

Bleb Needle Revision

Using a high dose of mitomycin C with bleb needling to revive failed glaucoma filtration procedures.

BY MARLENE R. MOSTER, MD, AND RAJESH K. SHETTY, MD

Despite the widespread use of antimetabolites, guarded filtration procedures still carry a significant risk of failure. Revitalizing a bleb with a needle at the slit lamp or in the OR avoids the risks of invasive surgery as well as the need for daily medications.

BACKGROUND

The goal of bleb needle revision is to re-establish the fistula from the anterior chamber to a subconjunctival bleb, where aqueous humor may be reabsorbed. The surface area of the bleb and the vascular permeability of its walls determine the rate of absorption. A larger fistula and a faster rate of absorption will ensure greater aqueous outflow and lower IOP.

In 1974, Swan¹ found, in postmortem studies, that episcleral cicatrization over the fistula was the main cause of late failures in glaucoma filtration surgeries. Encapsulation of the bleb (or Tenon's capsular cyst) often results in an early postoperative rise in IOP. With conservative management, however, encapsulation usually does not hinder bleb function.^{2,3} Obstruction of the internal ostium is rarely a cause of bleb failure.

Many surgeons have described techniques to re-establish the fistula with either same-site revision or transconjunctival needle revision. In 1941, Ferrer⁴ used "conjunctival dialysis" with both fine-point scissors and a spatula to separate the conjunctiva from the underlying sclera to improve aqueous outflow.

USING ADJUNCTS

Because scarring is the primary cause of failure in filtration procedures, adjunctive antifibrotics maintain long-term filtration in bleb needle revisions. Several reports have described using 5-fluorouracil (5-FU) or mitomycin C (MMC) as adjuncts during bleb needle revision.⁵⁻⁹ Antimetabolites inhibit the proliferation of fibroblasts and "freeze" the scarring process in the compromised tissue of the failed bleb.

MMC has several advantages over 5-FU, including a higher potency and a lower risk of bleb encapsulation.¹⁰

Ewing and Stamper⁶ used 5-FU in bleb needle revisions with a high success rate that was equivalent to their bleb needle revisions without 5-FU.

In 1996, Mardelli et al⁵ first described a method of bleb needle revision at the slit lamp with an adjunctive, low dose of subconjunctival MMC. In the study, 62 eyes underwent a total of 118 bleb needle revisions. The researchers injected a mixture of 0.01 mL of MMC (0.4 mg/mL) and 0.02 mL of bupivacaine and epinephrine. The investigators used a 30-gauge needle to perforate the area of fibrosis with multiple punctures and to lift the scleral flap. Thirty-six of the eyes underwent only one needling, and 48% of the eyes achieved a successful result (IOP < 18 mm Hg, without medication or further surgery) at 10 months. Several complications occurred, including ten serous choroidal detachments, one suprachoroidal hemorrhage, five bleb leaks, two hyphemas, two cases in which the iris blocked the sclerostomy, and one persistent hypotony.



Figure 1. The surgeon temporally injects 0.1 mL of MMC (0.4 mg/mL) and 0.1 mL of 1% nonpreserved lidocaine with a 30-gauge needle and directs the mixture toward the bleb. The ophthalmologist uses a closed needle holder to dissipate the MMC and lidocaine while stroking the conjunctiva, until there is no elevation and the conjunctiva is flat against the sclera again.



Figure 2. The physician elevates the conjunctiva and tracks a 27-gauge needle under the Tenon's capsule to make multiple holes in the scarred interface of the episclera near the bleb. The entry point acts as a fulcrum so the adhesions can be cut in many directions. Unless the adhesions around the scarred bleb are broken, it is difficult to form a uniform, diffuse bleb. The physician later uses a single hand-held cautery to close the entry site.

A direct comparison of the various methods of bleb needling is almost impossible given the differences in demographics, needling technique, and definitions of success in the literature. We use a tenfold greater dose of MMC than previously described.¹¹ The high dose of this antifibrotic reduces the need for repeated bleb needlings and the risks associated with them.

NEEDLE REVISION WITH A HIGH DOSE OF MMC

Preparing the Eye

We place a drop of a topical anesthetic agent, followed by a drop of 5% povidone-iodine ophthalmic solution, into the eye. Every 5 minutes for 20 minutes, we administer one drop of a fourth-generation fluoroquinolone antibiotic. We prepare the patient's eyelids in a sterile manner with the 5% povidone-iodine ophthalmic solution.

Initial Injection of Anesthetic and High-Dose MMC

Into a TB syringe, we draw 0.1 mL of nonpreserved 1% lidocaine and 0.1 mL of 0.4 mg/mL MMC (for a total of 0.04 mg of MMC). We switch to a 30-gauge needle and superotemporally inject the mixture 5 to 6 mm away from the filtering bleb, as the patient looks downward (Figure 1). We ask the patient to close his eye, which is then massaged for approximately 2 to 5 minutes.

Bleb Needling

The patient moves to the slit lamp, where we place a sterile lid speculum. Alternatively, this can be done in the OR. We introduce a TB syringe with a 27-gauge needle subconjunctivally to the tight Tenon's capsule around the bleb, puncture the adherent tissue, and lift the scleral flap (Figures 2 and 3). Next, we carefully move the needle from side to side, breaking episcleral adhesions, until the bleb is re-formed. In a pseudophakic eye, the needle can be passed under the scleral flap, into the anterior chamber. The needling procedure may be accompanied by a mild reflux hemorrhage into the anterior chamber. We use hand-held cautery at the entry point of the TB syringe to close the conjunctiva. At the end of the procedure, we place a drop of fluoroquinolone into the eye. Immediately after the procedure, we check the IOP. If the procedure is performed in the OR, a paracentesis can be made into the clear cornea, and the anterior chamber can be filled with additional BSS, thus elevating the bleb further (Figure 4).

Postoperative Care

The patient receives written instructions to use one drop of the fluoroquinolone q.i.d. for 4 days, ketorolac tromethamine 0.5% ophthalmic solution q.i.d. for 1 month, and prednisolone acetate 1% q2h while awake for the first day and then q.i.d. for 1 month. We provide the patient with a shield to wear while sleeping and schedule a follow-up appointment within 1 to 3 days.

OUR RESULTS

In our study of 36 patients undergoing bleb needle revision with a high dose of MMC, 64% of the eyes were



Figure 3. The surgeon carefully tracks the 27-gauge needle under the scleral flap while lifting it. The ophthalmologist carries the needle into the anterior chamber in the area of the original blockage. It is important to perform gonioscopy before needling.

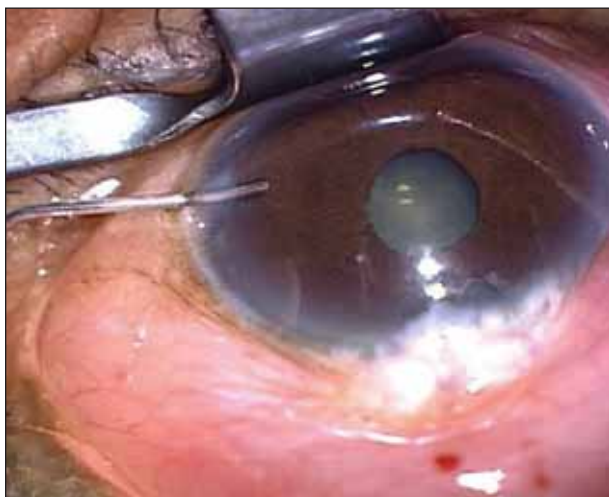


Figure 4. At the end of the procedure, the surgeon injects BSS through a paracentesis to elevate the bleb 270°. If the chamber is in danger of shallowing, the physician may inject viscoelastic intracamerally.

successful (ie, IOP was between 6 and 22 mm Hg) or qualified successes (ie, successful with antiglaucoma medications).¹¹ The average baseline IOP for the successes and qualified successes was 26.7 mm Hg with the use of 1.5 glaucoma medications. The average IOP 1 year after bleb needling was 13.6 mm Hg with an average of 0.5 medications. Patients whose blebs we needled at least 12 months after the failed filtration surgery were more successful than those in whom we performed the revision sooner. The complications in our study included three eyes with hypotony (one lasting more than 1 month), eight with transient hyphemas, and three with transient bleb leaks.

Corneal endothelial toxicity in humans has been reported at an intraocular concentration of 0.2 mg/mL of MMC.¹² The dose in our technique is tenfold less in concentration and would be lower if it were mixed with the aqueous in the anterior chamber. Ocular massage distributes the subconjunctival MMC further, thereby reducing the pressure gradient between the MMC and the anterior chamber.

Gandolfi et al¹³ showed that a subconjunctival injection of 1 mg of MMC (25 times that of our technique) lowered IOP in 12 blind eyes for up to 60 days. MMC may be toxic to the ciliary body epithelium from histopathologic findings in one eye 1 week posttrabeculectomy, however.¹⁴ Care must be taken to avoid an intraocular injection of the MMC at a level toxic to the retina (ie, > 2 µg). Such a toxic level may be reached if the entire amount is injected directly into the posterior chamber.¹⁵ We have not seen any ocular toxicity in the numerous bleb needlings that we have performed.

CONCLUSION

A needling procedure performed at the slit lamp or in the OR with a high dose of MMC can successfully resuscitate a failed filtration procedure. This technique avoids the expense and complications associated with more invasive surgical interventions, and it carries a minimal risk of toxicity. In addition, needling may convert a failed encapsulated bleb or scarred episcleral bleb (ring of steel) into a more diffuse bleb with more surface area for absorption and less risk of bleb leakage and late endophthalmitis.¹⁶ □

Marlene R. Moster, MD, is Attending Surgeon at the Wills Eye Hospital and Professor of Clinical Ophthalmology at the Thomas Jefferson University School of Medicine, both in Philadelphia. Dr. Moster may be reached at (215) 928-3342; moster@willsglaucoma.org.



Rajesh K. Shetty, MD, is Senior Associate Consultant at the Mayo Clinic in Jacksonville, Florida and Assistant Professor at the Mayo School of Medicine in Rochester, Minnesota. Dr. Shetty may be reached at (904) 953-2377; shetty.rajesh@mayo.edu.



1. Swan KC. Reopening of nonfunctional filters—simplified surgical techniques. *Trans Am Acad Ophthalmol Otolaryngol.* 1975;70:342-348.
2. Sherwood MB, Spaeth GL, Simmons ST, et al. Cysts of Tenon's capsule following filtration surgery: medical management. *Arch Ophthalmol.* 1987;105:1517-1521.
3. Costa VP, Correa MM, Kara-Jose N. Needling versus medical treatment in encapsulated blebs: a randomized, prospective study. *Ophthalmology.* 1997;104:1215-1220.
4. Ferrer H. Conjunctival dialysis in the treatment of glaucoma recurrent after sclerectomy. *Am J Ophthalmol.* 1941;24:788-790.
5. Mardelli PG, Lederer CM, Jr, Murray PL, et al. Slit-lamp needle revision of failed filtering blebs using mitomycin C. *Ophthalmology.* 1996;103:1946-1955.
6. Ewing RH, Stamper RL. Needle revision with and without 5-fluorouracil for the treatment of failed filtering blebs. *Am J Ophthalmol.* 1990;110:254-259.
7. Hodge W, Saheb N, Balazsi G, Kasner O. Treatment of encapsulated blebs with 30-gauge needling and injection of low dose 5-fluorouracil. *Can J Ophthalmol.* 1992;27:233-236.
8. Shin DH, Juzych MS, Khatana AK, et al. Needling revisions of failed filtering blebs with adjunctive 5-fluorouracil. *Ophthalmic Surg Lasers.* 1993;24:242-248.
9. Greenfield DS, Miller MP, Suner IJ, Palmberg PF. Needle elevation of the scleral flap for failing filtration blebs after trabeculectomy with mitomycin C. *Am J Ophthalmol.* 1996;122:195-204.
10. Azuara-Blanco A, Bond JB, Wilson RP, et al. Encapsulated filtering blebs after trabeculectomy with mitomycin C. *Ophthalmic Surg Lasers.* 1997;28:805-809.
11. Shetty RK, Wartluft L, Moster MR. Slit-lamp needle revision of failed filtering blebs using high-dose mitomycin C. *J Glaucoma.* 2005;14:52-56.
12. McDermott ML, Wang J, Shin DH. Mitomycin and the human corneal endothelium. *Arch Ophthalmol.* 1994;112:533-537.
13. Gandolfi SA, Vecchi M, Braccio L. Decrease of intraocular pressure after subconjunctival injection of mitomycin in human glaucoma. *Arch Ophthalmol.* 1995;113:582-585.
14. Nuyts RM, Felten PC, Pels E, et al. Histopathologic effects of mitomycin C after trabeculectomy in human glaucomatous eyes with persistent hypotony. *Am J Ophthalmol.* 1994;118:225-237.
15. Peyman GA, Greenberg D, Fishman GA, et al. Evaluation of toxicity of intravitreal antineoplastic drugs. *Ophthalmic Surg Lasers.* 1984;15:411-413.
16. Wells AP, Cordeiro MF, Bunce C, Khaw PT. Cystic bleb formation and related complications in limbus- versus fornix-based conjunctival flaps in pediatric and young adult trabeculectomy with mitomycin C. *Ophthalmology.* 2003;110:2192-2197.