

Retained Intraocular Foreign Body

BACKGROUND

Intraocular foreign bodies (IOFBs) account for almost 40% of penetrating ocular injuries¹⁻³. 75% of the IOFBs lodge in the posterior segment⁴. Retained intraocular foreign bodies most commonly result from occupational activities and predominantly involve males in 3rd to 4th decade⁵. Most sustain injury while hammering a metal with metal and 80% cases have metallic IOFBs⁶. The hammer-chisel injury is the most common cause of the IOFB in adults⁷. Other emerging causes like fire arm injuries and blast injuries are becoming common.

IOFB causes damage to the eye by the following mechanisms⁸:

- Cause mechanical trauma to the eye
- Introduce infection
- Exert toxic effect

The extent of ocular injury depends on:

- Size of the object
- Speed of impact (Air gun vs. BBI)
- Composition of the object
- Impact site

Classification

Intraocular foreign bodies can be classified according to:

1. Anatomical zone (Entry and Exit)
 2. Position of IOFB
 3. Nature of IOFB
1. Zones of ocular injury⁹
 - Zone 1: Isolated to the cornea (including the limbus).
 - Zone 2: From limbus to a point 5mm posterior in sclera.
 - Zone 3: Posterior to the anterior 5mm of the sclera.

2. Position of the IOFB

- IOFB located in the anterior segment
 - In the cornea
 - In the anterior chamber
 - In the anterior chamber angle
 - Intralenticular
- IOFB located in the posterior segment:
 - IOFB located in the vitreous cavity
 - IOFB floating into the vitreous after causing retinal trauma
 - IOFB embedded in the retina/ sclera

3. Nature of IOFB

- Metallic e.g. copper, iron
- Glass
- Plastic
- Organic e.g. wood
- Stone

COMPLICATIONS

IOFBs can be inert but often cause serious damage inside the eye and must be removed promptly.¹⁰Possible complications of IOFB include^{11,12}:

- Corneal opacity
- Cataract
- Intraocular hemorrhage (hyphema, vitreous hemorrhage)
- Elevated intraocular pressure
- Retinal breaks
- Retinal detachment: Rhegmatogenous or tractional.
- Proliferative vitreoretinopathy
- Hypotony
- Phthisis bulbi
- Endophthalmitis: More likely to occur with:
 - Contaminated injury
 - Retained IOFB
 - Rupture of lens capsule
 - Delayed surgical repair
- Siderosis (due to iron IOFB)
- Chalcosis (due to copper IOFB)

MANAGEMENT OF IOFB

1. History
2. Clinical Examination
3. Investigations
4. Surgery

1. HISTORY

History is very important to determine the origin of the foreign body¹³. Questions should be asked about the mechanism of injury and a high index of suspicion for the presence of IOFB should be maintained¹².

2. CLINICAL EXAMINATION

Complete ocular examination is important when possible and should always start with measurement of visual acuity and testing for the presence of relative afferent pupillary defect. Poor initial visual acuity and the presence of afferent pupillary defect are most important prognostic factors at presentation⁹.

Possible site of entry and exit should be looked for¹³. Posterior scleral rupture may be occult. Signs of occult globe rupture include diffuse Chemosis, asymmetric AC depth, low IOP, hemorrhagic choroidal detachment, and vitreous hemorrhage⁹. Indirect ophthalmoscopy through a dilated pupil may allow direct visualization of the IOFB at first opportunity. Applanation tonometry, gonioscopy and scleral depression should not be done in open globe injuries¹² because they may result in extrusion of the intraocular contents.

3. INVESTIGATIONS

CT scan with thin slices is currently considered the gold standard for the detection, localization and characterization of both metallic and non-metallic IOFBs.

B-scan Ultrasonography can be used to detect metallic IOFB but sensitivity is user dependent. It is contraindicated in globes suspected of rupture.

Plain X-ray orbits may be used as a screening modality for IOFBs but localisation of IOFBs without limbal ring may pose diagnostic problems.

MRI is contraindicated in the detection of suspected metallic IOFB. It may be considered when there is strong suspicion of a non-metallic foreign body not seen with CT scan or B scan ultrasonography¹⁴.

4. SURGERY

The surgery for patients with IOFB include:

- Primary repair (required in most cases).
- Removal of IOFB

TIMING OF PRIMARY REPAIR

The wound should be closed as soon as possible¹². Wounds at particular risk of infection such as contaminated wound, IOFB related injuries, vegetative injuries associated open globe injuries require more emergent care. Delay in closure could increase not just the risk of infection but also the opportunity for an expulsive hemorrhage and extrusion of intraocular contents⁹. Systemic and topical antibiotic therapy should be started as soon as possible¹⁵. Tetanus prophylaxis should never be forgotten.

TIMING OF IOFB REMOVAL

If the FB is present in the anterior segment then it may be removed at the time of primary repair.

Removal of IOFB from the posterior segment may be done at the time of primary repair or at an interval (surgeon's clinical assesment). The timing of intervention is primarily determined by the risk of endophthalmitis. If the risk is high, immediate Vitrectomy with removal of IOFB is indicated.¹² However if a patient presents to the vitreo-retinal surgeon with endophthalmitis and retained IOFB, then the main indication for early removal of the IOFB no longer applies. Despite this some surgeons prefer immediate Vitrectomy in patients presenting with endophthalmitis and retained IOFB, to remove the IOFB i.e. the presumed nidus of infection and debulk inflammatory debris in the vitreous. However, surgery in eye with active endophthalmitis is technically difficult and visualization of IOFB is often problematic¹⁶. Where there is no infection or retinal detachment then judicious delayed removal may be considered.

EARLY REMOVAL OF IOFB

Early removal of the IOFB at the time of primary repair has the following advantages¹⁷:

- Single procedure
- Decrease in endophthalmitis rate
- Decrease in PVR rate

Many studies suggest that early Vitrectomy and removal of IOFB decreases the risk of infectious

endophthalmitis and Proliferative vitreoretinopathy^{18,19}. Unless the IOFB is removed and the wound repaired within 24hrs the patient's risk of severe complications – such as endophthalmitis or vision loss – quadruples²⁰. Delay in IOFB extraction, presence of intraocular hemorrhage, preoperative retinal detachment, primary surgical repair combined with IOFB removal are the predictive factors for anatomic failure (postoperative retinal detachment is considered as the anatomic failure)²¹. Good initial presenting VA, early surgical intervention to remove IOFB (within 24 hours) and PPV are predictive factors for good visual outcome.

DELAYED REMOVAL OF IOFB

Delayed removal of IOFB has several advantages. It decreases the risk of intraoperative bleeding and allows spontaneous separation of posterior hyaloid,²³ making complete removal of the vitreous easier. This situation is more relevant to our set up. Delayed removal of IOFB may result in a significant increase in the development of endophthalmitis²². However delayed IOFB removal with a combination of systemic and topical antibiotic coverage can result in good visual outcome without an apparent increased risk of endophthalmitis or other deleterious side effects¹⁵. In eyes with clinical features of infective endophthalmitis and a retained IOFB immediate injection of intravitreal antibiotics with delayed removal of IOFB is a possible alternative to immediate removal of IOFB. This management may be associated with preservation of the eye and restoration of useful VA¹⁶. In patients with IOFB, final VA doesn't depend on the interval between injury and IOFB removal, and with regard to the risk of endophthalmitis, IOFB need not be considered an absolute indication for immediate intervention²⁴.

TYPE OF SURGERY

The surgical approach for posterior segment IOFB includes Vitrectomy and removal of IOFB by magnet or forceps. The best tool to extract an un-impacted ferrous IOFB is a strong intraocular magnet. For non-magnetic foreign bodies proper forceps are used. Following IOFB removal, a thorough peripheral Vitrectomy should be performed, and an attempt to remove the posterior hyaloid should be made¹².

Following is an algorithm for use of magnets, vitrectomy and scleral trap doors in the management of IOFB.

| | Visualised | Non Visualised |
|--|--------------------------------|--------------------------------|
| Vitreous Magnetic (unimpacted, no evidence of retinal injury.) | Ext. Magnet/ vitrectomy. | Vity, Forceps, Magnet |
| Non magnetic, un-impacted. | Vitrectomy, Forceps | Vity, Forceps |
| Intraretinal Magnetic and Non Magnetic | Trap Door/ Vitrectomy, Forceps | Trap Door/ Vitrectomy, Forceps |

A key principle in removing any IOFB from the posterior segment is obtaining excellent visibility. Using an external magnet with poor visibility can cause a myriad of complications. External magnets are used for magnetic IOFBs when the view is excellent and the IOFB is not impacted or encapsulated by the organized vitreous. In these patients, Vitrectomy is not necessarily required before using the external magnet¹⁰. When IOFB is obscured by opacification of media, embedded within tissues or encapsulated by organized vitreous, non-magnetic grasping forceps are used to remove IOFB. These patients always need Vitrectomy.

An encapsulated inert IOFB may be left alone in selected cases.

PROGNOSTIC FACTORS

Following factors affect the visual prognosis in patients with IOFB^{5, 25-28}.

- Initial visual acuity
- RAPD
- Mechanism of injury
- Wound size
- Zone of injury
- Intraocular hemorrhage (hyphema, vitreous hemorrhage)
- Presence or absence of endophthalmitis
- Uveal prolapse
- Pre-op retinal detachment
- Location of IOFB
- Type of IOFB
- Time of removal of IOFB
- Pars Plana Vitrectomy

REFERENCE

1. **Cazabon S, Dabbs TR.** Intralenticular metallic foreign body. *J Cataract Refract Surg.* 2002; 28: 2233-4.
2. **Arora R, Sanga L, Kumar M, et al.** Intralenticular foreign bodies: report of eight cases and review of management. *Indian J Ophthalmol.* 2000; 48: 119-22.
3. **Coleman DJ, Lucas BC, Rondeau MJ, et al.** Management of intralenticular foreign body. *Ophthalmology.* 1987; 94: 1647-53.
4. **Behrens-Baumann W, Praetorius G.** Intraocular foreign bodies. 297 consecutive cases. *Ophthalmologica.* 1989; 198: 84-8.
5. **Dhir SP, Mohan K, Munjal VP, et al.** Perforating ocular injuries with retained intra-ocular foreign bodies. *Indian J Ophthalmol.* 1984; 32: 289-92.
6. **Sriprakash KS, Sujatha BL, Kesarwani S, et al.** Surgical intervention in retained intra-ocular foreign body: Our experience. *Retina/Vitreous Session 2. AIOC 2006 Proceedings;* 493-5.
7. **Lai YK, Moussa M.** Perforating eye injuries due to intraocular foreign bodies. *Med J Malaysia.* 1992; 47: 212-9.
8. **Ahmadi H, Soheilian M, Sajjadi H, et al.** Vitrectomy in ocular trauma factors influencing final visual outcome. *Retina* 1993; 13: 107-13.
9. **Pieramici DJ.** Open globe injuries are rarely hopeless. Managing the open globe calls for creativity and flexibility of surgical approach tailored to the specific case. *Review of Ophthalmology.* 2005; 12: 6.
10. **Kalayoglu MV.** Evolving use of intraocular magnets in ophthalmic surgery. *Ophthalmology Web.*
11. **Memon AA, Iqbal MS, Cheema A et al.** Visual outcome and complications after removal of posterior segment intraocular foreign bodies through pars plana approach. *JCPSP.* 2009; 19 : 436-9.
12. **Katz G, Moisseiev J.** Posterior-segment intraocular foreign bodies: An update on management. Risks of infection, scarring and vision loss are among the many concerns to address. *Retinal Physician.* 2009.
13. **Kanski JJ.** Trauma. In: *Kanski JJ Clinical Ophthalmology. A systemic approach* 6th ed. Butterworth Heinemann. 2007; 847-68.
14. **Nair UK, Aldave AJ, Cunningham ET Jr.** Ophthalmic Pearls: Trauma. Identifying intraocular foreign bodies. *EyeNet Magazine* Oct 2007. Edited by Scott IU, Fekrat S.
15. **Colyer MH, Weber ED, Weichel ED, et al.** Delayed intraocular foreign body removal without endophthalmitis during Operations Iraqi Freedom and Enduring Freedom. *Ophthalmology.* 2007; 114: 1439-47.
16. **Knox FA, Best RM, Kinsella F, et al.** Management of endophthalmitis with retained intraocular foreign body. *Eye* 2004; 18: 179-82.
17. **Mittra RA, Mieler WF.** Controversies in the management of open globe injuries involving the posterior segment. *Surv Ophthalmol.* 1999; 44: 215-25.
18. **Jonas JB, Budde WM.** Early versus late removal of retained intraocular foreign bodies. *Retina.* 1999; 19: 193-7.
19. **Mieler WF, Ellis MK, Williams DF, et al.** Retained intraocular foreign bodies and endophthalmitis. *Ophthalmology* 1990; 97: 1532-8.
20. **Kalayoglu MV.** Evolving use of intraocular magnets in ophthalmic surgery. *OphthalmologyWeb.*
21. **Erakgun T, Egrilmez S.** Prognostic factors in vitrectomy for posterior segment intraocular foreign bodies. *J Trauma.* 2008; 64: 1034-7.
22. **Chaudhary IA, Shamsi FA, Al-Harathi E, et al.** Incidence and visual outcome of endophthalmitis associated with intraocular foreign bodies. *Graefes Arch Clin Exp Ophthalmol.* 2008; 246: 181-6.
23. **Mieler WF, Mittra RA.** The role and timing of pars plana vitrectomy in penetrating ocular trauma. *Arch Ophthalmol.* 1997; 115: 1191-2.
24. **Karel I, Diblik P.** Management of posterior segment foreign bodies and long-term results. *European J Ophthalmol.* 1995; 5: 113-8.
25. **Szijarto Z, Gaal V, Kovacs B, et al.** Prognosis of penetrating eye injuries with posterior segment intraocular foreign body. *Graefes Arch Clin Exp Ophthalmol.* 2008; 246: 161-5.
26. **De Souza S, Howcraft MJ.** Management of posterior segment intraocular foreign bodies: 14 years' experience. *Can J Ophthalmol.* 1999; 34: 23-9.
27. **Woodcock MG, Scott RA, Huntbach J, et al.** Mass and shape as factors in intraocular foreign body injuries. *Ophthalmology.* 2006; 113: 2262-9.
28. **Wani VB, Al-Ajmi M, Thalib L, et al.** Vitrectomy for posterior segment intraocular foreign bodies: visual results and prognostic factors. *Retina.* 2003; 23: 654-60.

Principal Author Prof. Mustafa Iqbal

Glaucoma

Early diagnosis and appropriate management is important to preserve vision in glaucoma.

**Prof. M Lateef Chaudhry
Editor in Chief**