

Intracameral Epinephrine for IFIS Prophylaxis

This approach may eliminate the need for adjunctive management strategies in most cases.

BY JOEL K. SHUGAR, MD, MSEE

Chang and Campbell's report of intraoperative floppy iris syndrome (IFIS) associated with the use of tamsulosin¹ is one of the landmark discoveries of this decade in the field of cataract surgery. The syndrome is characterized by a floppy, billowing iris that exhibits progressive miosis during cataract surgery, has a propensity to prolapse through all surgical incisions and into the phaco port, and is unresponsive to pupillary stretching.

Tamsulosin is a systemic alpha-1 adrenergic antagonist that has gained widespread popularity among urologists for treating the symptoms of benign prostatic hypertrophy. A significant proportion of men presenting for cataract surgery, therefore, are taking or have taken the drug. Tamsulosin's effect upon the iris is likely due to a blockade of the iris dilator muscle's alpha-1 adrenergic receptors. This effect often appears to be irreversible and of rapid onset. I have observed severe IFIS in patients with only a short history of using the drug who had discontinued it more than 1 year prior to surgery.

The initial suggestions for managing IFIS were to use Healon 5 (Advanced Medical Optics, Inc., Santa Ana, CA) and/or iris hooks or pupillary rings. Although effective, these modalities involve altering one's surgical technique. They also typically add time and expense to the case, and they raise the possibility of complications. For example, residual Healon 5 has been associated with severe postoperative pressure spikes, especially likely in the hands of surgeons who use it infrequently. The use of iris devices can lead to iatrogenic capsular tears, sometimes progressing to nuclear loss into the vitreous cavity (S. Rooney, MD, written communication, January 2006).

An optimal solution for managing IFIS would neither involve a change in surgical technique nor pose additional risk to the patient. Ideally, it would also use materials that are already readily available in most ophthalmic ORs. I searched for a pharmacologic agent to fulfill these criteria. Because tamsulosin blocks the alpha-1 adrenergic receptors of the iris dilator muscle, it seemed plausible that this blockade could be overcome by flooding the receptors with an intracameral administration of their natural agonist, epinephrine.

THE MIXTURE

The endothelial toxicity of epinephrine has decreased in recent years thanks to the introduction of a sulfite-free, preservative-free 1:1,000 solution (American Reagent Laboratories, Inc., Shirley, NY). It has been shown to cause much less corneal edema than earlier sulfite-containing solutions.² I measured the pH of this medication, however, and found it to be 3.13. In order to raise the pH enough for safe intracameral injection, I diluted one part of the stock solution with three parts Shugarcaine. The pH of the resultant mixture measured 6.90, well above the minimum safe threshold of 6.50.³

Shugarcaine is 4% unpreserved lidocaine (Abbott Laboratories, Inc., North Chicago, IL) diluted 1:3 with BSS Plus (Alcon Laboratories, Inc., Fort Worth, TX), which produces a 1% lidocaine solution with a pH of 6.97. I developed this mixture when my use of stock 1% lidocaine—the pH of which measures from 6.10 to 6.33—caused corneal edema in my cataract patients. Since I published this formulation,⁴ many ophthalmologists have adopted it. There has not



Figure 1. The author instills epi-Shugarcaine in the eye of a patient taking tamsulosin. A previously placed arcuate keratotomy is co-linear with the pupillary margin.



Figure 2. In the same eye, the author has completed the capsulorhexis and hydrodissection. The pupil has dilated an additional 2mm, and the arcuate keratotomy is now well within the pupillary margin.

been a single report of an adverse effect in the many thousands of cases in which Shugarcaine has been employed.

In the spring of 2005, I began using the mixture of epinephrine and Shugarcaine (which was dubbed *epi-Shugarcaine*) in patients with a history of taking tamsulosin. Because the solution also contains the intracameral anesthetic I routinely use, there was no need for me to change my surgical technique. I administer an initial injection of approximately 1mL prior to instilling a viscoelastic (Figure 1). In my experience, the iris' flaccidity typically resolves within a few seconds, and 1 to 2mm of additional mydriasis occurs during the next several minutes (Figure 2). It is my usual practice to repeat the intracameral injection of an anesthetic after completing phacoemulsification. If the patient used or is using tamsulosin, I instill the epinephrine-containing mixture.

In whole milliliter quantities, the formulation for epi-Shugarcaine is to mix 9mL of BSS Plus with 3mL of 4% preservative-free lidocaine and 4mL of 1:1,000 bisulfite-free epinephrine.

RESULTS

My experience with epi-Shugarcaine has been uniformly positive.⁵ To date, I have used it in more than 30 patients with a history of taking tamsulosin, and each case has been routine with no IFIS encountered. I did not administer the epinephrine-containing solution during surgery on the first eyes of two patients, and severe IFIS ensued, although I noted no IFIS on the second eyes in which epi-Shugarcaine was used. Per the suggestion of Samuel Masket, MD, of Los Angeles, I premedicated the first few eyes in which I used epi-Shugarcaine with atropine. For the past year, I have omitted the atropine and have not encountered any IFIS.

In June 2005, I suggested using the formulation in a posting on the ASCRS Eye Mail Cataract Group. Since then, about 10 ophthalmologists have reported their experiences with this mixture on the Eye Mail list, and all have been positive. Several surgeons have described patients who exhibited severe IFIS in their first eye (operated on without epinephrine) and required the use of iris hooks and/or Healon 5. In contrast, those patients' second eyes, in which the epinephrine mixture was used, did not pose unusual surgical difficulty. Additionally, several surgeons employed epinephrine in the middle of a case that had already progressed to severe IFIS. They reported that the medication aborted the IFIS and made the remainder of the case routine.

The interviews I have given in other publications have raised awareness of epi-Shugarcaine.^{6,7} Since then, I have received feedback from a multitude of other ophthalmologists regarding the use of this mixture. All have found it to be efficacious, and no adverse effects have been reported. Only one surgeon who did not use atropine with epi-Shugarcaine has encountered IFIS (S. Masket, MD, written communication, June 2006). A small subset of patients, therefore, might benefit from preoperative atropine and/or might subsequently require additional adjunctive techniques such as iris hooks or Healon 5.

Epi-Shugarcaine is my preferred form of prophylaxis against IFIS, because I do not use epinephrine without mixing it with the Shugarcaine formulation. In routine cases, surgeons may use lidocaine to dilate the pupil without the need for adjunctive agents,⁸ so lidocaine may add to the efficacy of the epinephrine mixture.

I often receive inquiries about substituting plain balanced salt solution for BSS Plus. Although some surgeons have reported success with this variation (R. Schultz, MD, written

communication, June 2006), I prefer BSS Plus because I initially inject the mixture prior to instilling a viscoelastic. I have measured the pH of epi-Shugarcaine formulated with plain balanced salt solution and found it to be 6.67, and I found the pH of bisulfite-free epinephrine diluted 3:1 with balanced salt solution to be 6.75. Plain balanced salt solution therefore may safely be used as a dilutant if BSS Plus is unavailable.

Other surgeons have recommended the use of intracameral phenylephrine (see the article by Richard Packard, FRCS, FRCOphth, on page 75). A review of the literature suggests that epinephrine has more potency at the alpha-1 adrenergic receptor,^{9,10} and phenylephrine's longer duration of action gives rise to concerns about potential anterior segment ischemia.

CONCLUSION

Epi-Shugarcaine has thus far proven to be safe and effective in IFIS prophylaxis. The combined experience of many surgeons suggests that this formulation will obviate the need for other techniques to expand a small pupil in the vast majority of cases. For eyes in which measures such as iris hooks are necessary, administering epi-Shugarcaine may

decrease the severity of IFIS and will not interfere with the adjunctive techniques. I therefore advocate epi-Shugarcaine as the preferred agent for IFIS prophylaxis in all patients with a history of using tamsulosin. ■

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