GLOBAL PERSPECTIVES

NONPENETRATING DEEP SCLERECTOMY: LESSONS FROM THE LEARNING CURVE

Technical nuances and intraoperative pearls to increase predictability.

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Despite the rapid evolution of glaucoma surgery and technological advances, mastery of traditional filtration procedures remains essential for glaucoma surgeons. Deep sclerectomy is an effective nonpenetrating procedure with a favorable safety profile, but its steep learning curve is widely recognized. Although surgical videos are an invaluable educational resource, the technical nuances of deep sclerectomy may be difficult to discern from a visual format alone.

This article provides practical tips to clarify the learning process and help surgeons perform deep sclerectomy with greater confidence and consistency.

SURGICAL TECHNIQUE

Exposure and Traction Suture

To establish adequate exposure and globe stabilization, a 6-0 polyglactin traction suture (Vicryl, Ethicon) is placed through the superior corneal limbus, typically using two passes. The suture may be wrapped twice around a hemostat and secured to the surgical drape or left hanging beneath the inferior lid speculum, where gravity provides consistent downward traction.

Conjunctival Peritomy

A fornix-based conjunctival peritomy is performed in the superonasal or superotemporal quadrant. An inverted L-shaped peritomy is preferred to provide adequate exposure while facilitating secure closure at the end of the procedure. The conjunctiva and Tenon capsule are grasped together with serrated forceps and a firm vertical hold, and an initial incision is made with Vannas scissors.

Westcott scissors are then used to perform blunt dissection. The scissors are inserted in the closed position and gently opened within the tissue plane to separate the conjunctiva and Tenon capsule from the sclera. Dissection is then performed along the curvature of the limbus by inserting one blade of the scissors beneath the conjunctiva while the tissue is gently drawn over the limbal edge to produce a controlled cut and minimize residual conjunctival or Tenon tissue at the limbus. The peritomy is extended to approximately 6 mm to ensure sufficient scleral exposure.

Next, blunt posterior dissection is performed to facilitate posterior aqueous flow. Additional blunt dissection is carried out along the lateral edges to mobilize the conjunctiva for closure at the end of the procedure.

The scleral surface is gently scraped with a Tooke knife, and residual Tenon tissue is carefully removed to create a clean surgical field. Hemostasis is performed only as required, beginning at low power and gradually increased if necessary. Excessive cautery should be avoided because scleral whitening and tissue contraction could complicate subsequent scleral flap dissection.

Superficial Scleral Flap

A superficial scleral flap measuring approximately 5 × 5 mm is fashioned in the surgeon's preferred configuration (ie, rectangular, trapezoidal, or parabolic). Adequate exposure and consistent flap thickness are more important than the specific shape. After the flap margins have been marked with calipers, the outline is scored using a super sharp blade or a microvitreoretinal blade.

Dissection of the superficial flap is then continued using a Mani crescent blade (Mani), which is advanced anteriorly in a controlled, painting motion until 1 to 2 mm of clear cornea has been reached. The intended depth of the flap is approximately one-third of the scleral thickness. Maintaining this depth is critical for safe subsequent dissection.

To judge flap thickness intraoperatively, the blade is gently placed beneath the scleral flap. If the blade is clearly visible through the tissue, the flap is likely too thin. Conversely, if the blade is not at all visible, the flap may be too thick.

Mitomycin C Application

After superficial scleral flap dissection, mitomycin C (MMC) is applied at a concentration of 0.2 to 0.4 mg/mL, depending on patient-specific risk factors. Sponges soaked in MMC are placed beneath the scleral flap and Tenon capsule for 2 to 3 minutes to ensure adequate exposure of the surgical site. Contact with the conjunctival edge should be avoided.

Following removal of the sponges, the area is thoroughly irrigated with ophthalmic balanced salt solution to minimize residual MMC. The use of approximately two bottles of 15 mL balanced salt solution is typically sufficient.

Creation of a Deep Scleral Flap and Unroofing Schlemm Canal

Dissection of the deep scleral flap is initiated within an approximately 1-mm margin of the superficial scleral flap. Dissection begins in one corner, where the surgeon digs until the dark coloration of the underlying choroid

TROUBLESHOOTING SURGICAL COMPLICATIONS

Traction Suture

- **Deep pass with leakage.** Hydrate the corneal entry with balanced salt solution. If leakage persists, remove the traction suture. Rehydrate the site and place a new traction suture at a different location.
- **Cheese wiring.** If cheese wiring occurs with one of the two traction sutures, proceed with the remaining suture. If cheese wiring occurs with both traction sutures, place a new one.

Bleeding During Deep Scleral Flap Dissection

- **Focal bleeding.** Apply gentle pressure with a cellulose sponge. Dry and reassess the area.
- **Persistent oozing.** Apply a heavy OVD over the point of bleeding. Reassess the area after a short pause.
- **Continued bleeding.** Carefully perform fine-tipped cautery of the area. Avoid excessive cautery to prevent tissue shrinkage.

Trabeculo-Descemet Membrane Perforation

Management depends on three factors: perforation size, iris involvement, and anterior chamber (AC) depth.

- **Small perforation with no iris prolapse and deep AC.** Close the superficial scleral flap with tight sutures only.
- **Small perforation with no iris prolapse and shallow AC.** Inject an OVD to reform and deepen the AC. Close the superficial scleral flap with tight sutures.
- **Large perforation with iris prolapse and shallow AC.** Inject an OVD to reform the AC. Perform a peripheral iridectomy. Close the superficial scleral flap tightly, converting it into a trabeculectomy.

becomes visible. Once this landmark has been identified, the surgeon can safely judge the depth of dissection. At this point, a thin layer of sclera is deliberately left over the choroid, and dissection is continued at this depth.

Magnification is required to accurately assess the depth of dissection and the arrangement of scleral fibers. When the fibers assume a more organized appearance, indicating the scleral spur, the appropriate plane corresponding to the trabeculo-Descemet window has been reached. An additional indicator of this level is the darker, grayish hue of the trabeculo-Descemet window. Recognition of these tissue characteristics is critical for safe continuation of the dissection.

As dissection progresses, aqueous percolation may become evident. In some cases, Schlemm canal is unroofed during this step. In others, the canal must be carefully peeled. The guiding principle is to peel only what is clearly visible. Repeated drying with a cellulose sponge can improve visualization of the tissue layers and facilitate controlled peeling of Schlemm canal.

Mild bleeding encountered at this stage typically indicates exposure of Schlemm canal. If additional aqueous percolation is required, the lateral edges of the trabeculo-Descemet membrane may be carefully incised using a microvitreoretinal blade with the bevel oriented upward. The central portion of the trabeculo-Descemet membrane should be avoided because there is a high risk of perforation. The anterior chamber depth should be monitored continuously during this stage of surgery.

Once adequate aqueous percolation has been achieved, the deep scleral flap is grasped with forceps and held perpendicular to the scleral surface and then excised with scissors. This step's simplicity belies its importance. Constant awareness of both blades and controlled, deliberate movements are critical because the risk of inadvertent perforation is high.

Closure

The superficial scleral flap is repositioned and loosely secured with 9-0 nylon sutures. The goal is to stabilize the flap without creating excessive tension that could compromise aqueous percolation through the trabeculo-Descemet membrane.

Conjunctival closure is performed by securely positioning the L-shaped conjunctival edge over the limbus, ensuring that it easily covers the deep sclerectomy site. An initial anchoring 9-0 polyglactin suture on a BV needle is placed and passed through the limbal cornea to secure the conjunctiva. A second anchoring suture is placed on the longer side of L-shaped peritomy, followed by a third anchoring suture on the same side, which is then used to complete a running conjunctival closure. This approach provides redundancy, in the event one anchoring suture becomes exposed, while allowing a smooth, tension-free closure. Finally, fluorescein staining is performed to check for leakage.

CONCLUSION

Deep sclerectomy is a delicate procedure that requires meticulous technique and careful recognition of intraoperative tissue cues. Attention to these anatomic landmarks and technical details can help guide the dissection and reduce the risk of complications. With a systematic approach and experience, the procedure can be performed with increasing confidence and consistency. ■

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