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CASE REPORT

Intraocular Foreign Body: Striving the Optimal Visual Outcome

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Abstract

Introduction: Intraocular foreign bodies (IOFBs) are defined as intraocularly retained, unintentional projectiles that require urgent diagnosis and treatment to prevent blindness or globe loss. **Case Presentation:** We report a case of IOFB due to occupational accidents. In this case, there were delays in extraction considering the health facilities and conditions related to COVID-19 infection. Initially, the patient underwent closure of the entrance wound, which was performed within the first 24 hours post-trauma. However, although there was no endophthalmitis, visual acuity at the end of the observation still showed an unexpected outcome. The patient was followed up for three months after IOFBs extraction. The timing of IOFBs removal depends on several factors, including the patient's overall health status, the nature of the injury, and the composition of the IOFBs. The postoperative examinations focus on complications such as endophthalmitis, postoperative retinal detachment, proliferative vitreoretinopathy (PVR), and sympathetic ophthalmia. The numerical values can then be used to predict the expected visual acuity using the ocular trauma score system. **Conclusions:** Many factors could affect the outcome quality of visual acuity. Primary wound closure, foreign body extraction, and anatomic reconstruction of the holistic ocular should be performed as soon as possible. Delay in definitive treatment was thought to affect worsening prognosis due to tissue proliferation and the tendency for severe complications, including endophthalmitis.

Keywords: intraocular foreign body; metallic; penetrating injury; open globe injury

Introduction

Intraocular foreign bodies (IOFBs) are defined as intraocularly retained, unintentional projectiles that require urgent diagnosis and treatment to prevent blindness or globe loss. In the Birmingham Eye Trauma Terminology System (BETTS), IOFBs was defined as one or more foreign objects that present with open globe injury. Technically IOFBs was a penetrating injury, however, grouped separately because of different clinical implications in management and prognosis.[1] The presentation, course, and prognosis of IOFBs injuries vary depending on several variables. IOFBs can result in penetrating or perforating open-globe wounds. The visual prognosis varies on the area of injury, the kind and size of the foreign body, and the complications that follow. An improved result in injuries involving IOFB is attributable to increased knowledge of eye safety, enhanced surgical methods, and developments in bio-engineering.[2]

Between 20.000 and 68.000 of the 2.4 million eye injuries that are thought to occur annually in the United States of America (USA) are severe enough to endanger vision.[3] The USA eye injury database lists the following as the locations of injuries[3]: homes (43%), businesses (20%), sporting events (13%), streets and highways (15%), farms (3%), and public buildings (3%). Many blunt objects (34%) and numerous sharp objects (26%) are the leading causes of injury, followed by car accidents (10%), gunshots (6%), BB and pellet guns (6%), falls (5%), fireworks (5%), hammering on metal (5%), and explosions (3%). In open-globe injuries, IOFBs can occur anywhere between 18% and 41% of the time. Young men constitute 92%-100% of the patients presenting with IOFBs.[3],[4] The average age of a patient with an IOFBs is 29 to 38 years, with a majority (66%) between 21 and

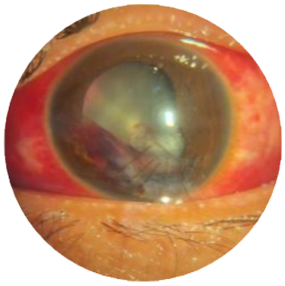

Figure 2. The left eye anterior segment examination.

40.[3],[4] Work is the most common place of injury (54%-72%), followed by home (30%).[3],[4] The most common causes include hammering (60%-80%), usage of power or machine tools (18%-25%), and weapon-related injuries (19%).[3],[4] Less common causes of an IOFBs-related injury include assault, motor vehicle accidents, lawnmowers, and firework injuries.[3],[4]

Establishing the therapy of a patient with ocular injuries requires confirming the presence or absence of a retained IOFBs. In any scenario, slit-lamp biomicroscopy or fundus examination can be used to detect IOFBs. Due to corneal injury or ocular media clouding, such as cataract, hyphema, or vitreous hemorrhage, it can be challenging to detect IOFBs in some situations. Surgery is usually necessary for IOFBs patients. The primary goals of the treatment are to remove the IOFBs, address existing difficulties, restore the ocular anatomy, and reduce potential complications in the future. Depending on the patient's condition, a series of phased surgeries can be necessary. More choices for handling complex cases are now possible because of improvements in microsurgical methods. Nevertheless, in some patients, preservation of the vision and globe may not be possible.[5]

In this case report, we report a metallic IOFBs due to occupational accidents. The surgeon performed pars plana vitrectomy and evacuation of the IOFBs to restore the anatomy of the eye. This report's explanation of the patient's condition and treatment was expected to provide input to improve the IOFBs patient's management later.

Figure 2. Skull AP-lateral x-ray.

Case presentation

An 18-year-old man suddenly presented with blurred vision in his left eye for five days after being hit by a small metallic object while at school practice in a lathe workshop. There were complaints of pain, difficulty opening the eyes, and watering in the left eye. The patient was immediately taken to the local hospital and underwent surgery to close the corneal wound about 12 hours after the incident. The patient was admitted and received an intravenous antibiotic, topical antibiotic, steroid, and cycloplegic agent for medical therapy. After surgery, the visual acuity was hand movement, and five days later gradually decreased. The patient was referred to our hospital because a foreign body was found in the eyeball.

On the initial examination, the left eye visual acuity was light perception with normal intraocular pressure. Anterior segment evaluation revealed a sutured corneal laceration in the inferior quadrant with a blood clot on the anterior chamber. The pupil was not round, with posterior synechia in one quadrant, and the lens revealed lens opacification with anterior capsule rupture. The ocular motility was good in all directions without any pain. Ultrasonography using amplitude and brightness scans depicted hyper-echogenicity in the posterior segment suggesting a solid mass with retinal detachment and ongoing vitreous. A skull radiograph revealed a high-density intraorbital mass confirmed with computed tomography (CT) scans as a hyperdense foreign body in the left globe, likely metal.

The patient was assessed as left eye open globe injury with BETTS classification type C, grade D, zone one with undefine pupillary defect. The patient was prepared to undergo pars plana vitrectomy, lensectomy, and foreign body removal. The surgery could be undergone on the 13th day after trauma and, during surgery, revealed total retinal detachment with a giant tear at 6 o'clock with a metallic foreign body in subretinal space. The 4 x 3 x 1 mm metallic object then remove using an intraocular magnet and forceps through the corneal incision. The surgery was continued with photocoagulation, silicone oil tamponade, and corneal incision suturing.

Following the surgery, the visual acuity remains light perception. Intravenous and topical medication was continued for five more days, and there was no infection sign. On follow-up at one month, the inflammatory phase had subsided; fundus examination revealed a retina attached with a peripheral retinal scar, but unfortunately, the visual acuity remains light perception. Three months after surgery, the visual acuity remains light perception with no infection or inflammatory sign.

Discussion and conclusions

The intraocular foreign body can be severe as it may result in vision-threatening ocular inflammations and even eye loss. Ocular damage and visual loss may be

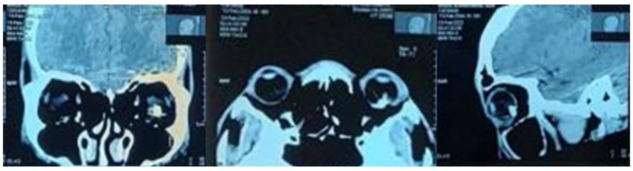

Figure 3. CT-scan evaluation.

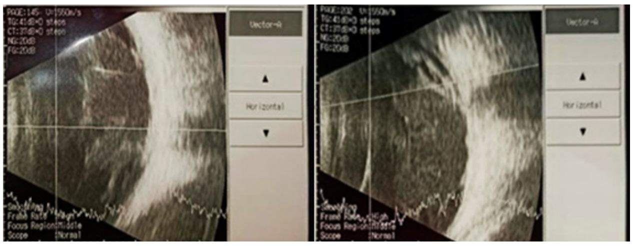

Figure 4. A-Scan and B-Scan Ultrasonography.

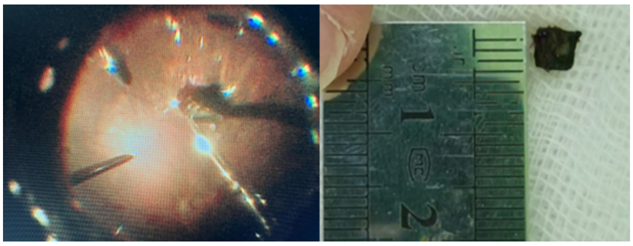

Figure 5. Vitrectomy and IOFBs extraction.

caused by laceration or hemorrhage directly caused by IOFBs at the time of injury, but it may also occur due to the consequent development of retinal detachment or endophthalmitis. Various factors have been suggested to be associated with the final visual outcomes in patients with IOFBs. These factors include the initial visual acuity, size, and location of the IOFBs, size, and location of the IOFBs entry wound, presence of relative afferent pupillary defect (RAPD), intraocular hemorrhage, retinal detachment and endophthalmitis.[5]

Intraocular foreign substances' path to enter the eye can result in direct mechanical harm. They can ricochet and inflict further intraocular harm; thus, their course is not always straightforward. Several variables influence the degree of IOFBs-induced intraocular damage. The length of the wound can predict the risk of retinal injury. A shorter wound results in less IOFBs energy being lost during penetration and allows it to penetrate further into the eye, where it might harm the retina. Intraocular injury is more likely to occur when foreign objects enter the eye through the sclera rather than the cornea. Object shape can also be predictive of intraocular damage. Sharp IOFBs cause less damage than blunt ones of the same size.[7] This patient experienced trauma due to metal objects caused by the hammering process. The object's shape tends to be irregular with sharp edges so that at high velocity, it could penetrate the posterior segment.[1]

A thorough history is a crucial step in the preoperative care of IOFBs. Depending on the severity of the injury, a complete ocular examination should be performed after taking a history. This includes checking the injury and its surroundings for prominent foreign bodies and lacerations and performing visual acuity tests, pupillary evaluations, external slit lamp tests, and fundus examinations.[8] Ocular imaging is a vital tool for managing IOFBs. The appropriate diagnostic tool for visualization and localization depends on the suspected composition and location of the IOFB. As in this case, the initial ultrasound assessment was biased because there was retinal detachment and hemorrhage around the foreign body, thus forming a membrane-bound image of the echogenic lesion that was difficult to define. CT scan to confirm the presence of metal objects in these patients should be performed for preoperative localization of IOFBs. Magnetic resonance imaging (MRI) is used only when the presence of a metallic IOFBs is ruled out.[9],[10] IOFBs pose a significant threat of infection. Cultures should be obtained, and the patient's tetanus status should be determined and enhanced if necessary. Using a broad-spectrum empirical regimen, this patient was given intravenous and topical antibiotic therapy for infection prophylaxis. However, this patient was not given intravitreal antibiotics considering the risk of infection was not too high. Fortunately, the patient showed no signs of infection until the wound healed three months post-trauma.[3],[9],[10]

Several variables influence the time of IOFBs elimination. In individuals with endophthalmitis symptoms, globe repair with quick IOFBs removal is nearly always advised unless concurrent life-threatening damage precludes ocular surgery.[11] In the absence of ophthalmologists skilled in the necessary surgery, it may be preferable to delay IOFBs removal, stabilize with primary globe closure, and treat with intravitreal and systemic antibiotics. The patient can then be swiftly sent to the specialist to remove the foreign body effectively. This treatment strategy was carried out in our patient while optimizing his condition until he was ready for surgery; close observation of possible complications should be carried out, including control of intraocular pressure to prevent glaucoma secondary to inflammation.[2],[12] Potential advantages to delayed IOFBs removal include improved control of inflammation caused by initial open globe injury, the ability to assess intraocular structures further, and the possible development of spontaneous posterior vitreous detachment, which might make excision of the posterior hyaloid easier. Delaying the surgery will also allow adequate time to assemble appropriately skilled operation room personnel and necessary surgical equipment. Although there are some advantages to delaying IOFBs removal, there is a high risk of endophthalmitis by leaving a potentially contaminated foreign body in the eye.[3],[12]

The most popular method for removing IOFBs from the posterior portion is pars plana vitrectomy (PPV). The ability to see the IOFBs clearly, getting rid of media opacities, and hastening the removal of inflammatory mediators during surgery are some benefits of vitrectomy. The size and makeup of the IOFBs determine the extraction procedure. An intraocular rare earth magnet can remove metallic and ferromagnetic IOFBs under 0.1 mm in size. If the IOFBs is suspended in the vitreous cavity, small, nonferrous (and magnetic) IOFBs can be retrieved with merely the vitreous cutter if the overall volume of the foreign body is more significant than 4 x 4 x 4 mm^3, the doctor may want to consider performing a T-shaped sclerotomy for IOFBs extraction. The sclerotomy site allows for the removal of smaller foreign objects. If the IOFBs can be withdrawn without causing more damage to the tissue, it can also be taken out through the original corneal or scleral entry site. It might be necessary to reopen the sutured entry site for this maneuver. As an alternative, as was already noted, it might be necessary to design a new extraction locus or increase an existing sclerotomy to extract the IOFBs. The surgeon should conduct a retinal examination with scleral depression following removing the IOFBs to look for retinal tears, retinal detachment, and/or choroidal separation. In this case, IOFBs was found in the superior subretinal region with retinal tear and retinal detachment. The IOFBs was taken using forceps and an internal magnet; furthermore, extracting it through the sclera was quite risky because of its large size. The IOFBs was extracted through a new incision in the cornea with a previous lensectomy as a way out, and then in the anterior chamber was taken using forceps. Silicone oil was chosen because of the superior tear position to achieve retinal attachment, and then laser photocoagulation was performed. If necessary, the lens is temporarily left aphakia, and a secondary intraocular lens (IOL) implant will be planned after wound healing so that the inflammatory reaction is not too severe. Neither chorioretinectomy nor scleral buckle was not performed in either case at the surgeon's preference.[3],[12]

Examining problems such as endophthalmitis, postoperative retinal detachment, and proliferative vitreoretinopathy (PVR) is critical to the postoperative process. Retinal detachment pre and postoperatively is a severe injury complication linked to IOFBs. Between 6% to 40% of postoperative cases result in retinal detachment. The visual prognosis is poor in the case of postoperative retinal detachment, however, it is considerably worse in the case of preoperative retinal detachment, according to numerous studies. PVR, a severe complication and a barrier to successful retinal reattachment surgery, involve the formation and contraction of membranous scar tissue on the epiretinal and/or subretinal surface. PVR is linked to subpar visual results. The size of the IOFBs and the number of retinal tears are some risk variables connected to the emergence of PVR.[7] Three months after the incident, there was no indication of an infection that would have caused endophthalmitis. There was no evidence of bleeding or inflammation, and the retina looked to be connected. Nonetheless, observations must consider the possibility of an infectious or persistent inflammatory response.[13]

Visual acuity is an important prognostic factor for the overall visual outcome. Other factors associated with the poor visual outcome that have been reported in the literature include hyphema, vitreous hemorrhage, uveal prolapse, no PPV for posterior IOFBs, PVR, hammering metal on metal as a mechanism of injury, the culture of a nonvirulent organism, younger age, increased wound length, wound more significant than the IOFBs in most extensive length, the presence of retinal detachment, the presence of an afferent pupil. Standard lens at presentation, absence of lens injury, shorter wound length, anterior segment IOFBs, older age, use of PPV rather than magnets for posterior situated IOFB, lack of retinal detachment, and absence of endophthalmitis are other characteristics that portend a favorable visual prognosis. The injury's location and manner significantly impact the patient's ultimate best-corrected visual acuity.[3],[14],[15] In this instance, the ocular trauma score system calculated 45 points, divided into category two, with the best interpretation of visual acuity at six months > 20/40 being 15% and the worst interpretation being no light sensitivity at 28%. In the first case, the patient's visual acuity was the light perception, and the condition was as of the third follow-up month after the incident.

Many factors could affect the outcome quality of visual acuity. Primary wound closure, foreign body extraction, and anatomic reconstruction of the holistic ocular should be performed as soon as possible. Delay in definitive treatment was thought to affect worsening prognosis due to tissue proliferation and the tendency for severe complications, including endophthalmitis. However, the use of safety equipment at work was a wise procedure that should be done.

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