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, Swan found, in postmortem studies, that episcleral cicatrization over the fistula was the main cause of late failures in glaucoma filtration surgeries. En capsulation 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. 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, Ferrer 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. 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. Ewing and Stamper 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 al 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.

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

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.
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. 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 reformed. 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
successful (ie, IOP was between 6 and 22 mm Hg) or qualified successes (ie, successful with antiglaucoma medications).\(^{13}\) 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 needed 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.\(^{13}\) 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 al\(^{13}\) 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 post trabeculectomy, 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; shettyrajesh@mayo.edu.

---