

Intravitreal Triamcinolone-Induced Ocular Hypertension

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CASE PRESENTATION

A 54-year-old Asian female presented to the emergency room with acute anterior uveitis in her right eye. She had a prior history of HLA-B27–associated bilateral anterior uveitis that was previously treated with topical steroids. She was highly myopic (−7.25 D OD, −8.00 D OS) and was taking medication for systemic hypertension.

On examination, the patient's BCVA was 20/50 OD and 20/20 OS. Her right eye was positive for cells in the anterior chamber, cystoid macular edema (CME), and an early epiretinal membrane. The examination also demonstrated evidence of previous uveitis in her left eye and clear crystalline lenses bilaterally.

Over the next 4 months, the patient received three orbital floor injections of 40 mg of triamcinolone acetate for inflammation and macular edema. Although the vision in the patient's right eye improved from 20/50 to 20/30 after each injection, her IOPs also rose incrementally with every treatment. Her elevated IOP was treated cumulatively with topical timolol, dorzolamide, brimonidine, and bimatoprost. Six months after the patient received her last dose of triamcinolone, she had normal visual fields and optic discs, and her IOP peaked at 45 mm Hg. With continued topical therapy, the patient's IOP subsequently decreased to 13 mm Hg by 9 months after her last orbital floor injection.

The patient developed a worsening cataract and epiretinal membrane in her right eye that reduced her vision to 20/80 over the next few months. She underwent combined vitrectomy, epiretinal membrane peeling, and cataract extraction. The patient also took oral prednisone perioperatively (25 q.d.) and instilled topical prednisone acetate (10 mg/mL q.i.d.) postoperatively. She continued to use topical timolol, dorzolamide, and brimonidine but discontinued bimatoprost.

One week postoperatively, the patient's BCVA was

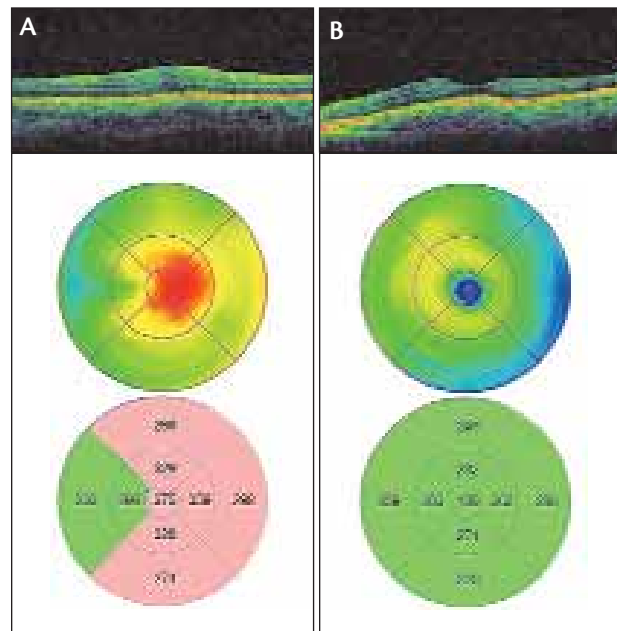


Figure 1. Horizontal line scans (6 mm) (top) and thickness maps (bottom) of the patient's maculae obtained with the Stratus OCT (Carl Zeiss Meditec, Inc., Dublin, CA) prior to the administration of intravitreal triamcinolone show thickening in the right eye (A) compared with the left (B).

20/60 OD. Over the next 4 weeks, her visual acuity decreased to 20/120 due to increasing macular edema that was confirmed by fundoscopy and with optical coherence tomography (Figure 1). She had persistent anterior chamber inflammation despite topical and oral prednisone (10 mg q.d.). The patient's IOP was maintained at approximately 21 mm Hg on this regimen.

In view of the patient's deteriorating vision and macular edema, we administered 4 mg of intravitreal triamcinolone to her right eye via a pars plana injection. The

next day, her IOP was 30 mm Hg, and a 1-mm pseudohypopyon was present. The patient's vision improved to 20/80 over the next week, but by day 7, her IOP had increased to 46 mm Hg despite oral acetazolamide (250 mg q.i.d.) and continued maximal topical therapy.

Comments on Management

RNW: I wonder if postoperative inflammation could have contributed to the spike in IOP 1 day after the first intravitreal injection and whether the presence of a preservative in the triamcinolone, not the drug itself, was responsible for the rise. Steroid-induced ocular hypertension usually occurs later.

JGC: Intravitreal triamcinolone can be filtered to remove benzyl alcohol, an agent commonly used as a solvent. The drug was not filtered in this case, which could have caused inflammation in the anterior chamber. It would be interesting to know if preservative-free triamcinolone is less likely to cause an earlier rise in IOP than a preserved formulation of the drug.

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— Jonathan G. Crowston, MD, PhD

JBR: One could also consider that mechanical obstruction of the trabecular meshwork contributed to this patient's early rise in IOP. In this case, a pseudohypopyon caused by intravitreal triamcinolone migrated into the anterior chamber of the patient's pseudophakic, vitrectomized eye. The pseudohypopyon resolved over the following week. A rise in IOP induced by intravitreal triamcinolone can occur as early as 1 week postinjection,¹ especially in a patient who is known to respond to steroids.

JGC: The early rise in IOP may have been due to inflammation, but the persistent elevation that followed was likely induced by the steroid rather than by uveitis. The patient had not experienced an elevation in her IOP during previous episodes of uveitis. Her initial rise in IOP occurred after the orbital floor injections of triamcinolone. Her IOP reached 46 mm Hg 1 week after the left pars plana injection of triamcinolone, and the retina sur-



Figure 2. The patient had a quiet diffuse superior bleb in her right eye 4 months after undergoing trabeculectomy with mitomycin C.

geons felt it was likely that she would need additional injections of this drug in the future to reduce her CME.

Discussion of Management Options

RNW: A conventional approach would be to perform a pressure-lowering surgical procedure such as trabeculectomy, perhaps in combination with irrigation and aspiration of the triamcinolone from the anterior and posterior chamber. It is possible, however, that the intraocular triamcinolone could prevent the formation of scar tissue in the subconjunctiva after trabeculectomy, so there may be more benefit from leaving it in situ. Nonpenetrating surgery has also been used to lower IOP in patients with steroid-induced ocular hypertension.²

JGC: A recently published small case series documented a reduction in IOP after vitrectomy and washout of triamcinolone.³ We recently tried to treat a case of intravitreal triamcinolone-induced ocular hypertension with this approach, but the procedure was not successful, and the patient later required a trabeculectomy.

CKSL: We had a similar case in Hong Kong where a small pseudohypopyon was detected by anterior segment optical coherence tomography. The washings removed from the anterior chamber contained crystallized triamcinolone. Postoperatively, the chamber quieted, and the patient's IOP returned to preinjection levels.

JGC: What are some alternative therapeutic approaches for steroid-induced hypertension?

RNW: Glucocorticoid antagonists, including progesterone, mifepristone, and anecortave acetate might be

beneficial in treating steroid-induced glaucoma. Because progesterone is a weak antagonist, it is unlikely to be efficacious, and mifepristone is not generally available.

Investigators are studying anecortave acetate as a treatment for neovascular age-related macular degeneration and are also evaluating its effect in patients with primary open-angle glaucoma, many of whom are sensitive to steroids.⁴ The drug may act as an antagonist of the glucocorticoid receptors in the trabecular meshwork and has been proposed to be effective in lowering IOP in patients with steroid-induced glaucoma.⁴

JGC: Given that our patient received intravitreal triamcinolone to reduce her CME, would a glucocorticoid antagonist interfere with the former drug's desired action on the retina to reduce the macular edema?

"Glucocorticoid antagonists, including progesterone, mifepristone, and anecortave acetate might be beneficial in treating steroid-induced glaucoma."

— Robert N. Weinreb, MD

RNW: Is triamcinolone's glucocorticoid effect on CME the result of a rise in IOP and Starling's law, or do glucocorticoids have a direct effect on leaking retinal vessels? Almost 30 years ago, it was reported that a steroid-related rise in IOP could effectively treat CME and improve visual acuity.⁵

JGC: The cellular pathways underlying CME may also differ depending on whether the etiology is venous occlusion, diabetes, uveitis, or cataract surgery. Thus, the effect of glucocorticoids on CME and the value of these agents for managing elevated IOP may differ according to the condition's etiology.

The literature describes the use of argon or selective YAG laser trabeculoplasty for treating steroid-induced ocular hypertension.⁶ This approach may be an option for some patients, although more evidence is required.

JBR: We were reluctant to consider selective laser trabeculoplasty in this case, because the patient's IOP was very high, and she had a history of uveitis.

RNW: I share your concerns. Trabeculoplasty may not be sufficiently effective in patients with IOPs higher than 40 mm Hg.

CONCLUSION

The patient underwent a fornix-based trabeculectomy with mitomycin C (0.4 mg/mL for 3 minutes). Postoperatively, she required one subconjunctival 5-fluorouracil injection. Her postoperative IOP was low, ranging between 5 and 8 mm Hg.

Four months postoperatively, a quiet diffuse bleb was present in the patient's right eye (Figure 2), and her BCVA was 20/60. The patient reported subjective improvement in her vision, but her macular thickness remains above 300 μ m. □

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- Jonas JB, Degenring R, Kreissig I, et al. Intraocular pressure elevation after intravitreal triamcinolone acetonide injection. *Ophthalmology*. 2005;112:593-598.
- Krishnan R, Kumar N, Wishart PK. Viscocanalostomy for refractory glaucoma secondary to triamcinolone acetonide injection. *Arch Ophthalmol*. 2007;125:1284-1286.
- Agrawal S, Agrawal J, Agrawal T. Vitrectomy as a treatment of elevated intraocular pressure following intravitreal injection of triamcinolone. *Ophthalmology*. 2004;138:679-680.
- Sjaarda RN, Robin AL, Suan EP, Davis AA. Anterior juxtasceral depot of anecortave acetate: novel long-duration intraocular pressure reduction in glaucoma caused by intravitreal triamcinolone acetate. *Invest Ophthalmol Vis Sci*. 2006;47:E-Abstract 402.
- McEntyre JM. A successful treatment for aphakic cystoid macular edema. *Ann Ophthalmol*. 1978;12:119-1224.
- Ricci F, Missiroli F, Parravano M. Argon laser trabeculoplasty in triamcinolone acetonide induced ocular hypertension refractory to maximal medical treatment. *Eur J Ophthalmol*. 2006;16:756-757.