

Needle Revision for Filtering Blebs

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Abstract

Trabeculectomy is generally a successful procedure for reducing intraocular pressure (IOP) in glaucoma patients. However, failure of the filtering bleb may occur. Needling is a minimally invasive procedure used to re-establish aqueous flow in the eye in the event of bleb failure. Needle revision is useful in cases of low blebs where flow is restricted by episcleral fibrosis, thick walled loculations within blebs otherwise appearing functional, encapsulated blebs, localized blebs, and dysesthetic blebs. The procedure can be performed in a variety of settings from the operating room to the slit lamp. Use of antifibrotics can make the procedure more effective. Significant complications are unusual but include hypotony, intractable bleeding, and failure to resolve the indication for surgery. Needle revision is a simple procedure that should be considered in cases of inadequate filtration, need for bleb remodeling, and where re-establishing flow will control IOP.

Keywords

Bleb revision, bleb needling, glaucoma, filtering surgery

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Glaucoma is a visually debilitating disease that is estimated to affect more than 60.5 million people worldwide, rising to 79.6 million by 2020.¹ Most treatment strategies for glaucoma involve lowering intraocular pressure (IOP), some by increasing the outflow of aqueous from the eye. While medical therapy is the first strategy used in treatment, surgical intervention is often required when IOP cannot be adequately controlled with medications.

Trabeculectomy is commonly used to increase aqueous outflow and lower IOP. In a trabeculectomy, a sclera fistula is made to allow aqueous to drain out of the eye into the subconjunctival space, forming a filtering bleb. The aqueous is then reabsorbed, mostly with the tears.^{2,3} While trabeculectomy has a high success rate, post-operative bleb manipulation is one way to repair unsuccessful blebs.^{4,5} Needle revision, also referred to as needling, is a simple and effective bleb revision technique used to restore filtering capabilities of a defective bleb or to reshape a functioning bleb.

Bleb Anatomy

The anatomy of a functioning filtration bleb must be understood in order to understand what needle revision is trying to accomplish in a failed bleb. Most filtering blebs contain loculations that are delimited by internal fibrous walls. In bleb development, the walls are formed from conjunctival adherence to the underlying sclera and episclera. The main loculation is formed at the sclerostomy site and may be surrounded by

other, usually smaller, loculations. The desired wound healing process following trabeculectomy is for the area around the sclerostomy and filtering loculations to refrain from complete normal healing while the outer walls of the bleb and surrounding conjunctiva should heal normally. The healing process never ends but continues, in the form of bleb remodeling, for the long term. Unfortunately, either during healing or remodeling, subconjunctival fibrotic tissue can form in undesirable places, such as over the sclerostomy site or within the filtering loculations. When the main loculation of the bleb becomes burdened by subconjunctival fibrotic tissue, limiting its surface area, filtration failure can occur, causing IOP to rise despite a bleb that would appear desirable.

Needle revision may be a way to improve filtration in these failed blebs. The procedure uses a needle to lyse the subconjunctival fibrotic tissue limiting the areas of filtration, increasing the surface area of the filtering loculation, and therefore lowering IOP. Additionally, the needle may be used to remove fibrotic tissue from the scleral flap or penetrate the sclerostomy site itself to reinitiate aqueous movement from the eye.^{5,6}

Indications for Bleb Needling

There are several treatment options available in the scenario of a failed filtering bleb: medical or laser therapy, another trabeculectomy, tube shunt implantation, or revision of the failed filtering bleb. Needling attempts to avoid more involved surgery by preserving the current trabeculectomy site.⁵ Indications for bleb needling are as follows:

- Failure of filtration secondary to episcleral fibrosis. In this situation, as described above, fibrotic tissue forms over the scleral flap, limiting flow into the bleb itself. Needle revision may help by breaking up the fibrotic tissue, restoring flow to the main filtering loculation.
- Failure due to localization of the bleb. This later phenomenon occurs when dense connective tissue forms, limiting outflow to the main loculation, forming a small demarcated bleb. This situation represents true fibrosis. Needling may help to break up the fibrotic tissue, enlarging the area of transconjunctival filtration.
- Bleb encapsulation. This early post-operative scenario occurs when a bleb develops dense collagen walls as the bleb morphology is forming, resulting in elevated IOP. This condition generally resolves on its own but occasionally requires intervention as a temporizing measure.
- Dysesthesia due to bleb misdirection or malpositioning. Needling may alter the bleb architecture, making it lower or more diffuse, thus increasing patient comfort and improving filtration.⁵
- Clinical pearl for the first two situations: If the bleb looks like it should be filtering properly, but is not working well enough to keep IOP at the targeted level, then needling is indicated. However, if there is no bleb or severe scarring of the bleb so that it appears there is no flow, needling should not be attempted, as it will most likely not be successful.

How Effective is Bleb Needling?

Needle revision can be a successful treatment for failed filtering blebs.⁵⁻¹⁰ However, as with any surgery, there is the risk of failure. Needle revisions performed less than four months from the time of trabeculectomy have been associated with greater success than those performed later.⁷ Greater success in needling procedures has also been associated with limbus-based rather than fornix-based trabeculectomies, possibly due to the trend for limbus-based procedures to produce higher, less diffuse blebs that are not as adherent to the episcleral surface.¹¹ Higher pre-needling IOP (>30mmHg), an immediate post-needling IOP >10mmHg, and patients who did not receive mitomycin C (MMC) treatment during the initial filtering surgery were also associated with a higher rate of failure.¹²

Procedure

Needle revision of filtering blebs can be performed in a variety of settings: at the operating microscope with a full operating room set-up, at the slit lamp, in the office minor procedure room with the operating microscope, or while the surgeon is wearing loupes.⁵ Regardless of the location, the procedure is carried out similarly, although various surgeons have reported slightly different techniques.^{5-9,13}

Before the procedure, one of the most important decisions is which particular antifibrotic agent to administer, as well as its concentration. 5-fluorouracil (5-FU) is considered less potent than MMC because it intercalates into DNA and only kills cells that are dividing. On the other hand, MMC kills all cells, regardless of their phase in the cell cycle.¹⁴ Those blebs that resulted in a thick scar and quick failure may require the more potent MMC, while those that succeeded longer and failed slowly may respond adequately to 5-FU.⁵ 5-FU is available commercially pre-mixed and is usually dosed at 5–7.5mg.^{12,13} 5-FU has been reported as injected pre-needling (with additional injections at post-operative

visits based on post-operative appearance of the bleb),¹³ pre-needling only,¹⁰ and both pre- and post-needling^{4,12} with success. However, MMC must be mixed either at a compounding pharmacy or during surgery. Mixtures and methods for administration include 0.1ml of 0.2mg/ml MMC (0.02mg MMC) with 0.1ml of 0.2% lidocaine before needling,¹³ 0.1ml of 0.4mg/ml MMC (0.04mg MMC) with 0.1ml sterile, non-preserved 1% lidocaine before needling,⁸ and by a sponge soaked with MMC (0.5mg/ml) left on the conjunctiva for six minutes.⁹ Additionally, a two-step procedure, where 0.2ml of a 50:50 mixture of 2% lidocaine with epinephrine is followed by another injection of 0.01ml of 2% MMC before needling, along with a post-operative subconjunctival MMC injection, has also been reported.⁷ Most surgeons administer either 5-FU in doses as described above or MMC as a single dose in lidocaine 5 minutes before needling. There is little conclusive evidence to demonstrate a significant difference between MMC and 5-FU in terms of success. One recent study comparing MMC with 5-FU concluded that MMC was more effective in restoring failed filtering blebs than 5-FU.¹³ Whichever antifibrotic is chosen, whether injected before or after the needling procedure, should be administered transconjunctivally away from the sclerostomy to avoid inadvertent intracameral administration.

The needling procedure is generally performed under the topical anesthesia of the surgeon's choice. A retrobulbar block should be avoided as any conjunctival ballooning may make visibility of landmarks and end-points more difficult. After pre-operative instillation of standard anesthetic, antibiotics, and possibly antifibrotic agent, an area approximately 1cm from the bleb is punctured with the needle. The needle is then passed through the subconjunctival space to the main loculation of the bleb overlying the scleral flap. A sign that adequate puncture has been performed is a bleb forming around the needle tract. If a bleb does not form around the needle tract, then a sweeping motion can be used to break up fibrotic tissue in the bleb. If this motion is still not adequate to produce a bleb, then the scleral flap can be localized by scratching with the needle against the scleral surface until the scar from the scleral flap can be felt catching the needle tip. Then the needle can be used to lift the flap to permit greater aqueous flow.

Occasionally, it is necessary to enter the anterior chamber with the needle to re-open the sclerostomy. The need to enter the anterior chamber with the needle is a poor prognosticator of success. At whichever point in the procedure, when the bleb elevates like a balloon, indicating fluid is filtering, the needle can be retracted and the entry site checked for leaks. If a leak is present, cautery or suture can be used to seal it. To avoid leaks, some surgeons use 30-gauge needles rather than the more standard 25-gauge needles. A variety of blades can also be used,^{5,6} but have limited advantages. If subconjunctival antifibrotic administration was not performed prior to the procedure, injection near, but not into, the bleb is indicated. Topical corticosteroids should be applied post-operatively until the bleb becomes quiet (usually about two weeks followed by a taper), along with routine post-operative antibiotics to prevent infection.^{2,5}

Complications Intrableb Bleeding

Even though needling is a straightforward procedure, complications can occur. Intrableb bleeding occurs frequently,^{7,9,13} due to the vascularity of

conjunctiva and Tenon's capsule layers. To complicate matters, the entry site is small, so cautery cannot be used for hemostasis. Fortunately, bleeding is generally limited. Direct application of pressure to a bleeding vessel may be effective to prevent larger bleeds. Also large blood vessels should be avoided where possible, as well as excessive penetration of the episcleral surface where blood vessels may be numerous.⁵ Possible puncture of these episcleral and large blood vessels is the main reason to do as little during the needling procedure as possible to obtain the desired result.

Infection

Post-operative infection, while rare, is a possible complication.¹³ Using sterile technique and antibiotics are good preventative measures. Patients who have active posterior blepharitis should be treated before needling.

Bleb Leaks

Conjunctival perforations may occur due to inadvertent needle puncture or tearing through scar tissue.¹³ Smaller punctures often resolve spontaneously with no further problems. Larger holes should be either sutured or cauterized to prevent leakage and subsequent bleb failure. Occasionally, if a large distal puncture occurs and the main loculation of the bleb has not been entered, the needle revision may need to be aborted to allow holes to close with a more likely successful result at a later date.⁵

Hypotony

Hypotony for days to weeks after the needling procedure is common due to low resistance to aqueous flow after lysing the scar tissue.^{7,10} Generally, the hypotony is self-limited and will resolve spontaneously. Topical atropine may be indicated if the chamber shallows. Avoiding the Valsalva

maneuver should also be stressed to the patient as a way to prevent suprachoroidal hemorrhage. Barring any pain, vision loss, or flat anterior chamber, short-term hypotony will not adversely affect the outcome.⁵

Filtration Failure

The most common complication of needling is failure to achieve the desired result—adequate reduction of IOP. Multiple sessions of needle revision may be required.^{11,13} It is important to note that the likelihood of success of repeated needling is reduced with each attempt. In cases where initial success with the needling occurred but early failure reverted the bleb back to preoperative conditions, an additional needling procedure with more aggressive wound modulation therapy is warranted. If the procedure was successful for a long time (years) and the bleb appearance is still good, then repeat needling is warranted. However, if failure occurs more than a few weeks out, but there was no long-term success, other interventions should be considered.

Conclusions

Needle revision is a successful procedure that can be used in cases where fibrotic tissue is interfering with successful aqueous flow, where filtration is inadequate, or where bleb architecture needs to be altered. Use of antifibrotic agents can make the revision more successful, but they should be injected away from the sclerostomy site. Complications such as intrableb bleeding and hypotony are common, but infections and bleb leaks may rarely occur. Consideration should be given to this procedure before other interventions, even before adding a medication to an inadequately filtering trabeculectomy. Multiple needling procedures may be necessary for adequate filtration, but other solutions should be considered when needling is not effective in achieving adequate filtration. ■

1. Quigley HA, Broman AT, The number of people with glaucoma worldwide in 2010 and 2020, *Br J Ophthalmol*, 2006;90(3):262–7.
2. Jones LS, Shetty RK, Spaeth GL, Trabeculectomy. In: Chen TC (ed.), *Surgical Techniques in Ophthalmology: Glaucoma Surgery*, Philadelphia, PA: Saunders Elsevier, 2008;1–27.
3. Allingham RR, Damji KF, Freedman S, et al., Filtering Surgery. In: Pine J, Murphy J (eds), *Shields' Textbook of Glaucoma*, Philadelphia, PA: Lippincott Williams and Wilkins, 2005;568–609.
4. King AJ, Rotchford AP, Alwitry A, Moodie J, Frequency of bleb manipulations after trabeculectomy surgery, *Br J Ophthalmol*, 2007;91(7):873–7.
5. Feldman RM, Tabet RR, Needle revision of filtering blebs, *J Glaucoma*, 2008;17(7):594–600.
6. Hung JW, Bellows AR, Bleb Revision. In: Chen TC (ed.), *Surgical Techniques in Ophthalmology: Glaucoma Surgery*, Philadelphia, PA: Saunders Elsevier, 2008;43–53.
7. Gutierrez-Ortiz C, Cabarga C, Teus MA, Prospective evaluation of preoperative factors associated with successful mitomycin C needling of failed filtration blebs, *J Glaucoma*, 2006;15(2):98–102.
8. Shetty RK, Wartluft L, Moser MR, Slit-lamp needle revision of failed filtering blebs using high-dose mitomycin C, *J Glaucoma*, 2005;14(1):52–6.
9. Iwach AG, Delgado MF, Novack GD, et al., Transconjunctival mitomycin-C in needle revisions of failing filtering blebs, *Ophthalmology*, 2003;110(4):734–42.
10. Kapasi MS, Birt CM, The efficacy of 5-fluorouracil bleb needling performed 1 year or more posttrabeculectomy: a retrospective study, *J Glaucoma*, 2009;18(2):144–8.
11. Hawkins AS, Flanagan JK, Brown SV, Predictors for success of needle revision of failing filtration blebs, *Ophthalmology*, 2002;109(4):781–5.
12. Shin DH, Kim YY, Ginde SY, et al., Risk factors for failure of 5-fluorouracil needling revision for failed conjunctival filtration blebs, *Am J Ophthalmol*, 2001;132(6):875–80.
13. Anand N, Khan A, Long-term Outcomes of Needle Revision of Trabeculectomy Blebs With Mitomycin C and 5-Fluorouracil: A Comparative Safety and Efficacy Report, *J Glaucoma*, 2009;18(7):513–20.
14. Lama PJ, Fechtner RD, Antifibrotics and wound healing in glaucoma surgery, *Surv Ophthalmol*, 2003;48(3):314–46.