

Intraoperative Miosis

BY LUTHER L. FRY, MD; ROBERT H. OSHER, MD; SAMUEL MASKET, MD;
RICHARD J. MACKOOL, MD; DAVID F. CHANG, MD; DOUGLAS D. KOCH, MD;
ALAN S. CRANDALL, MD; RICHARD L. LINDSTROM, MD; STEPHEN S. LANE, MD;
AND ROGER F. STEINERT, MD

CASE PRESENTATION

You have begun routine phacoemulsification in an eye with a marginally dilated pupil that has no evidence of intraoperative floppy iris syndrome (IFIS). The pupil begins to constrict during phacoemulsification so that you no longer feel safe continuing. What is your preference for intraoperative dilation? The choices include pharmacologic agents, ophthalmic viscosurgical devices (OVDs), pupillary stretching, or expanding devices.

LUTHER L. FRY, MD

I have had little success with viscomydriasis, intracameral epinephrine, or pupillary stretching in cases such as this one. I think a pupillary expansion device would be the best bet.

Although intracameral epi-Shugarcaine seems to have little effect on pupillary size when used intraoperatively, I might try it anyway. It stiffens the iris in a case of IFIS, and I do not hesitate to use it if there is evidence of this syndrome. It is well known that bimanually stretching an IFIS iris is not only ineffective, but it makes the iris even floppier. Bimanual stretching works reasonably well in these cases, however, if the iris is pretreated with epi-Shugarcaine. For this reason, I use this solution in every eye with a small pupil before stretching the iris, on the chance that the patient has undergone treatment with Flomax (Boehringer Ingelheim Pharmaceuticals, Inc., Ridgefield, CT) or another alpha-1a blocker in the past. In this case, if I were to perform bimanual stretching, I would first inject epi-Shugarcaine beneath the iris.

Here, I think it would be easiest and most effective to insert a pupillary expansion device. I have used iris hooks and the Graether silicone expansion ring (Eagle Vision, Inc., Memphis, TN) in the past, but I presently prefer the Malyugin Ring (MicroSurgical Technology, Redmond, WA), because I find it easier and faster. One minor caveat: if the device is inserted after the case has begun, it is easy to engage the capsulorhexis with one or more of the scrolls of the Malyugin Ring. I have done so a couple of times. This event has not caused any problem, and disen-

agement was easy when I noticed the problem. I have used the larger 7-mm ring in only a couple of cases, so I do not have enough experience to comment on it. The smaller device may be easier to insert and creates an adequately sized pupil, so I use it.

ROBERT H. OSHER, MD

I would inject epi-Shugarcaine and then use viscomydriasis with Healon5 (Abbott Medical Optics Inc., Santa Ana, CA). I would not hesitate to use a Fry pupillary stretching technique with two dull instruments after depressing the anterior capsule with an OVD in order to avoid engaging the edge of the capsulorhexis. My next step used to be to insert iris hooks, but I now prefer to inject the new 7-mm Malyugin Ring. Even though my slow-motion phaco parameters offer extra safety when working near or beneath the iris, years of experience have confirmed that compromised visualization increases the chance of encountering an intraoperative complication.

SAMUEL MASKET, MD

Prevention always trumps reaction; the preoperative use of a topical nonsteroidal anti-inflammatory drug may preclude intraoperative miosis in many cases. Nevertheless, certain conditions (including IFIS) may contribute to progressive miosis. A prime example is the fluctuation in the anterior chamber's depth that may occur in postvitrectomy eyes, highly myopic eyes, and those with generally weakened zonules. These cases can lead to iris retro-pulsion syndrome, which may induce miosis as surgery progresses.

Owing to reduced visibility, it is generally cumbersome to use mechanical devices to stretch the pupil once the crystalline lens has been removed. I therefore prefer to instill intraocular epinephrine/lidocaine (epi-Shugarcaine) in combination with copious amounts of a retentive OVD (DisCoVisc [Alcon Laboratories, Inc., Fort Worth, TX] or Healon5) and reduced fluidic turnover (Osher's slow-motion phacoemulsification). Also, if possible based on space and the health of the endothelium, I prefer to bring the nucleus anterior to the plane of the pupil so

that the iris will be less likely to enter the phaco tip. If all of these strategies fail, I will employ iris hooks. Although I generally prefer the Malyugin Ring for small pupils, I find it more difficult to manage than individual hooks after the crystalline lens' removal.

RICHARD J. MACKOOL, MD

Prevention is preferable to management. In that regard, preoperatively administering a topical nonsteroidal anti-inflammatory drug and using a phaco incision that does not leak and a minimally leaky sideport incision (to lessen turbulence) combine to decrease the chances of pupillary contracture during the procedure.

Because I already have epinephrine in the infusion bottle, if the pupil constricts intraoperatively, I do not add more during the cataract procedure. I would instead perform the following maneuvers, as needed, in the order presented:

1. attempt again to expand the pupil by injecting an OVD (Viscoat; Alcon Laboratories, Inc.)
2. use a Beehler two-pronged pupillary dilator (Moria, Antony, France)
3. insert iris retractors

Other surgeons may prefer various pupillary expanding devices. I recommend caution when removing a Malyugin Ring. The portions that surround the iris are capable of entrapping the tissue, especially if the iris becomes hydrated during the procedure and/or the ring has become somewhat deformed due to re-sterilization. Rapidly removing the device without verifying that the iris is completely released could result in the creation of an iridodialysis or even a total iridectomy.

DAVID F. CHANG, MD

I would first ask the patient if he or she has ever taken alpha blockers. If IFIS were likely, I would want to avoid sphincterotomies or pupillary stretching. Intracameral epinephrine might work, but in all likelihood, I would have already tried it because of the pupil's marginal starting size. Either iris retractors or the Malyugin Ring could be used, as long as the capsulorhexis' edge were not hooked by the device. Using a dispersive or retentive OVD to separate the iris and anterior capsular planes would facilitate the placement of either surgical instrument. Most surgeons will find that it is easier to avoid snagging the capsulorhexis by individually placing iris retractors compared with inserting a Malyugin Ring. If using the latter, I would first inject and open the ring entirely within the anterior chamber before individually and sequentially positioning each coil to confirm that I did not engage the capsulorhexis' edge.

DOUGLAS D. KOCH, MD

I would proceed with the following sequence of steps:

1. inject 1/5000 epinephrine (1/1000 diluted [1 mL] with balanced salt solution [4 mL]) plus additional preservative-free 1% lidocaine as a second injection
2. instill Healon5, if needed, while reducing the aspiration flow rate to 20 mL/min and the vacuum level to 225 mm Hg
3. employ iris hooks if needed

ALAN S. CRANDALL, MD

I would first try [AC: My first approach would be?] pharmacological with Shugarcaine or with unpreserved lidocaine and epi [AC: epinephrine?], which I always have in the OR. I would add an OVD (usually DisCoVisc or Healon5). I also usually switch to a Flomax setting on my phaco machine, which lowers the bottle and reduces the flow rate (to 25 mL/min) and the vacuum level to 300 mm Hg (linear ultrasound). I do not like to stretch the pupil at this time, but I would add iris hooks. If I were worried about the [AC: capsular?] support, I always have Mackool hooks [AC: proprietary? If so, please indicate manufacturer] and a Malyugin Ring available. It can be slightly difficult to visualize the edge of the capsulorhexis when placing the ring, but with OVDs, the ring can help.

“The best pearl is to hydrodissect or viscodissect the nucleus until it tilts out of the bag into a vertical position.”

—Richard L. Lindstrom, MD

RICHARD L. LINDSTROM, MD

My first response to significant miosis during surgery is to inject unpreserved intracameral epinephrine 1:1000 diluted 5 to 1 with balanced salt solution under the iris. Then, I will perform viscomydriasis with a cohesive OVD while taking care to inject it in the center of the pupil in the iris plane. Many years ago, I taught special methods for operating on small pupils. To me, the best pearl is to hydrodissect or viscodissect the nucleus until it tilts out of the bag into a vertical position. With the phaco tip bevel down, the surgeon can then remove a nucleus fairly easily, even with a small pupil. This approach also works well in cases of IFIS, and the iris can be pushed posteriorly with a dispersive OVD and held back with the nucleus and viscoelastic.

My current advice is not to operate on a small pupil. My next step in this case would be to perform bimanual iris stretching and to repeat the viscomydriasis. If the pupil's size were still inadequate, I would place a Malyugin Ring. I always have iris hooks available; they

work well but take longer to place and remove. In select cases in which the capsule is loose as well, such as in eyes with severe pseudoexfoliation, the pupil can be retracted and the anterior capsulotomy's edge supported with hooks at the same time. The Malyugin Ring is pretty straightforward and intuitive to place, but surgeons should take special care and go slowly when removing the device, because it can catch on the iris.

STEPHEN S. LANE, MD

I would inject epinephrine 1:1,000 (1 mL mixed with 4 mL of balanced salt solution) intracamerally. In my experience, pupils that dilated to a size with which I was comfortable before the initiation of phacoemulsification almost always return to that diameter. If this measure were ineffective, I would instill Viscoat or Healon5 to provide viscomydriasis and go to low flow parameters to maintain adequate pupillary dilation. Iris hooks, pupillary stretching, and the use of a Malyugin Ring are all possibilities, but they must be used with care in an eye that has already undergone a capsulorhexis to avoid engaging its edge with a hook, instrument, or ring in addition to or instead of the pupillary edge. Such snags could cause the anterior capsular rim to tear around the equator and potentially result in a dropped nucleus and/or vitreous loss.

ROGER F. STEINERT, MD

In my experience, stretching is helpful for an initially small pupil with constricting fibers or adhesions. Viscomydriasis and low-flow phacoemulsification assist with a marginally dilated pupil at the start of the case, but these measures are often inadequate when a pupil starts to constrict intraoperatively. That leaves the surgeon with mechanical dilating devices like hooks and rings. Of these, I find the Malyugin Ring the easiest and most effective. The 6-mm device is easier to insert but may not create enough dilation for every surgeon's comfort, in which case the new 7-mm ring can be inserted. ■

Section editor Michael E. Snyder, MD, is a cataract specialist at the Cincinnati Eye Institute in Ohio. Robert H. Osher, MD, is a professor of ophthalmology for the University of Cincinnati College of Medicine, and he is medical director emeritus at the Cincinnati Eye Institute. Dr. Osher is a consultant to Abbott Medical Optics Inc. and Alcon Laboratories, Inc. They may be reached at (513) 984-5133; rhosher@cincinnatieye.com.

David F. Chang, MD, is a clinical professor at the University of California, San Francisco, and is in private practice in Los Altos, California. He acknowledged no financial interest in the products or companies he mentioned. Dr. Chang may



be reached at (650) 948-9123; dceye@earthlink.net.

Alan S. Crandall, MD, is a professor, the senior vice chair of ophthalmology and visual sciences, and the director of glaucoma and cataract for the John A. Moran Eye Center at the University of Utah in Salt Lake City. [AC: please make disclosure for your comments in accordance with CRSToday's policy] Dr. Crandall may be reached at (801) 585-3071; alan.crandall@hsc@utah.edu.



Luther L. Fry, MD, is a clinical assistant professor of ophthalmology at the University of Kansas Medical Center in Kansas City. He acknowledged no financial interest in the products or companies he mentioned. Dr. Fry may be reached at (620) 275-6302; lufry@fryeye.com.



Douglas D. Koch, MD, is a professor and the Allen, Mosbacher, and Law chair in ophthalmology at the Cullen Eye Institute of the Baylor College of Medicine in Houston. He acknowledged no financial interest in the products or companies he mentioned. Dr. Koch may be reached at (713) 798-6443; dkoch@bcm.tmc.edu.



Stephen S. Lane, MD, is a managing partner of Associated Eye Care in St. Paul, Minnesota, and is an adjunct clinical professor for the University of Minnesota in Minneapolis. He is a consultant to Alcon Laboratories, Inc. Dr. Lane may be reached at (651) 275-3000; sslane@associatedeyecare.com.



Richard L. Lindstrom, MD, is the founder of and an attending surgeon at Minnesota Eye Consultants, PA, in Minneapolis. He is a consultant to Abbott Medical Optics Inc., Alcon Laboratories, Inc., and Bausch & Lomb. Dr. Lindstrom may be reached at (612) 813-3600; rlindstrom@mmoney.com.



Richard J. Mackool, MD, is the director of the Mackool Eye Institute and Laser Center in Astoria, New York. He is a consultant to Alcon Laboratories, Inc. Dr. Mackool may be reached at (718) 728-3400 ext. 256; mackool@eye@aol.com.



Samuel Masket, MD, is a clinical professor of ophthalmology at the University of California, Los Angeles. He is a consultant to, in on the speaker's bureau of, and has received grants/research support from Alcon Laboratories, Inc. Dr. Masket may be reached at (310) 229-1220; avcmasket@aol.com.



Roger F. Steinert, MD, is the vice chair of clinical ophthalmology and the director of cataract, refractive, and corneal surgery at the University of California, Irvine. He acknowledged no financial interest in the product or company he mentioned [RS: please confirm or correct]. Dr. Steinert may be reached at (949) 824-4122; roger@drsteinert.com.

