig. 2B). A peripheral iridotomy was not performed.

At one-week postoperative visit, his visual acuity was 20/400

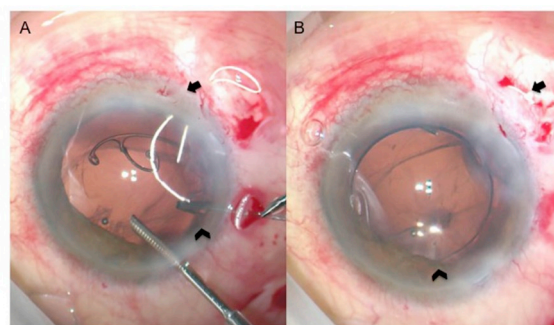


Fig. 2. Intraoperative photo shows 2A) capsule retractor (arrowhead) and Gore-Tex suture looped in Capsule tension segment (arrow) 2B) a well-centered three-piece IOL with haptics in sulcus (arrowhead) and a Gore-Tex suture loop in the superotemporal sclera (arrow).

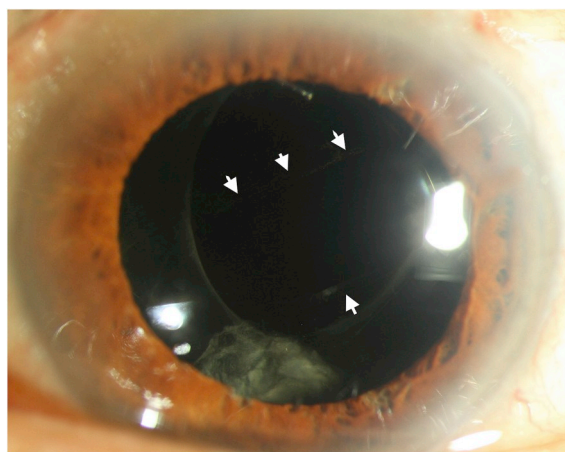


Fig. 3. Post-operative slit lamp photo of the IOL centered in the sulcus with an outline of the PC tear (with arrows demarcating the tear).

pinhole 20/70–2 improving with refraction to 20/40–2. The IOL was well centered (Fig. 3). The macular OCT showed parafoveal intraretinal fluid cysts consistent with cystoid macular edema (CME) and was put on higher doses of prednisolone acetate and ketorolac drops with subsequent resolution of CME. At three months, his BCVA was 20/30 in the left eye.

3. Discussion

Isolated posterior capsular ruptures are relatively rare following ocular trauma. The proposed mechanism of PCT is thought to be due to several forces, including compression, coup and contrecoup.^{15,16} Blunt trauma causes compression along the anterior-posterior axis, which simultaneous expansion in the equatorial plane. This can stretch zonules and tear the posterior capsule. In coup injuries, direct contusion and indentation of the cornea onto the lens can result in cataract formation and tear to the anterior¹⁶ or posterior capsule.¹¹ Lastly, direct injury to the front of the eye can lead to contrecoup injury to the retina, which bears the full effect of the shock waves passed on by the elastic globe. The vitreous can rapidly rebound anteriorly and cause the posterior capsule to burst open.^{11,15} It is likely that our patient suffered from all of these forces, with resultant traumatic mydriasis, iritis, and zonular dialysis, in addition to PCT.

Our patient was unique in that he had rupture of the posterior capsule without formation of intumescent traumatic cataract, which likely would develop in the ensuing weeks. We hence could visualize the tear without additional testing. Frequently though, hydrated lens matter following a capsular tear obscures visualization of the posterior

capsule. In such instances, using the appropriate imaging technique is critical in preoperative determination of the integrity of the posterior capsule. The preferred modality for imaging the posterior capsule is b-scan ultrasonography using a 20 or 25 MHz probe, which is able to penetrate depth of 12 or 20mm, respectively.^{17,18} This is in comparison to a 50MHz probe, which has a depth of penetration of only 5mm. Using a 20-MHz probe, Tabatabaei et al., were able to visualize the posterior border of crystalline lens in all 43 eyes and identify PCT in 17 eyes (39.5%), with a sensitivity of 93% and specificity of 86%.¹⁸ Other modalities reported in the literature include Scheimpflug imaging, which can document and quantify the size of tears pre-operatively,^{10,19} and anterior segment spectral domain coherence tomography (SD-OCT) with capabilities of prolonged scan depth, which has been shown to identify posterior polar cataracts.^{20,21}

Management of cataract with pre-existing PCT depends on the extent of the tear, the presence of zonular dialysis and vitreous loss, and status of the lens. Important surgical goals in these cases are to minimize extension of the PCT, prevent posterior dislocation of nuclear material and retention of adequate capsule to support a posterior chamber IOL. In the past, these cases were typically managed with pars plana lensectomy and extracapsular cataract extraction.^{22,3,22} More recently, surgeons have successfully performed clear corneal incision and standard phacoemulsification with IOL implantation in the capsular bag^{10,11} with anterior optic capture,²³ or placement the sulcus.²⁴ Other surgical techniques include use of anterior chamber maintainer with hydrodissection and manual extraction of lens nucleus,⁴ or use of high speed vitrector to remove the lens matter.²⁵ For cases with large PCT, vitreous prolapse or zonular instability, pars plana vitrectomy can be performed.¹¹

Femtosecond laser has been successfully used in cases of traumatic cataract,^{26–29} subluxated traumatic cataracts,³⁰ and penetrating injury of the cornea and anterior lens capsule.³¹ Based on our experience with this case, we believe that FLACS is particularly advantageous in cataracts with preexisting PCT because it facilitates creation of a capsulotomy and increases the ease of nuclear removal by segmentation. These two steps can maximize the chance of removal of lens material without posterior dislocation. We were able to safely perform a femtosecond laser-assisted capsulotomy and nuclear segmentation without putting significant strain on the posterior capsule. These steps facilitated retention of most of the capsular bag and facilitated placement of a CTS followed by IOL placement in the ciliary sulcus. In this case, we did not perform optic capture because we were concerned that capturing a 6.5mm MA60BM IOL optic in a 5.0mm rhexis may cause an inadvertent tear in the anterior capsule. Instead, we sought to maximize stability of the IOL by orienting the haptics 90° away from the area of zonular dialysis. Optic capture represents one of the best methods to center and stabilize the optic of a sulcus fixated lens and would have been our preference except for our concern related to the sizing as mentioned above. While optic capture was not performed in this case, optic capture may be considered in other cases to ensure stability of the entire complex.

To our knowledge, this is the first report of the use of FLACS for pre-existing PCT. Our case suggests that it can be performed safely by taking specific precautions, such as increasing the posterior capsule safety margin and only performing segmentation once to reduce formation of gas in the bag. Furthermore, like has been previously reported,³² placement of a CTS facilitated stabilization of the capsular bag, permitting placement and good centration of a three-piece IOL in the sulcus.

4. Conclusion

Management of isolated posterior capsular rupture depends on accurate assessment of the tear as well as presence of injury to other structures. This paper discusses optimal techniques for imaging the posterior capsule in such cases. While previous reports have described

use of standard phacoemulsification and IOL insertion, our report highlights the advantages of using FLACS in management of traumatic PCTs and outlines modifications to the technique of FLACS for such cases.

Patient consent statement

Written consent to publish this case has not been obtained. This report does not contain any personal identifying information.

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Authorship

All authors attest that they meet the current ICMJE criteria for authorship.

Declaration of competing interest

The authors have no financial disclosures.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ajoc.2020.100742>.

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