

Intravitreal Kenalog and Glaucoma

The nature of steroid-induced glaucoma and the troubles in treating it.

BY RICHARD A. LEWIS, MD

Ophthalmologists successfully use intravitreal triamcinolone acetonide (Kenalog; Bristol-Myers Squibb Company, New York, NY) to treat a variety of retinal proliferative disorders, including diabetic retinopathy, retinal vascular occlusive disease, retinitis pigmentosa, macular edema, and occult retinal lesions. Administered in a dose ranging from 2 to 4 mg that may be injected again in 8 to 12 weeks, the drug acts to reduce retinal leakage. This relatively inexpensive agent has great efficacy in the posterior segment, improves vision remarkably, and alleviates symptoms.

Unfortunately, like other drugs, intravitreal Kenalog is associated with ocular complications. Despite the surgeon's adherence to preinjection hygienic standards, subconjunctival hemorrhages, direct injury to the lens, or retinal trauma may occur. Also of concern is that administering Kenalog intravitreally can increase IOP and cause glaucoma.

STEROID-INDUCED SIDE EFFECTS

Researchers have described steroid-induced glaucomas since the introduction of various forms of prednisone nearly 50 years ago. Investigators have suggested that steroid treatment causes morphologic changes in the trabecular meshwork that then result in glaucoma.¹ Specifically, steroids are believed to induce the expression of TIGR, or GLC1a, which produces the protein myocilin.² One recent study³ indicated that the overexpression of myocilin has a de-adhesive effect on trabecular meshwork cells.

Other reports have documented elevated IOP independent of steroid delivery to the eye or rest of the body. Although only small subsets of the population are high responders to steroids, many patients are susceptible. The most dramatic rise in IOP occurs when the steroid is applied topically or intravitreally in the eye, as in the case of Kenalog.

Of concern is that Kenalog-induced pressure spikes tend to be more dramatic and quicker in onset than

“The most dramatic rise in IOP occurs when the steroid is applied topically or intravitreally in the eye, as in the case of Kenalog.”

other steroid-induced elevations. In one study⁴ of patients receiving intravitreal Kenalog, approximately 28% of the subjects developed a significant rise (≥ 5 mm Hg) in IOP above baseline during the first 3 months of treatment. In another study,⁵ up to 50% of the patients receiving intravitreal Kenalog developed elevated IOP. A known history of primary open-angle glaucoma does not appear to increase the risk of glaucoma from intravitreal Kenalog. Studies are pending, however.

The magnitude of the pressure rise and its resistance to conventional hypotensive agents⁶ make Kenalog-induced glaucoma different from other forms of corticosteroid glaucoma and especially difficult to treat.

TREATING KENALOG-INDUCED GLAUCOMA

That the administered agent resides in the vitreous cavity for an extended period delays its clearing in steroid-susceptible patients. In fact, short of performing a vitrectomy, it is difficult to clear the eye of the compound. Thus, the direct application of Kenalog in the posterior segment (the very reason that the intravitreal injection is clinically effective) creates an obstacle to providing hypotensive therapy.

Conventional topical glaucoma therapy for elevated IOP often has little effect in those cases, and systemic acetazolamide is frequently necessary. In some patients, however, neither topical nor systemic medications will

VITREORETINAL PERSPECTIVE

By Christopher D. Riemann, MD

From a retinal perspective, the intravitreal injection of 4 to 20 mg of triamcinolone acetonide (Kenalog; Bristol-Myers Squibb Company, New York, NY) may offer hope to many patients who previously had limited treatment options. Anecdotal reports and small case series suggest that intravitreal Kenalog may benefit select patients with subfoveal choroidal neovascularization, diffuse diabetic macular edema, retinal venous occlusive disease with cystoid macular edema, and refractory uveitis. Some of these patients experience a stunning improvement in visual function; often they see many lines better on the eye chart. While the exact magnitude and duration of these benefits have not been determined, this kind of treatment response was rarely seen before the advent of intravitreal Kenalog.

Although individual practice patterns vary, the five retinal surgeons at the Cincinnati Eye Institute (including myself) administer intravitreal Kenalog approximately 120 times per month. An informal canvassing of the four glaucoma specialists in our practice revealed that glaucoma surgery for Kenalog-induced glaucoma was performed about 10 times in the past year. Although not statistically rigorous, this finding translates to seven glaucoma surgeries per 1,000 intravitreal injections of Kenalog.

My colleagues' and my experience at a large, multisubspecialty ophthalmology practice validates the potential for a sight-threatening elevation in IOP after intravitreal Kenalog, but it also puts the risk into a broader context. After injection, many patients have markedly improved vision. Some have IOP responses. Most often, these pressure spikes can be managed without surgery. Whether the benefits of intravitreal Kenalog are as good as they appear and outweigh its risks needs to be investigated further, preferably with prospective randomized trials. In the meantime, a frank discussion with the patient of the risks, benefits, and uncertainties is essential.

Christopher D. Riemann, MD, is a vitreoretinal surgeon at the Cincinnati Eye Institute in Ohio. He stated that he holds no financial interest in the product or company mentioned herein. Dr. Riemann may be reached at (513) 984-5133; criemann@cincinnatieye.com.



control the IOP, which can sometimes rise so high as to threaten visual function and necessitate glaucoma surgery.

Other than anecdotal case reports, little has been published on the surgical management of steroid-induced glaucoma secondary to intravitreal Kenalog. As is often true in secondary glaucomas, argon and selective laser trabeculoplasties are ineffective. Because many patients with steroid-induced glaucoma are also at risk for subcapsular cataract, other approaches must be considered. These include standard trabeculotomy with antifibrotics, phacoemulsification alone, combined trabeculectomy and phacoemulsification, and vitrectomy. Unfortunately, controlling IOP and restoring visual function without jeopardizing retinal pathology treated with intravitreal Kenalog presents a distinct challenge. □

Richard A. Lewis, MD, is in private practice in Sacramento, California. He stated that he holds no financial interest in the products or companies mentioned herein. Dr. Lewis may be reached at (916) 455-9938; rlewiseyemd@yahoo.com.



- Hernandez MR, Weinstein BI, Dunn MW, et al. Glucocorticoid target cells in human outflow pathway: autopsy and surgical specimens. *Invest Ophthalmol Vis Sci.* 1983;24:1612-1616.
- Richards JE, Ritch R, Lichter PR, et al. Novel trabecular meshwork inducible glucocorticoid response mutation in an eight-generation juvenile-onset primary open-angle glaucoma pedigree. *Ophthalmology.* 1998;105:1698-1707.
- Wentz-Hunter K, Shen X, Okazaki K, et al. Overexpression of myocilin in cultured human trabecular meshwork cells. *Exp Cell Res.* 2004;297:39-48.
- Bakri SJ, Beer PM. The effect of intravitreal triamcinolone acetonide on intraocular pressure. *Ophthalmic Surg Lasers.* 2003;34:386-390.
- Jonas JB, Kreissig I, Sofker A, Degenring RJ. Intravitreal injection of triamcinolone for diffuse diabetic macular edema. *Arch Ophthalmol.* 2003;121:57-61.
- Singh IP, Ahmad SI, Yeh D, et al. Early rapid rise in intraocular pressure after intravitreal triamcinolone acetonide injection. *Am J Ophthalmol.* 2004;138:286-287.