

Case Report

Management of double-penetrating ocular injury with retained intraorbital metallic foreign body

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Abstract

The prognosis of double penetrating ocular trauma is usually guarded. We report the good anatomical and functional outcome in a patient with double-penetrating ocular trauma associated with intraorbital foreign body. A 58-year-old man presented at the emergency room complaining of blurred vision of the left eye with stinging pain after he hammered an iron plate. Best-corrected visual acuity was hand movement/30 cm. Subconjunctival hemorrhage with one 1.4-mm laceration wound was noted over the nasal conjunctiva. Fundus examination showed vitreous hemorrhage with one whitish patch over the nasal retina. Orbital computed tomography scan revealed one metallic foreign body at the posterior nasal upper orbit. Double-penetrating globe injury with intraorbital foreign body was impressed, and immediate vitrectomy surgery with endolaser photocoagulation was carried out. One exit wound nasal to the disc was noted during operation. The intraorbital metallic foreign body was left alone. Vision recovered to 6/8.6 without ocular complication after a 20-month follow-up. Prompt, careful preoperative evaluation and meticulous vitrectomy intervention are essential in the successful management of such patients. Posteriorly located intraorbital metallic foreign body should be managed conservatively. Long-term regular electroretinography evaluation is needed for possible retinal toxicity from intraorbital foreign body.

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1. Introduction

Open globe injury is a major cause of monocular blindness. The management of open globe injuries continues to pose difficult management dilemmas. The standard practice worldwide has been to undertake a primary repair to restore the structural integrity of the globe at the earliest opportunity.¹ If an intraorbital foreign body exists, it should be evaluated whether there is possible retina damage and whether surgical intervention is needed. Herein, we report a case of successful management of double-penetrating ocular injury associated with an intraorbital foreign body.

2. Case report

A 58-year-old male presented at our emergency room complaining of progressively blurred vision of the left eye with stinging pain after he had hammered an iron plate. He denied any systemic disease, but had received ocular surgery for an orbital tumor in his left eye 20 years before. The initial best-corrected visual acuity (BCVA) was 6/6 in the right eye and hand movement (HM)/30 cm in the left eye. Intraocular pressure was 12 mmHg in both eyes. Movement of both eyes was full and free.

On slit-lamp examination, subconjunctival hemorrhage on the nasal side with a suspected scleral entrance wound about 1.4 mm in length was noted in the left eye (Fig. 1A). The cornea was clear, and there was no cell or flare in the anterior chamber. Mild nucleosclerosis of the lens without traumatic damage was noted. On indirect ophthalmoscopic examination,

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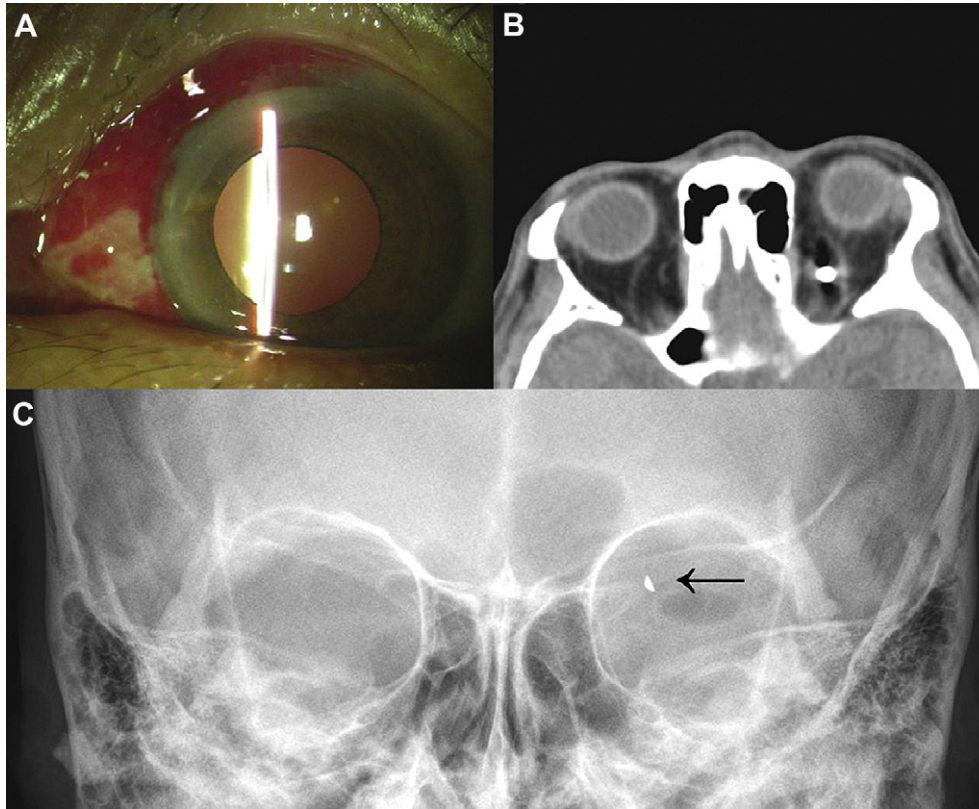


Fig. 1. (A) Slit-lamp photography of left eye showed subconjunctival hemorrhage, laceration and suspected entrance wound with clear lens. (B) Orbital CT scan revealed intraorbital air and one high-density foreign body in the nasal upper orbit. (C) Skull routine scan showed one metallic foreign body in the nasal upper orbit (solid arrow).

vitreous hemorrhage (VH) with a whitish patch nasal to the optic disc was noted. Orbital computed tomography (CT) scan showed intraocular and intraorbital air. One high-density foreign body was found on the posterior nasal upper orbit (Fig. 1B). Skull X-ray confirmed one 2.3×3.6 mm metallic foreign body on the nasal upper orbit (Fig. 1C). B-scan sonography revealed several high-density signals (vitreal opacity) without acoustic shadow in the left eye. Double-penetrating ocular injury with retained intraorbital foreign body in the left eye was impressed and immediate vitrectomy was performed. Intra-operatively, the entrance scleral wound was found at 9 o'clock location (1.4 mm in length, 4 mm from the limbus). There was dense vitreous and pre-retinal hemorrhage. The full-thickness scleral exit wound surrounded by avulsed retina hole margin nasal to the optic disc was also noted. The exit wound was at the corresponding location of the entrance wound, compatible with the diagnosis of perforating globe injury. During vitrectomy, iatrogenic posterior vitreal detachment was induced from disc margin and the adherent cortical vitreous was carefully separated from the exit wound. Intraocular laser photocoagulation around the retinal hole at the exit wound (Fig. 2) and cryopexy over the entrance wound were applied. Intravitreal injection of antibiotics (vancomycin 1 mg/0.1 mL and ceftazidime 2 mg/0.1 mL) was performed after collecting vitreous specimens for microorganism culture. The initial topical antibiotics instillation was 2.5% vancomycin every two hours alternating with 5% ceftazidime eye

drops. The microbiologic culture of vitreous disclosed a negative finding one week later. The patient's BCVA recovered to 6/12 one week postoperatively, and 6/8.6 at 20-month follow-up. The serial electroretinography (ERG) and electrooculogram study showed no flattening response on ERG and improved Arden ratio (reference data: 180%) in the left eye during the regular follow-up period (Table 1).

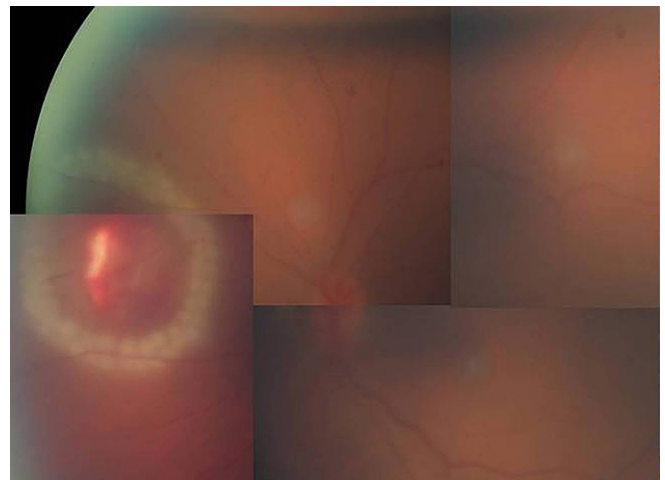


Fig. 2. Post-operative fundus picture showed attached retina and the scleral exit wound surrounded by laser photocoagulation spots.

Table 1
Post-trauma electrophysiological examinations.

	Electroretinography						Electrooculogram		
	Cone cell response wave ^a (μm)						Arden ratio (%)		
	1 mo		3 mo		9 mo		1 mo	3 mo	9 mo
	A	B	A	B	A	B			
OD	245	329	195	286	210	342	169	182	170
OS	232	329	162	271	176	361	135	137	157

OD = oculus dexter, right eye; OS = oculus sinister, left eye.

^a Under single-flash condition (photopic electroretinography).

3. Discussion

The incidence of open globe injury is about 3.6 to 3.8 per 100,000 population annually around the world.^{2–4} According to the Birmingham Eye Trauma Terminology System,⁵ open globe injury can be classified into laceration and rupture injury due to different mechanisms. For laceration injury, if the entrance and exit wound exist at the same time and are caused by the same agent it is regarded as a double-penetrating globe injury or perforating injury. If only one entrance wound is noted without exit, it is defined as a penetrating injury. There are two peaks of incidence, one in young adults and the other in the elderly over age 70 years. There is a strong preponderance for open globe injuries to affect the male gender. This may reflect the more aggressive characteristics of male behavior.³

The perforations often occur at the weak points of the globe, such as the limbus and insertion area of the extraocular muscle, and most of them (70%) are located anterior to the ora serrata.¹⁶ Endophthalmitis occurs in 2–7% of patients with penetrating injuries and the incidence increases to 7–31% if intraocular foreign body (IOFB) exists.¹⁶

There are several predictive factors relative to the poor prognosis of final visual acuity, including poor presenting BCVA, positive relative afferent pupillary defect, old age, blunt injury with eyeball rupture, more posterior injury site, lid laceration, lens damage, VH and IOFB.^{6,7} In our patient, the poor predictive factors included poor presenting BCVA, old age and VH. In this case, however, as the exit wound was nasal to the disc, far from the posterior pole, and there was no IOFB or disorganized ocular tissue, the final visual outcome was good. Prompt preoperative evaluation and meticulous vitrectomy intervention also contributed to the good final anatomical and visual outcome in this case.

The standard practice for open globe injury is to undertake primary surgical repair to restore the structural integrity of the globe, resolve hypotony and recreate the barrier against infection at the earliest opportunity. Only when the injury is beyond primary repair is enucleation considered. If double-penetrating injury happens, the posterior exit wound is often left to heal spontaneously without surgical intervention. Experimental animal studies have shown that the scleral wounds are closed with fibrosis by day seven after injury.⁸ Aggressive manipulation may cause further hemorrhage and uvea prolapse.

Plain radiography, ultrasonography examination and orbital CT scan can provide adequate information to evaluate the location of intraorbital foreign body (IOFB), the presence of IOFB, choroidal hemorrhage and ocular integrity. In the animal model developed by Cleary and Ryan,⁹ intraocular blood could create posterior vitreous detachment one week after artificial penetrating injury, and proliferation of cells on the retinal surface and vitreous may induce tractional retinal detachment six weeks later. Performing vitrectomy is suggested within 14 days after injury.⁹ Although there was no IOFB noted under ultrasound examination and CT scan in our patient, VH and a possible exit wound could be seen by indirect ophthalmoscope. Immediate primary repair and vitrectomy were therefore carried out at the same time in our patient to clean the opacified media, seal the retinal hole and check out any possible IOFB.

With the management of IOFB, the optimal management of retained intraorbital metallic foreign bodies remains controversial.¹⁰ The size, composition, location and the complications caused by the foreign bodies may influence the subsequent decision to remove them.^{11–13} Posteriorly located IOFBs have an increased risk of motility disturbance or optic neuropathy after surgical removal; conversely, anteriorly located IOFBs are more easily removed. Therefore, when the foreign body is organic or it causes ocular complication, surgical intervention is indicated. If it is inorganic and anteriorly located without ocular complications, the surgical options regarding whether or not to remove the foreign body can be discussed with the patient. In our case, the IOFB was posteriorly located, away from the optic nerve, and did not interfere with the extraocular muscle. This posteriorly located intraorbital metallic foreign body was managed conservatively. Surgical removal is only indicated when it causes significant orbital complications, such as neurological compromise, mechanical restriction of ocular movements, acute or chronic inflammation or infection.¹⁴ Regular ERG follow-up is, however, necessary. In the literature, retained intraocular copper and iron have been noted to diminish the ERG response, such as a progressive decrease in b-wave amplitude with relative preservation of a-wave response.^{15,16} Serial ERG study is therefore valuable in the early detection of retinal damage and can be used to monitor the retinal photoreceptor dysfunction during long-term follow-up.

In conclusion, the posteriorly located intraorbital metallic foreign body should be managed conservatively. In our case, the retained intraorbital metallic foreign body was well-tolerated without adverse effect during 20-month follow-up.

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