Management of Intraocular Foreign Bodies

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Intraocular foreign bodies are present in up to 41 percent of all open globe injuries. While foreign objects can be composed of almost any substance, most are metal, as the majority of patients are injured while wielding a hammer. In addition, intraocular foreign bodies (IOFBs) may become embedded in any ocular structure, from the anterior chamber to the retina.

Given the risk of endophthalmitis, prompt evaluation and treatment are essential. But even when managed properly, IOFBs associated with traumatic eye injuries may lead to severe vision loss.

Evaluating the Patient

IOFBs should be suspected in all open globe injuries. The preoperative evaluation should include a focused history to determine the time and mechanism of the injury along with detailed information about the composition of the object. For liability reasons, it is important to note whether the injury occurred in the workplace and whether the patient was wearing protective eyewear when the injury occurred.

A careful ocular examination, minimizing pressure to the globe to avoid further expulsion of its contents, is essential. If the view to the posterior pole is limited, gentle B-scan ultrasonography by an experienced ultra sonographer to ensure that no pressure is applied to the globe, is a useful adjunct.

CT scans may aid in identifying objects and further evaluating the globe, orbital bones and retrobulbar space. False-negative CT results may occur with IOFBs that are small or of wooden, vegetable, plastic or ceramic content. MRI is contraindicated in the presence of a metallic object.

Indications for Removal

As a general rule, if the IOFB is accessible, then removal is the best option. If more harm to the globe may occur with attempted retrieval of the object, removal may not be indicated, especially if the object is not directly damaging an intraocular structure and is not expected to cause secondary sequelae.

Moreover, some IOFBs can be tolerated when left in the eye, including those made of glass, plastic, pencil lead (graphite), stone, aluminum or gold. However, metal objects with low redox potential or objects contaminated with organic matter can cause significant morbidity. Issues to consider include the following:

- **Toxicity.** Metallic objects consisting of iron, lead or copper and its alloys should be removed because of well documented toxic effects on intraocular tissues. For instance, siderosis bulbi, caused by intraocular toxicity from ionized iron, is characterized by a rust colored corneal stroma, iris heterochromia with brownish-discoloration, a dilated and nonreactive pupil, orange deposits in the lens epithelium and anterior cortex, and retinal degeneration. The toxic effects of copper in the eye depend on the percentage of copper in the IOFB. Acute chalcosis occurs with metals with a copper content of 85 percent or more and is characterized by sterile endophthalmitis, corneal and scleral melting, hypopyon and retinal detachment. Other clinical findings include a Kayser-Fleischer ring, iris heterochromia with greenish discoloration, a “sunflower” cataract and retinal degeneration. Chronic chalcosis may be seen with metals containing less than 85 percent copper, but this finding rarely leads to blindness.
- **Contamination.** In an outdoor setting, IOFBs are often contaminated with vegetable matter, increasing the risk of infectious endophthalmitis.

Management Tips

The goal in managing an IOFB is to achieve the best visual outcome possible by identifying and closing the entry and exit sites, reconstructing the eye and, if possible, removing the object.

Removal vs. monitoring. Ideally, an IOFB should be removed within 24 hours of the time of injury, and the object and the surrounding ocular tissue should be sent for culture.

If removal of the object could cause significant damage to an eye that otherwise presents with good visual acuity and no evidence of endophthalmitis, then regular follow-up using visual acuity, slit lamp and serial electroretinograms (ERGs) is a reasonable option. The recommended ERG schedule is monthly to bimonthly for the first six months; then a repeat exam six months later followed by annual exams. [1] If the ERG shows deterioration, immediate surgical intervention with removal of the object is required.

Risk of endophthalmitis. The incidence of post-traumatic endophthalmitis with a retained IOFB is between 5 and 30 percent. In one retrospective study of 589 eyes with a retained object, 7.5 percent developed clinical evidence of endophthalmitis.[2]

In post-traumatic endophthalmitis, gram-positive organisms (including coagulase-negative *staphylococci* and *streptococci* species) represent most cases, while gram-negative and fungal organisms account for a smaller percentage. *Bacillus cereus,* a gram-positive organism, presents with a rapidly progressive destruction of the eye, which may lead to loss of vision and possibly the eye itself if the infection is not recognized and treated promptly.

Use of antibiotics. To decrease the risk of endophthalmitis, removal of the IOFB should be done concurrently with primary globe repair and administration of intravitreal and topical antibiotics. No standard criteria exist to guide antibiotic use for eyes with IOFBs. In general, topical antibiotics are used to provide broad-spectrum

coverage. Intraoperatively, 0.1 ml each of intravitreal vancomycin (1 mg/ml) and ceftazidime (2.25 mg/ml) should be administered.

Although the effectiveness of systemic antibiotics to decrease the incidence of endophthalmitis has not been shown, their use should be considered while awaiting definitive surgical therapy if the surgery cannot be done within 24 hours. Owing to their broad spectrum of activity and bioavailability, the third- and fourth-generation fluoroquinolones are generally recommended. In a retrospective study of 79 eyes for which removal was delayed for more than one month because of military conditions, the use of topical and systemic antibiotics produced good visual outcomes.[3]

Tips on Removal

Most IOFBs are extracted from a new opening unless the entrance wound is large. Two types of instruments are used: an intraocular magnet and a forceps. The choice of instrument depends on the foreign body. A magnet can remove an object of any size, shape and weight with a ferrous content. For other IOFBs, a variety of forceps may be required depending on the object's size and shape.

The surgical approach depends on the object's location in the eye:

Anterior chamber placement. The anterior chamber is maintained with viscoelastic. If the object is visible, a limbal incision can be made over the object. Alternatively, an incision is created 90 to 180 degrees from the object for better access with forceps.

If the IOFB is hidden in the angle, an endoscope, inserted through an incision 180 degrees from the object, may be used for visualization. And the IOFB may be removed with a magnet or forceps through an incision created 90 degrees from the object.

Intralenticular placement. An inert IOFB embedded in a lens with no cataract may be observed. The lens may or may not be salvageable after the object is removed.

If a cataract is present, the lens may be removed during primary or secondary repair. If the lens is removed, IOL placement should be deferred when vitreoretinal damage is suspected, since an IOL may interfere with the view of the posterior segment. IOL placement should also be deferred when endophthalmitis is present or is at high risk of developing. If an IOL will be placed during primary repair, the integrity of the lens capsule and its zonules should be evaluated.

Posterior segment placement. A hyphema, cataract or vitreous hemorrhage that interferes with the view to the posterior segment should be removed. If the IOFB is visible and free-floating in the vitreous cavity, a pars plana vitrectomy with removal of the object with a magnet and/or forceps may be attempted. A 20-gauge pars plana vitrectomy is the preferred procedure. However, a smaller-gauge vitrectomy may be feasible in cases involving an object between 0.3 and 0.5 mm in diameter in a globe that can tolerate elevated IOP.

The posterior hyaloid is detached and removed to eliminate any tractional component, and vitreous strands and/ or the fibrous capsule of the IOFB are

released to facilitate its removal. Enlarging a pars plana incision site allows for extraction of the object.

Outcome

Poor prognostic factors include a large entrance wound located posteriorly; large, blunt, nonmetallic objects in the posterior segment; an initial visual acuity of less than 5/200; a relative afferent pupillary defect; and endophthalmitis. Overall, a favorable prognosis with a final visual acuity of 20/40 or better may be expected in up to 71 percent of eyes.

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1 Neumann, R. et al. *Arch Ophthalmol* 1992;110:1269–1272.

2 Chaudhry, I. A. et al. *Grafes Arch Clin Exp Ophthalmol* 2008;246:181–186.

3 Colyer, M. H. et al. *Ophthalmology* 2007;114:1439–1447.

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