Review Article

Role of imaging in diagnosis and management of intraocular foreign bodies: A short review

Rajwinder Kaur, Balbir Khan, R. N Bhatnagar

Department of Opthalmology, Gian Sagar Medical College and Hospital, Banur, Rajpura, Punjab, India.

Keywords: *Endophthalmitis, Intraocular foreign bodies, Retinal detachment, Ocular siderosis*

Abstract

IOFBs (intraocular foreign bodies) can be found in up to 40% of penetrating or open-globe ocular trauma cases. Vision loss can be devastating as a result of endophthalmitis, retinal detachment or ocular siderosis. However, timely and appropriate management often leads to favorable anatomic outcomes with restoration of good visual function in the majority of cases. The identification of IOFBs can be quite challenging clinically. Several imaging modalities are currently available to aid in screening for the presence of retained IOFBs—each with its own advantages and limitations.

***Corresponding author:**
Dr. Rajwinder Kaur, Assistant Professor, Department Of Opthalmology, Gian Sagar Medical College And Hospital, Banur, Rajpura-140401, Punjab, India.

Introduction

Mechanism of injury: IOFBs (intraocular foreign bodies) can be found in up to 40% of penetrating or open-globe ocular trauma cases**. [1, 2]** Young men are most prone to sustaining open-globe injuries with retained IOFBs, with the majority of injuries occurring at the workplace. Hammering, using machine tools, shooting weapons and being in proximity to explosions are among the most common mechanisms involved in retained IOFB cases. Less common causes include assault, motor vehicle accidents, lawn mower injuries and insect stings. The foreign bodies produced by hammering tend to be small, sharp projectiles that penetrate the eye with less disruption and carry a more favorable prognosis. Roughly 90% of the involved projectiles are metallic, and over half of these are magnetic. The other mechanisms of injury tend to produce projectiles that are larger and blunter, consequently causing more damage to the eye on penetration, oftentimes leading to a more guarded visual prognosis. **[3-5]**

Evaluation:

As with all vision-threatening injuries, evaluation begins with a thorough history, including setting of the trauma, time of injury, use of safety glasses, possible materials involved in the injury, and any events or interventions since the time of injury. There must be a high suspicion for a retained IOFB in the setting of hammering, sawing, drilling, grinding or an explosion. It should be assumed that ocular injuries sustained in these types of settings potentially harbor an IOFB until proved otherwise. History solely can give clue in cases of severely traumatized eye with hyphema, sclera tear, vitreous hemorrhage, retinal detachment and media opacity.

After excluding life threatening conditions, a thorough ocular examination should follow, including visual acuity assessment, pupillary evaluation, IOP and external slit-lamp examination and assessment of media clarity. Evaluation of extent of entry wound to decide for primary repair, as it is important to maintain the integrity of the globe .Primary repair of the globe and intravitreal pharmacological drugs can be given to minimize the incidence of endophthalmitis. Intraocular pressure may be measured if the procedure will not place undue force on the globe. Subtle signs, including focal lens opacities, IOP asymmetry, pupil asymmetry, iris heterochromia, iris hole, or small self-sealing wounds, may suggest the presence of an IOFB. In cases of scleral wound entry sometimes clear lens allows the visualization of foreign body directly in vitreous cavity or on retina. In cases presenting with hyphema, traumatic cataract, vitreous hemorrhage suspected of harboring IOFB should be imaged to rule out the presence of IOFB.

Current Imaging Modalities

Computed tomography (CT) is currently considered the "gold standard" for the detection, localization and characterization of both metallic and nonmetallic IOFBs. Traditionally, axial sections separated by 3 to 5 mm have been utilized as an initial screening study for IOFBs. But with advancement axial and coronal cuts of <1.5mm are advised. Spiral CT is a newer advancement that has helped overcome some of the limitations of conventional CT, including motion artifacts and long examination times. **[6]** But because studies comparing the detection of steel IOFBs measuring 0.06 mm^3 or larger have shown no difference in sensitivity between spiral and conventional scanning CT, **[7, 8, 9]** either imaging modality is probably adequate for detection of all but the smallest of IOFBs.

Advantages are-

1. Little need of patient cooperation
2. No manipulation of traumatized globe.
3. Exact localization of foreign body whether intraocular or extraocular, or retro-ocular.
4. Exact size and number of foreign body.
5. Nature of foreign body.(metallic or non metallic or organic)
6. In case of trauma, CT scan can show presence of fractures and foreign body related complications (Optic nerve compression, infection) and orbitocranium extension.

Limitation –

It is costly not affordable by poor patients.

Small RIOFB may lose their radio-density and may not be visible on plain X-ray and Ultrasound these detected on CT scan.

Standard B-scan ultrasonography can also be used for localizing IOFB, but the sensitivity is user-dependent. In addition, it is important to note that a small amount of intraocular air can occasionally be mistaken for an IOFB and that contact ultrasonography is contraindicated in globes suspected of rupture. It detects both radiolucent and radio-opaque IOFB. Ultrasound with A and B mode with low gain showing hyper-reflective echoes on B scan and corresponding high spike on A mode is suggestive of IOFB. Hyper-reflective spike of IOFB persists even at low gain while hyper-reflective spike of vitreous hemorrhage and vitreous debris disappears..

Ultrasound biomicroscopy (UBM) has been examined as an adjunct to CT scanning. Deramo and colleagues demonstrated the usefulness of UBM in the detection of suspected IOFB in nine eyes, including two eyes in which CT scanning failed to visualize wooden and metallic foreign bodies. UBM was found to be especially helpful in the management of small, nonmetallic IOFBs located in or near the anterior chamber. [**10]**

Plain film X-rays alone may be used as a screening modality for IOFBs in all high velocity injuries with the evidence or a suspicion of IOFB. But of all the imaging techniques, x-rays are most likely to yield an equivocal result. Most of the metal fragments are clearly visible on plain X-ray, although some metals are relatively radiolucent (e.g. Aluminium).Single AP view and Lateral orbital X-ray is sufficient. Limbal metallic ring or contact lens may be used to localize the IOFB. Etherington and colleagues conducted a retrospective review to characterize the usefulness of both CT scanning and plain film x-rays as screening modalities for IOFBs. Their study revealed that if an IOFB could be seen on a plain film x-ray, then 6-mm CT cuts would be sufficient to detect and localize the IOFB. Conversely, when IOFBs were not able to be seen on plain films, 3-mm CT cuts were necessary to ensure accurate localization. [**11]**

Magnetic resonance imaging (MRI) is contraindicated in the detection of suspected metallic IOFBs because the associated electromagnetic field can cause foreign body migration, potentially damaging intraocular tissues. An MRI is also more susceptible to motion artifact than other imaging modalities. MRI may be considered when there is a strong suspicion of a nonmetallic (small plastic and /or wood) foreign body not seen with CT scanning or B-scan ultrasonography.

A Classic Case of Metal on Metal Eye Injury

Chief Complaint: Acute right eye pain.

History of Present Illness: A 36 year-old male presented with right eye pain immediately after he had been pounding a metal object with a metal chisel. He was not wearing safety glasses and felt something strike his right eye. This was followed by tearing and blurred vision. He continued working for a few hours, but when the vision and tearing did not improve; he went to a local emergency room. He was diagnosed with a corneal abrasion and sent home on topical antibiotics. An appointment with a local ophthalmologist was made for the following morning where his vision was found to be hand motions, a traumatic cataract had developed, and there was suspicion of an intraocular foreign body (IOFB).

He was then referred to the Department of Ophthalmology, Gian Sagar Medical College and Hospital, Banur, Patiala.

OCULAR EXAMINATION

Visual acuity: Right eye (OD) HM, Left eye (OS) 20/20.

Intraocular pressure: OD 16 mmHg, OS 17 mmHg.

Pupils: Dilated upon arrival by outside ophthalmologist.

External and anterior segment examination: OD: Conjunctiva mildly injected, no conjunctival lacerations, no subconjunctival hemorrhage. Cornea, with central 1 mm Seidel-negative, full-thickness laceration. Anterior chamber formed, 1+ cell, no hypopyon or hyphema. Dense traumatic cataract, with disruption of anterior lens capsule. No view of the anterior vitreous. OS: Normal.

Dilated fundus exam (DFE): OD: No view due to cataract, OS: Normal .Since there was no view to the posterior pole and we suspected an IOFB due to the presence of the cataract and the mechanism of injury, the patient underwent Ultrasonography of the right globe.

Clinical Course: The patient was diagnosed with a corneal laceration, traumatic cataract, and an intralenticular metallic IOFB. He was brought to the operating room urgently for corneal laceration repair, Planned Phaco aspiration with intraocular lens implant and removal of the metallic IOFB was done. A careful indented peripheral retinal examination was performed, which did not reveal any other retinal breaks or impact sites. 50 mg of cefazolin and 10 mg of dexamethasone were injected beneath the conjunctiva.

Post-operatively the patient was instructed to use Prednisolone eye drops 10 times daily in the operative eye.

At the first post-operative week, vision in the right eye had improved to 6/12p -2.50Dcyl at 180 degree.

At his 8 week follow-up, the patient's vision improved to 6/9 with a -1.50D cylinder 180 degree.

Conclusion

We conclude that CT scan is the investigation of choice for diagnosing and exact localization of intraorbital foreign body especially where IOFB is not clinically visible. But in developing countries, cost is a limiting factor.

Acknowledgements

None.

Funding

None.

Competing Interests

None declared.

References

1. Greven CM, Engelbrecht NE, Slusher MM, Nagy SS. Intraocular foreign bodies: management, prognostic factors, and visual outcomes. *Ophthalmology*. 2000; 107: 608-612.

2. Thompson WS, Rubsamen PE, Flynn HW Jr, Schiffman J, Cousins SW. End ophthalmitis after penetrating trauma. *Ophthalmology*. 2000; 107: 608-612.
3. Williams DF, Mieler WF, Abrams GW, Lewis H. Results and prognostic factors in penetrating ocular injuries with retained intraocular foreign bodies. *Ophthalmology*. 1988; 95: 911-916.
4. Khani SC, Mukai S. Posterior segment intraocular foreign bodies. *Int Ophthalmol Clin.*1995; 35: 151-161.
5. Potts AM, Distler JA. Shape factor in the penetration of intraocular foreign bodies. *Am J Ophthalmol.* 1985; 100: 183-187.
6. Nanda SK, Mieler WF, Murphy ML. Penetrating ocular injuries secondary to motor vehicle accidents. *Ophthalmology*. 1993; 100: 201-207.
7. Dass AB, Ferrone PJ, Chu YR Esposito M, Gray L. Sensitivity of spiral computer tomography scanning for detecting intra-ocular foreign bodies. *Ophthalmology*. 2001; 108(12): 2326–2328.
8. Woodcock MG, Scott RA, Huntbach J, Kirkby GR. Mass and shape as factors in intra-ocular foreign body injuries. *Ophthalmology*. 2006; 113(12): 2262–2269.
9. Chacko JG. Detection and localization of steel intra-ocular foreign bodies using computerized tomography: a comparison of helical & conventional axial scanning. *Ophthalmology*. 1997; 104(2): 319–323.
10. Deramo VA et al. The role of ultrasound bio-microscopy in ocular trauma. *Trans Am Ophthalmol Soc.* 1998; 96: 355–365.
11. Etherington RJ, Hourihan MD. Localisation of intra-ocular and intra-orbital foreign bodies using computer tomography. *Clin Radiol*. 1989; 40(6): 610–614.