

How to Do an Enucleation

BY CARRIE L. MORRIS, MD, AND JULIE A. WOODWARD, MD
 EDITED BY INGRID U. SCOTT, MD, MPH, AND SHARON FEKRAT, MD

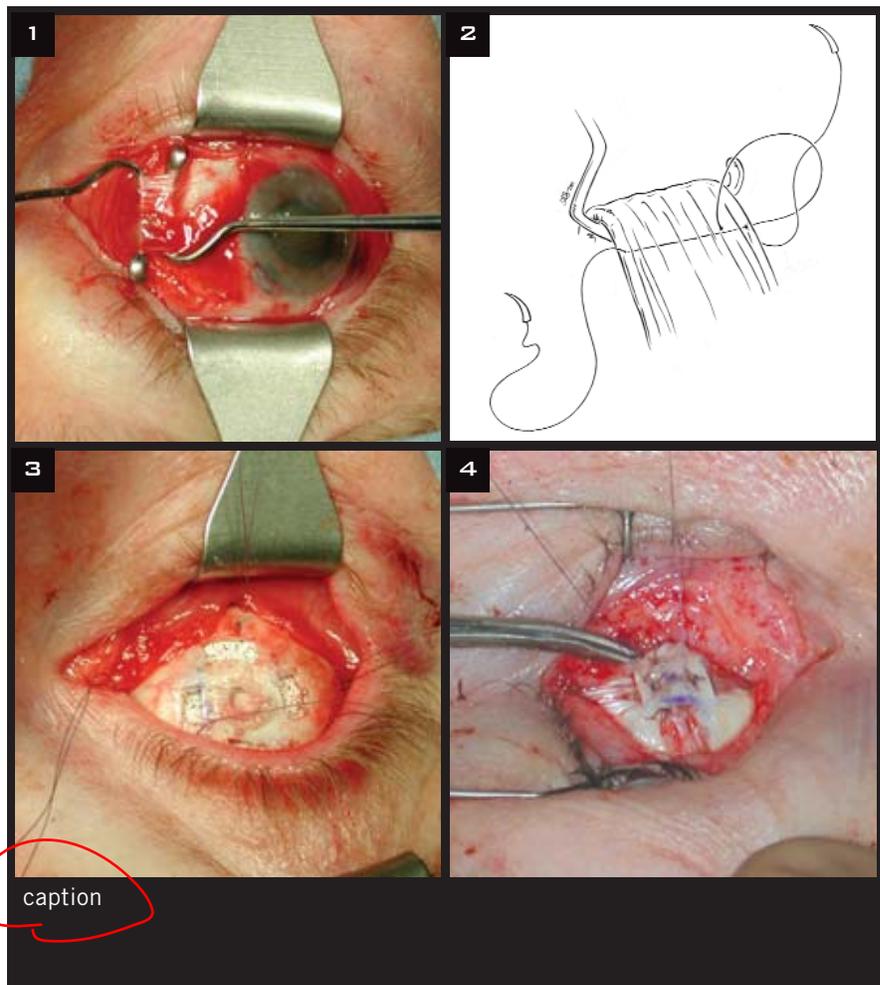
Although therapeutic enucleations have been performed since the 16th century, surgical techniques are continually evolving to achieve optimal cosmetic and functional results. The goals of enucleation involve elimination of pain, excellent cosmesis and restoration of orbital volume. The indications for enucleation include a blind, painful eye; a painless but disfigured, blind eye that causes psychological distress; sympathetic ophthalmia; and both diagnostic and therapeutic evaluation of intraocular tumors.

Preoperative Procedures

Before securing consent, a detailed discussion with the patient should explain the indications, risks, benefits and alternatives to the procedure. The surgeon should make the patient aware of possible complications, which include loss of extraocular muscle function with decreased motility of the prosthesis, orbital infection, implant extrusion, enophthalmos, pyogenic granuloma, ptosis, and visual hallucinations. The patient should be aware that future surgery may be necessary to correct such complications.

If medically permissible, the patient should not take aspirin 14 days, non-steroidal anti-inflammatory agents five days, or anticoagulants three days before surgery. The patient's primary care physician should give medical clearance for surgery and oversee the adjustment of anticoagulant medications.

The patient, nursing staff and oph-



thalmologist-surgeon should confirm which eye is to be removed. General or monitored anesthesia can be used along with a local anesthetic mixture of 5 cc of 2 percent lidocaine with epinephrine 1:100,000, 5 cc of 0.75 percent bupivacaine and 1 cc of hyaluronidase 150 units/milliliter given as a retrobulbar

injection as well as a small amount subconjunctivally surrounding the limbus. This will help to prolapse the globe, augment hemostasis, lessen postoperative discomfort, inhibit the vagal oculocardiac reflex, and aid in the delineation of the dissection plane under Tenon's fascia.

Surgical Technique

After establishing a sterile field, eyelids are retracted with a lid speculum or a traction suture. Enucleation is initiated by performing a 360-degree periotomy. Bluntly dissect Tenon's fascia away from the globe using curved Stevens scissors in the four quadrants between the rectus muscles. Care should be taken to preserve the integrity of the conjunctiva and Tenon's capsule, since these will be an essential component to proper closure over the implant. Each rectus muscle is isolated with a muscle hook, followed by placement of a second hook from the opposite direction. Tenon's capsule is cleared away from the muscle (Fig. 1). Next, each muscle is secured by a locking double-armed 6-0 absorbable suture 2 to 4 millimeters posterior to the insertions. One arm is threaded through the muscle at half-thickness, then the needle is passed full thickness about one quarter muscle width from the edge and locked securely to the muscle. The other arm is passed similarly through the other edge of the muscle (Fig. 2). The suture can be clamped to the drape to avoid displacement of the muscle. Each muscle is then transected anterior to the suture.

While placing gentle upward traction on the globe with forceps grasping the medial and lateral rectus muscle stumps, the optic nerve is "strummed" behind the globe with a large curved hemostat to determine its location. Then, while the hemostat is pushed posteriorly, the optic nerve is clamped for one to two minutes. To obtain a stump of optic nerve, gently pull the globe anteriorly as the optic nerve is transected with the enucleation scissors. Any remaining adherent soft tissue is trimmed with scissors and the two oblique muscles are transected. Every attempt should be made to minimize the manipulation of orbital fat to reduce the possibility of orbital fat atrophy, which causes hollowing of the superior sulcus. Immediately pack the orbit with neuropaddies soaked in local anesthetic with epinephrine, applying pressure for at least two to five minutes to the socket. Rarely, bipolar cautery is necessary to provide hemostasis. The globe should always

Postop Management

Examine the patient on postoperative day 1, week 1 and month 1, watching for evidence of

- disinserted muscles
- orbital infection
- implant extrusion
- overall progress and healing

Order a prosthesis fitting with the ocularist at postoperative week 6.

Offer thorough patient instruction on proper socket hygiene and lubrication.

Consider peg placement at postoperative month 6 for additional implant motility.

Encourage the patient to wear safety glasses to protect the fellow eye.

be sent for pathologic examination.

(Instructions for enucleation of an eye with an intraocular tumor are beyond the scope of this article.)

Implant Selection and Placement

Next, sizers are used to establish the appropriate implant size for the orbit. The surgeon should be able to easily appose the layers of Tenon's capsule and conjunctiva over the implant's surface without tension. Select the largest implant that fits easily into the socket, realizing that a smaller sized implant will reduce the chance of extrusion, while a larger sized implant will offer superior motility and cosmesis. When selecting the size of the implant, the surgeon should remember that encasing the implant with sclera adds 1 to 2 mm of diameter to the implant.

Porous or nonporous? In cases of panendophthalmitis, the surgeon should place a nonporous implant or pack the orbit with iodoform gauze and delay implant placement until the infection is resolved. Otherwise, the surgeon may use her own discretion regarding which type of implant to use, guided by each patient's specific needs. The surgeon may select either a porous (e.g., hydroxyapatite, porous polyethylene) or nonporous implant (e.g., PMMA, silicone, acrylic). Compared with non-

porous implants, hydroxyapatite and porous polyethylene implants facilitate vascularization and incorporation of neighboring tissue and decrease the incidence of migration and extrusion. Drilling 1-mm holes into hydroxyapatite implants at muscle insertion sites may further enhance vascularization. The porous implants may indirectly enhance implant motility if a peg is attached to the implant and prosthesis postoperatively.

Wrapped implants. Hydroxyapatite implants wrapped in sclera or coated with a mixture of polylactic and polyglycolic acid may be used to facilitate placement and attachment of the extraocular muscles to the implant. Polyethylene implants are malleable and allow direct attachment of muscles to the implant, eliminating the need to wrap the implant and curtailing cost and time of the procedure. Some studies state that implant motility is related to the attachment of extraocular muscles to the implant or to the covering material rather than the type of implant itself. But there is some debate about this topic.^{1,2}

If the surgeon desires to wrap the implant, donor or autogenous sclera may be used. Encase the implant with sclera such that the edges are oriented posteriorly. Secure the covering with 5-0 absorbable sutures, creating a posterior window for penetration of fibrovascular tissue. Using a number 15 scalpel blade and pointed-tip scissors, cut four 5 mm x 2 mm windows in the sclera for the attachment of the rectus muscles. Correlate window positions to the approximate muscle insertion points, thereby devising an additional scaffold to foster vascularization (Fig. 3).

Placement. Whether or not it is encased in sclera, the implant is positioned within the muscle cone, posterior to Tenon's capsule. The rectus muscles are secured to the implant at their corresponding insertion sites by passing the preplaced, double-armed, 6-0 absorbable suture through the anterior tip of the window of the implant covering or directly to the bare implant (Fig. 4). Next, Tenon's capsule is closed with interrupted and buried 5-0 absorbable

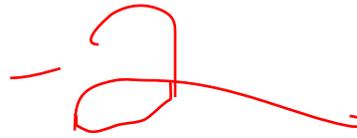
sutures. Precise, meticulous closure of Tenon's capsule, with no openings, is essential to circumvent future extrusions. Use a running, 6-0 absorbable suture to close the conjunctiva. Effort should be made to avoid invaginating the epithelium, which may lead to cyst formation.

Following tissue closure over the implant, 2 ml of bupivacaine 0.75 percent may be injected into the retrobulbar space to provide postoperative pain relief. A conformer is placed to maintain the inferior and superior cul-de-sacs, preventing symblepharon formation and allowing for a better-fitting prosthesis. Topical antibiotic ointment is applied to the conjunctival fornices and lid. The orbit is covered with a gentle pressure patch for at least 24 hours to lessen postoperative edema.

Challenges and Postop Follow-Up

The surgeon may be challenged with associated concurrent problems such as: blepharoptosis, entropion, ectropion, conjunctival and Tenon's capsule deficiency, tear insufficiency or conjunctival scarring. When planning the surgical approach, one must consider that the integrity of the conjunctiva and Tenon's capsule may be compromised, such as in patients who have undergone multiple glaucoma or retinal surgeries. Scarring of the conjunctiva and Tenon's capsule will create a suboptimal environment for proper closure of these layers and increase the risk for implant exposure. These patients should be informed that a conjunctival and Tenon's capsule graft may be necessary to adequately appose the respective tissues, providing proper coverage for the implant. Additional reconstruction may be required to deepen the fornices at a later date. Thus, certain steps of the procedure may need modification.

in oculoplastic and reconstructive surgery; both are at Duke University.



1

2 Custer, P. L. et al. *Ophthalmology* 2003;110:2054–2061.

2

3 Long, J. A. et al. *Ophthalmic Plastic Reconstr Surg* 2003;19:194–197.

Carrie L. Morris, MD, is a first year ophthalmology resident and Julie A. Woodward, MD, is assistant professor of ophthalmology