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Case Report

Intraocular foreign body (IOFB)

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ABSTRACT

Intraocular foreign bodies (IOFBs) were 16-40% of open globe trauma and could cause severe visual loss. Therefore, they require immediate diagnosis and treatment. This is a case of an 18-year-old man who came to the hospital complaining of a metal piercing in his left eye while cutting some metal about 2 hours before entering the hospital. On ophthalmologic examination, visual acuity of the left eye was 3/60, and a full-thickness laceration of the cornea with an IOFB was seen at the anterior chamber base. Immediate IOFB evacuation was carried out on the same day as the incident happened. During the operation, a metal intraocular foreign body with a sharp tip, 4x2x1 mm in size, was successfully removed in intact condition. Next, the laceration and the corneal limbus incision were sutured using 10.0 nylon. The stitches are tight, and the anterior chamber depth is maintained. Evaluation on the fourth week after IOFB evacuation showed that visual acuity in the left eye was 6/20 with lens correction C-1.50 x 150° become 6/7.5. Appropriate and prompt diagnosis and management of open eye injury can contribute to preserving a good anatomical and functional result.

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INTRODUCTION

Intraocular foreign bodies (IOFBs) are characterized as intraocularly retained, accidental projectiles that require immediate diagnosis and treatment to prevent blindness or eye loss (Erakgun & Egrilmez, 2008; Liu et al., 2017; Patel et al., 2012; Yeh et al., 2008). The intraocular foreign body can consist of almost any substance, most of which are metal, as most patients are injured when holding a hammer. Patients' visual prognosis can be affected by physical and chemical damage from the pathogens of IOFBs (Virgana & Widyanatha, 2021).

Sixteen to forty percent of open globe trauma are IOFBs and often can cause severe visual loss. Younger men constitute 92-100% of the patients with IOFBs. The usual age of the affected person with an IOFB is twenty-nine to thirty-eight years old, with most of them (66%) between twenty-one and forty. After the workplace (54-72%), the home is the second most common place for injury (30%) Wulan et al., 2018).

Laceration or bleeding from IOFBs can lead to ocular damage and visual loss directly after the injury; otherwise, retinal detachment or endophthalmitis also causes visual loss due to the consequent development. Visual results in patients with IOFBs are related to various factors. Those factors consist of the preliminary visual acuity, size and location of the IOFB entry wound, length and location of the IOFB, presence of relative afferent pupillary defect (RAPD), intraocular bleeding, detachment of the retina, and endophthalmitis (Jung et al., 2021).

Effective therapeutic plans, intraoperative guidance, prognosis, and counseling can be achieved by promptly evaluating patients with possible IOFBs based on prior signs and symptoms. The preoperative preparations include obtaining a clinical history and ophthalmic evaluation, characteristics of IOFBs found by neuroimaging, and consideration of antibiotics medication. Besides clinical exams on the slit-lamp and indirect fundoscopy, diverse imaging methods are treasured for the recognition and localization of IOFBs (Wulan et al., 2018).

The main goal of the treatment is to eliminate the IOFBs, clear up complications that already took place, restore the anatomy of the eye, and decrease feasible complications in the future (Jung et al., 2021). This case report describes the clinical findings, diagnosis, management, results, and follow-up plan in patients with IOFBs.

CASE REPORT

An 18-year-old man came to the eye clinic of PKU Muhammadiyah Gamping Hospital with a complaint that his left eye was pierced by metal while he was cutting some metal about 2 hours ago. The patient felt pain in the left eye and blurred vision. On examination, visual acuity of the left eye was 3/60, and there is conjunctival hyperemia and corneal edema with a total thickness laceration on the cornea about 4 mm. A piece of metal foreign body was seen at the anterior chamber base that penetrated the patient's eye. The anterior chamber was deep, and there was no leakage from the corneal laceration. Iris was within normal limits, with no laceration and prolapse of the iris tissue, and the pupil looked round. The lens looks clear, and there is no tear in the lens capsule. The posterior segment was within normal limits. The patient was diagnosed with perforating left eye injury with intraocular foreign body (IOFB).

The general examination found that the general condition was good, with adequate nutrition and good awareness. The blood pressure was 110/70 mmHg, pulse 72x/minute, respiration rate 20x/

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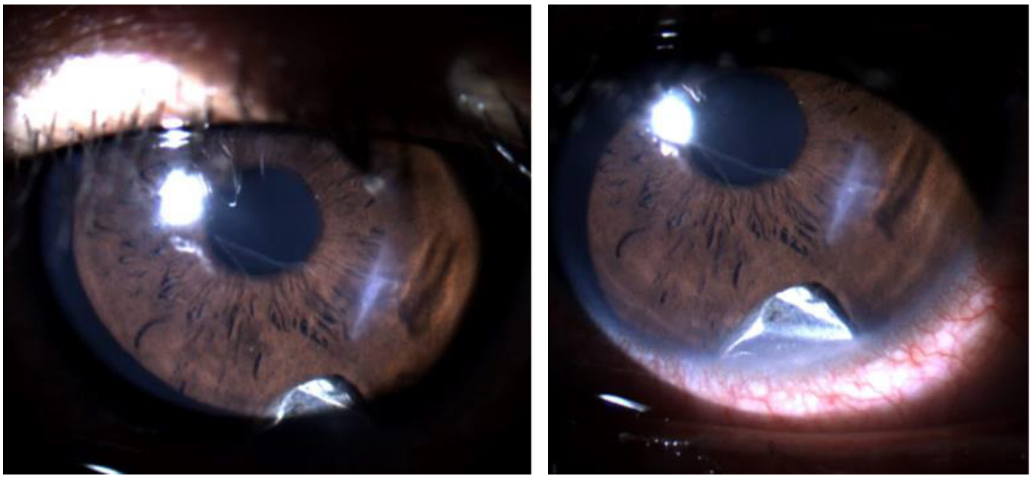

Figure 1. The results of the slit-lamp biomicroscopic examination on the patient's first day showed a corneal laceration.

Figure 2. The metal foreign body (4x2x1 mm) that was successfully evacuated

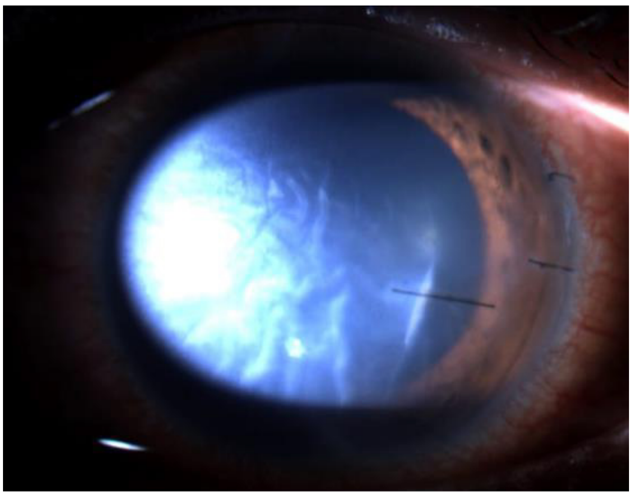

Figure 3. Day 5 after IOFB evacuation

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minute, body weight 58 kg, and temperature 36.2°C. The heart and lungs are within normal limits, liver and spleen are not palpable.

Blood examination revealed leukocytes $14.4x10^3$/ml, hemoglobin 16 g/dl, platelets $333x10^3$/mL, hematocrit 46.5%, PPT 14 seconds, APTT 38.7 seconds, random blood glucose 81 mg/dl, non-reactive HBsAg, and negative SARS CoV-2 antigen. The thorax x-ray examination shows a normal broncho vascular pattern, both sinuses are taper, both diaphragms are smooth, and cor within normal limit.

The patient underwent an intraocular foreign body evacuation on the same day as the incident happened. Premedication was an injection of 1 gram of Ceftriaxone and Levofloxacin eyedrops every 2 hours. The operation was performed under general anesthesia. During the operation, a metal intraocular foreign body with a sharp tip, 4x2x1 mm in size, was successfully removed using Keelman tweezers in the intact condition through a 6 mm incision at the temporal side of the corneal limbus. Next, the laceration and the corneal limbus incision were sutured using 10.0 nylon thread. The stitches are tight, and the eye's anterior chamber can be maintained in depth.

The medication given after surgery were Levofloxacin tablet once daily, Mefenamic Acid tablet three times daily, Methyl Prednisolone tablet 16 mg 2-1-0, Levofloxacin eye drops every 3 hours, Polymyxin-Neomycin-Dexamethasone eye drops every 3 hours, and Atropine sulfate 1% eye drops two times a day.

On the fifth day after IOFB evacuation, the visual acuity of the left eye was 1/300, the cornea looked edematous, corneal Descemet's folds were found, corneal and limbus sutures were tight, and conjunctival hyperemia was found (Figure 3). The anterior chamber was deep, the iris was within normal limits, the pupil was dilated by 8 mm due to the effects of atropine sulfate eye drops, the lens was clear, and the posterior segment was difficult to visualize. Postoperative therapy of Methyl Prednisolone tablet 16 mg twice daily, Levofloxacin eyedrops every 3 hours, and Polymyxin-Neomycin-Dexamethasone eye drops every 3 hours was given.

Two weeks after IOFB evacuation, visual acuity of the left eye was 6/60, corneal edema was reduced, corneal Descemet's fold disappeared, corneal and limbus sutures were tight, and conjunctival hyperemia was reduced. The anterior chamber was deep, the iris was

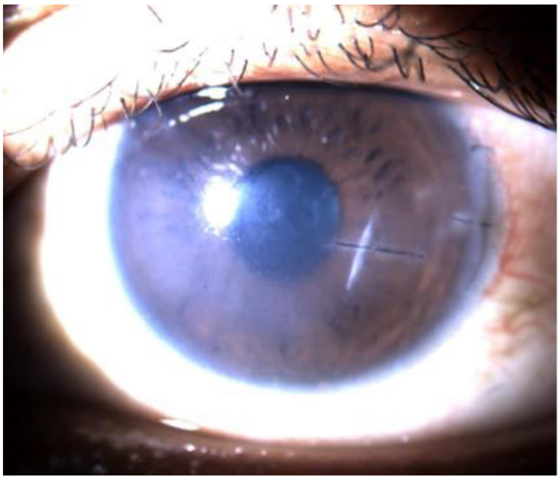

Figure 4. Two weeks after the IOFB evacuation

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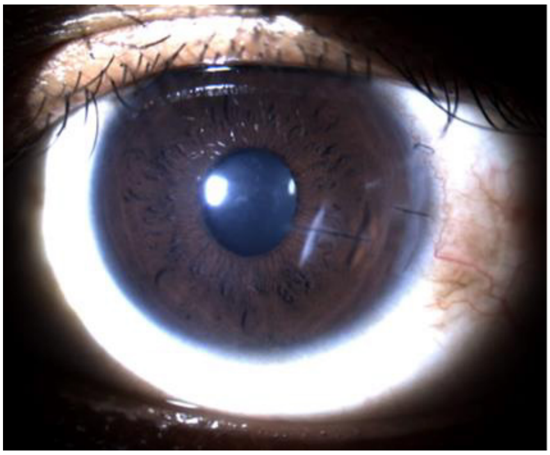

Figure 5. Four weeks after the IOFB evacuation.

within normal limits, the pupillary diameter had returned to normal (3 mm), the lens was clear, and the posterior segment was within normal limits (Figure 4). The therapy given was Methylprednisolone 8 mg 2 – 1 – 0 tab for a week, then 1 – 1 – 0 tab for the following week, and Polymyxin-Neomycin-Dexamethasone eye drops four times a day.

On the fourth week after IOFB evacuation, visual acuity of the left eye was 6/20 with lens correction C-1.50 x 150° become 6/7.5. The cornea was clear, the corneal and limbal sutures were within normal limits, and conjunctival hyperemia was minimal. The anterior chamber was deep, the iris and pupil were within normal limits, the lens was clear, and the posterior segment was within normal limits (Figure 5). The patient was given Methylprednisolone 4 mg 1 – 1 – 0 tab for five days, and artificial tears eye drops four times a day.

DISCUSSION

IOFBs have been formerly categorized in line with their location (anterior chamber, posterior chamber), material characteristics (metal, magnet, wood), length, mechanism of trauma, setting (workplace, battlefield), and period (acute, chronic). The Ocular Trauma Classification organization subdivided open globe injuries into: (1) penetrating injuries if there is an entry wound; (2) perforating injuries if there is an entry also an exit wound; and (3) lacerations and blunt ruptures, and as being either with or without a retained IOFB. The wound's most posterior extent is a marker to categorize the entry site: zone 1 for cornea; zone 2 for sclera until 5 mm behind the corneoscleral limbus; and zone 3 for sclera more than 5 mm behind the limbus (Parke et al., 2013).

The patient, in this case, had penetrating trauma to the left eye, which resulted in a corneal laceration, and the foreign body remains in the anterior chamber. The patient complained of pain and blurry vision in the traumatized eye, the visual acuity at baseline was 3/60. Pain and decreased vision caused by corneal lacerations. The cornea is the front wall of the eyeball, in the form of transparent and avascular tissue, with a shape like a watch glass. The cornea is sensitive to pain because it is innervated by the ciliary nerve (branch of the trigeminal nerve). The cornea functions as a refraction tool (the greatest refractive power). It is also very sensitive because of its clarity and curvature, which results in minimal structure and shape changes and can cause visual disturbances (Suhardjo & Agni, 2017).

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On examination, there was a foreign/metal body 3 mm in size at the base of the anterior chamber, iris and pupil round, central, pupil diameter 3 mm, direct and indirect light reflexes (+), clear lens, clear vitreous, well-defined papillae and optic discs, CD 0,3 mm, retina within normal limits, IOP 14 mmHg. This examination shows that the IOFB only reached the anterior segment, while the posterior segment appeared within normal limits, and there was no vitreous leak. Thus, according to the literature mentioned above, the IOFB, in this case, belongs to zone 1 in the anterior segment. According to Parke et al., the anterior chamber is the most common place for IOFBs to be found about 21% to 38% of the time. Slit-lamp examination alone can diagnose IOFBs in the anterior chamber, iris surface, or intraventricular. When anterior segment IOFBs are suspected, a gonioscopy examination is required to achieve complete visualization of the angle (Parke et al., 2013).

The clinician should execute signs and symptoms of endophthalmitis by doing a complete exam of the ocular structure, such as visual acuity, pupils response, IOP, slit-lamp biomicroscopy, evaluation of media clarity, wounds size, iris color, lens position, signs of retinal tears and detachments (Wulan et al., 2018). Ocular imaging such as ultrasonography, B-scan, X-ray imaging, CT scan, and MRI have been used to detect IOFBs. The appropriate diagnostic devices for visualization and localization rely on the suspected composition and vicinity of the IOFBs. Metal and non-metal material can be detected by CT scan with one millimeter section and no contrast. Although the plain film may be failed to recognize up to sixty percent of the time metallic foreign bodies; however, it is still a cheap and effortlessly obtainable examination the physicians could ever get. Ultrasonography may be up to ninety-eight percent sensitive in detecting IOFBs. Detachment of retinal and intraocular bleeding, signs of endophthalmitis, and scleral wound entry also can be detected by the USG. MRI can be used after the existence of metallic IOFB is excluded (Wulan et al., 2018).

This patient was diagnosed IOFB based on Birmingham Eye Trauma Terminology (BETT) mentioned in Figure 6. Khun et al. recommended the BETT for precise definitions of all ocular trauma types. Open globe injury is defined as a complete-thickness wound within the corneoscleral wall. Closed globe injuries are subdivided into lamellar lacerations and contusions relying on the presence of a partial-thickness wound. Open globe injuries are subdivided into lacerations and ruptures. Laceration and rupture are both full-thickness wounds of the eye wall, and the difference is that a blunt object causes that rupture; meanwhile, the laceration is caused by a pointy object. In the case of open globe injury with rupture, because the eye is full of incompressible liquid, the effect consequence is a momentary increase in IOP. The eyewall budge at its weakest point at the affected site or somewhere else, such as the actual wound and an old cataract wound, is produced by an inside-out mechanism. An outside-in mechanism can cause a wound at the affected site in open globe trauma with laceration (Jung et al., 2021).

After the diagnosis, this patient immediately planned for an IOFB evacuation operation under general anesthesia. The intravenous and topical antibiotic was given preoperative. Oral antibiotics, analgetic, and steroid; topical antibiotic steroid; and cycloplegic were given after surgery.

Dexamethasone is a product that contains a combination of a fixed-dose corticosteroid and one or more anti-infective drugs. Ophthalmologists use it primarily to treat

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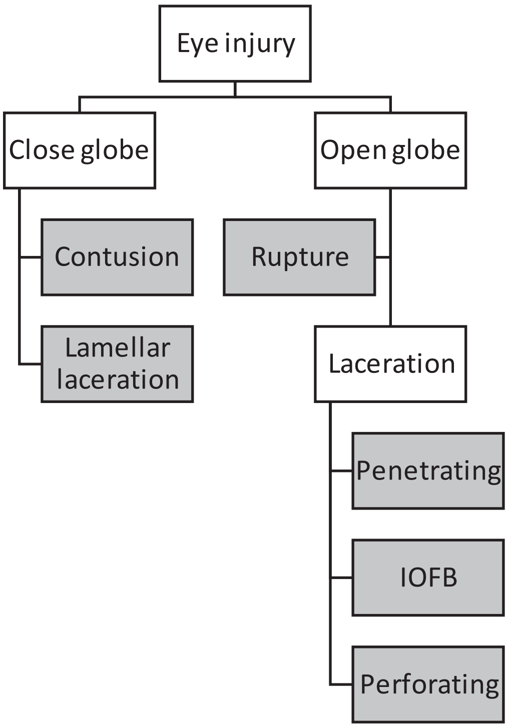

Figure 6. Overview of BETT (Birmingham Eye Trauma Terminology). The shaded boxes represent the actual diagnoses that are used clinically (*Source*: Kuhn et al., 2004)

conditions requiring both, e.g., marginal keratitis due to a combination of staphylococci infection and allergic reactions, blepharoconjunctivitis, and phletenular keratoconjunctivitis. This mixture of drugs is also used postoperatively (Flach & Fraunfelder, 2019). Ophthalmic corticosteroids are more effective in suppressing inflammatory mediators that cause pain than ophthalmic NSAIDs. Corticosteroids can speed up the healing response and prevent tissue scarring by reducing inflammation. This is important because corneal scarring can cause permanent vision loss. Levofloxacin is an anti-microbial agent inhibiting gram-positive and gram-negative bacteria (Katzung & Trevor, 2015). Systemic ceftriaxone is given as an antibiotic premedication to prevent endophthalmitis (Parke et al., 2013).

Prophylactic antibacterial is extensively given in many forms with some evidence-based for effect on endophthalmitis rate. Systemic penicillin, vancomycin, cephalosporin, or fluoroquinolone are generally given before or during the IOFBs extraction. After systemic administration, fluoroquinolones in intravenous or oral forms have been proven to have better intraocular penetration. In some centres with low reported postoperative endophthalmitis rates, intraocular ceftazidime and vancomycin are used at the time of the surgical procedure as prophylactic properties (Parke et al., 2013).

Atropine sulfate 1% is an antimuscarinic drug that has capabilities as a pupil dilator and relaxes the eye muscles. Patients with ocular injury could experience a deep, painful sensation, intense photophobia from the ciliary body, and iris muscle irritation. One percent of atropine sulfate or one percent of homatropine hydrobromide inhibits muscarinic receptors in the ciliary body and iris sphincter. Therefore,

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cycloplegics dilate the pupil and prevent the lenses' ability to accommodate for 1 to 12 days. Cycloplegics offered a larger amount of pain relief by rendering the involved muscles inactive and fixing the pupil. Cycloplegics are also beneficial because they inhibit the leakage of additional inflammatory proteins through blood-aqueous barrier stabilization. Thus, it also prevents synechia, whether it is anterior or posterior (Dinardo & Boncher, 2012).

The patient's health status, the character of the injury, the composition of the IOFBs, and the availability of the ophthalmologist and the equipment are several factors that determine the operating time. Yeh et al. proposed the potential benefits of immediate IOFB extraction, such as decreased proliferative vitreoretinopathy (PVR), decreased risk of endophthalmitis, and a patient's single procedure. The risk of PVR is likely to be accelerated by the presence of an IOFB and post-traumatic infection (Wulan et al., 2018).

Different techniques need to be employed within the extraction of IOFBs, relying on the material, location, and size of the IOFBs. The removal approach for IOFBs is primarily based on their size and material. Small (<1 mm), metallic, and ferromagnetic IOFBs may be eliminated with an intraocular magnet, whereas small, nonferrous materials can be removed with the vitreous cutter alone. Intraocular or basket forceps can be used to eliminate intermediate-sized (1-3 mm) IOFBs, regardless of the material. Diamond-coated forceps are required to remove larger (3-5 mm) and glass materials IOFBs to prevent slippage of the IOFBs during removal. Regarding the vicinity of the IOFBs, IOFBs from the anterior chamber, including the cornea, anterior chamber, and intralenticular IOFBs, are typically extracted together with cataract removal (Jung et al., 2021).

Metallic IOFBs are also related to non-infectious toxicity. Metal is stated in 60-88% of IOFBs, up to 90% of which may be magnetic. Copper, lead, zinc, iron, and nickel can trigger ocular toxicity, with the most harm caused by copper and iron. Iron creates heterochromia, degeneration of retinal pigment, cataracts, and alternation of retinal vascular, and further causes Siderosis bulbi. Diffused siderosis may be best identified by an electroretinogram with a decreased B wave. Chalcosis bulbi secondary to copper depends on the copper ion concentration. If the IOFBs are more than 85%, it could produce tremendous inflammation with hypopyon, rapid progression to phthisis, and sterile endophthalmitis. Kayser–Fleisher rings, sunflower cataracts, or refractile retinal and anterior chamber crystals can be produced by chronic mild chalcosis (Lit & Young, 2002; Yan et al., 2016).

Primary surgical intervention must be performed immediately. It is critical to reduce the risk of endophthalmitis and limit the extrusion of ocular contents by suturing the entry sites. The presence of endophthalmitis upon presentation likewise mandates urgent surgical closure, culture, and antibiotic administration (Parke et al., 2013). Surgical priorities consist of closure of the entry access, elimination of the intraocular foreign body, and prevention or treatment of endophthalmitis (Cosar et al., 1999).

CONCLUSION

Many factors affect the presentation, results, and prognosis of IOFBs. The clinician should conduct a comprehensive history taking, ocular examination, and imaging to evaluate the patient with suspected IOFBs. The benefits and downsides of the deliberate surgical procedure should be considered carefully as a determination of the surgical timing. The approach of IOFB extraction should be selected cautiously based on numerous concerns.

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Preventing and treating feasible complications is crucial after the procedure. Early treatment and complete evaluation of patients are critical to achieving a good prognosis.

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