

# Clinical Features of Perforating Eye Injuries Complicated with Intraocular Foreign Bodies Located at the Posterior Global Wall

Zufeng Huang<sup>1</sup>, Linxing Chen<sup>2\*</sup>, Yingyu Zeng<sup>3</sup>, Caimei Lin<sup>4</sup>

<sup>1</sup> Central People's Hospital of Zhanjiang, Zhanjiang 524000, China

<sup>2</sup> Zhongshan Ophthalmic Center, Sun Yat-sen University, Guangzhou 510060, China

<sup>3</sup> The First Affiliated Hospital, Sun Yat-sen University, Guangzhou 510080, China

<sup>4</sup> Leizhou Women and Children Hospital, Zhanjiang 524000, China

## Abstract

**Purpose:** To investigate the clinical characteristics and therapeutic effects of vitrectomy in patients with perforating eye injuries with foreign bodies at the exit wound in the posterior global wall.

**Methods:** Fifty-two cases, diagnosed with perforating eye injury with foreign bodies at the exit of the posterior global wall and admitted to our hospital between June 2010 and June 2013, were enrolled in this study. All patients underwent vitrectomy and removal of intraocular foreign bodies and were followed up for 6 to 24 months. The causes of injuries were analyzed and postoperative visual acuity and overall treatment efficacy were evaluated.

**Results:** Intraocular foreign bodies were successfully removed in all cases. The incidence of postoperative complication was low. Among 52 subjects, 46 showed alleviated symptoms after treatment with an overall efficacy of 88.46%.

**Conclusion:** Perforating eye injuries combined with residual foreign bodies in the posterior global wall are commonly observed in young people who perform physical labor. Vitrectomy has a high efficacy for the treatment of perforating eye injuries complicated with foreign bodies located at the posterior global wall, with a low incidence of postoperative complications. (*Eye Science* 2013; 28:180–184)

**Keywords:** perforating eye injury; clinical features; intraocular foreign body

Perforating eye injury complicated with foreign bodies located in the posterior global wall is an

acute and severe ocular trauma. It is characterized as perforating eye injuries caused by sharp tools, affecting both anterior segment and posterior wall. It is extremely challenging to treat patients with foreign bodies located at the exit of the posterior global wall, so these patients often have poor prognosis<sup>1</sup>. Perforating eye injury mainly arises from the invasion of foreign bodies into eyes, thereby differing from common intraocular injuries. Much attention should be placed on pain management of perforating eye injuries. Traditional sclerotomy effectively removes intraocular foreign bodies but fails to treat vitreous hemorrhage and epiretinal proliferation. The development of vitrectomy now provides more options for removing intraocular foreign bodies. In this clinical trial, a total of 52 patients with perforating eye injury complicated with foreign bodies in the posterior global wall underwent vitrectomy in our hospital between June 2010 and June 2013. Here, the efficacy of removing foreign bodies by vitrectomy was reported as below.

## Materials and methods

### General data

Among all 52 patients, 37 (71.15%) were male and 15 (28.85%) female with a sex ratio of 2.47: 1. The patients aged between 15 to 52 years, ( $34.1 \pm 5.9$ ) years on average. Male patients aged between 15 to 51 years, ( $30.2 \pm 5.6$ ) years on average, 19 aged 15 to 25 years, 10 aged 25 to 40 years and 8 aged above 40 years. For female counterparts, age ranged from 17 to 52 years, ( $33.8 \pm 6.6$ ) years on average, 8 cases of 17 to 25 years, 6 aged 26 to 40 years

and 1 aged older than 40 years. A total of 31 patients were treated in our hospital within 24 h after injuries, 11 within 24–48 h and 5 within 48–72 h. The remaining 5 patients were transferred to our hospital at 5–7 d after receiving stage I wound sutures.

**Eye examinations**

All patients underwent slit-lamp microscope and vitreous examination using preset lens. All cases had unilateral injuries (52 eyes including 32 right and 20 left eyes). Preoperative visual acuity was shown in Table 2. The causes of ocular injuries were illustrated in Table 1.

**Table 1** Features of intraocular foreign bodies (n denotes number of eyes)

Sources of injuries	Number of eyes	Percentage (%)	Occupational injuries/accident
Metal shavings	21	40.38	17/4
Nails	10	19.23	10/0
Glass shard	9	17.31	6/4
Wood shavings	5	9.62	5/1
Car accidents	2	3.85	1/4
Fireworks	5	9.62	3/2

**Surgical approach**

Eight patients were admitted to our hospital within 24 h post-injury and presented with pyogenic endophthalmitis upon admission. They received vitrectomy to remove intraocular foreign bodies and then treated with gas-fluid exchange, use of heavy water, endolaser, scleral condensation, silicon oil filling and scleral buckling. Those who were hospitalized relatively late could receive corneoscleral wound sutures, suture adjustment, or removal of ocular surface foreign bodies. Systemic and topical antibiotic treatments were conducted simultaneously. At 1 week after hospitalization, they underwent surgical treatment. Preoperative examinations: The foreign bodies were located by X-ray. The surgical method was determined by CT combined with B-ultrasound examinations. Patients underwent conventional three-channel vitrectomy, avoiding the original wounds. Cen-

tral vitreous opacity and vitreous hemorrhage were radically removed. Posterior vitreous cortex was completely separated to identify the position of foreign bodies and prevent photocoagulation. Intraocular foreign bodies were removed and then gas–fluid exchange, endolaser and condensation were performed. Seven cases were injected with inertia gas and 21 with silicon oil. For six patients with retinal detachment, the foreign bodies were removed after vitrectomy. Then, gas-fluid exchange, endolaser or condensation was performed. Inertia gas C3F8 or silicon oil was injected in one case and silicon oil in five patients depending upon actual situations. The patients were kept in prone position postoperatively. Systemic antibiotics therapy was given for 14 d. For patients presenting with severe postoperative reactions, subconjunctival injection of vancomycin and dexamethasone was administered. For those with endophthalmitis, the selection of drugs was adjusted according to the outcomes of in vitro drug sensitivity experiment. The anterior segment and fundus were observed on a regular basis<sup>6</sup>. The patients orally took antibiotics for 1 week and used topical hormone-containing eye drops and cornea nurturing eye drops. The silicon oil was removed at 3–12 months postoperatively. The follow up lasted for 6 to 24 months.

**Evaluation criteria**

Preoperative and postoperative visual acuities were statistically compared. Patients were divided into three categories according to their visual acuities, visual acuity <0.05 was defined as blindness, 0.05< visual acuity <0.3 and visual acuity >0.3 (low vision). Normal visual acuity was deemed as recovery; visual acuity recovery with postoperative complications was defined as efficacious; wound healing while failure of visual acuity recovery was slightly efficacious and no visual improvement and loss of eyeballs was inefficacious. The overall efficacious rate=recovery rate + efficacious rate + slightly efficacious rate<sup>7</sup>.

**Table 2** Comparison of preoperative and postoperative visual acuities (52 eyes)

Visual acuity	No light perception	<0.05	0.05–0.3	>0.3	Recovery	Slightly efficacious	Efficacious	Inefficacious	Efficacious rate
Preoperative visual acuity	15	12	16	9					
Postoperative visual acuity	2	10	25	15	4	17	25	6	88.46%

**Table 3** Summary of postoperative complications (n denotes number of eyes)

Complications	Number of eyes	Incidence	Treatment
Retinal detachment	6	11.54%	Retinal detachment surgery
Chamber hyphema	7	13.46%	mydriasis and steroid medication
IOP elevation	4	7.69%	anti-glaucoma medication and others
IOP reduction	2	3.85%	trabeculectomy
Anterior chamber hyphema	5	9.62%	anterior chamber irrigation

## Results

### Postoperative recovery of visual acuity

In 52 patients, intraocular foreign bodies were completely removed with a success rate up to 100%. No incidence of endophthalmitis was observed in all 52 patients, 38 among whom were injected with silicon oil and 14 with inertia gas. In 52 patients, seven eyes had retinal hemorrhage, 22 retinal breaks, 6 presenting with retinal injury and hemorrhage when removing foreign bodies, 2 containing foreign bodies with a diameter > 9 mm and showing lens injury in the process of foreign body removal and then subject to lens excision. All patients were subjected to 6–24 months follow-up. Preoperative and postoperative visual acuities were statistically compared. Different degrees of visual acuity recovery were observed in 35 eyes, as shown in Table 2.

### Complications

Intraoperative complications: 5 cases had hemorrhage and 6 presented with retinal vessel hemorrhage resulting from the detachment of foreign bodies; these patients were treated with elevated perfusion and underwater electrocoagulation, *etc.* These symptoms did not affect the treatment efficacy. No incidence of endophthalmitis was observed postoperatively. Hyphema and mild opacity of aqueous humor were observed in 7 eyes, which were absorbed after mydriasis and steroid medication therapies. Postoperative retinal detachment was seen in 6 eyes and was properly restored after two surgeries. Elevated intraocular pressure was observed in 4 eyes. Normal intraocular pressure was regained in 1 eye after intraocular gas absorption, in 2 after anti-glaucoma medication therapy, and in 1 after postoperative removal of silicon oil. Two cases had decreased intraocular pressure and hyphema in 5 eyes. The management and treatment of different complications are

illustrated in Table 3.

## Discussion

Perforating eye injury is a severe and complicated type of ocular trauma, generally resulting from sudden and strong impact from blunt tools. The external impact is strong enough to cause posterior injuries involving the optic nerve, the macula, and large retinal vessel and to lead to destruction of eye function. Postoperative complications include inflammation, and chemical and toxic injuries induced by intraocular foreign bodies<sup>2</sup>. Perforating eye injury is likely to cause residual foreign bodies in the posterior globe wall, probably leading to endophthalmitis, optic nerve injury, and serious damage to patients' visual acuity<sup>8</sup>.

Perforating eye injury complicated with foreign bodies in posterior globe wall is predominantly seen in the male population, and is the primary factor of visual loss, especially in the young population<sup>3</sup>. The findings in this investigation confirmed that 88.46% of visual defects results from occupational injuries. Visual defects can severely influence the patient's work and daily life and increase social burden. Consequently, elevating awareness of work safety, propaganda, and improving protection measures for daily work can contribute to the prevention of visual defects. Among the 52 patients, 27 (51.92%) were aged below 25 years. Young individuals have the highest risk of perforating eye injuries due to a variety of factors. Hence, physicians should attempt to decrease the incidence of ocular damage during the treatment to guarantee their normal work and daily life. The purpose of the surgical approach is not only to remove intraocular foreign bodies, but also to reduce the incidence of secondary injuries caused by surgery. The recovery of visual acuity is the primary goal.

The posterior globe wall injuries typically involve multiple ocular structures. Timely removal of intraocular foreign bodies is of great importance for alleviating ocular damage and preventing the incidence of postoperative complications<sup>5</sup>. Removal of intraocular foreign bodies aims to promote visual recovery rather than simply removing foreign bodies. Consequently, how to properly handle intraocular foreign bodies and establish surgical design depends upon patients' injury history, properties of foreign bodies, ocular condition and the position of foreign bodies. The traditional technique of removing intraocular foreign body via a scleral incision makes it difficult to precisely locate the position of foreign bodies and fully expose the posterior globe wall. Hence, it is not applicable for the removal of foreign bodies at the posterior globe wall. Moreover, it fails to properly treat postoperative complications, such as retinal incarceration, lens opacity, vitreous hemorrhage and proliferative vitreoretinopathy. Compared with the traditional method, vitrectomy presents with the following advantages. First, antibiotics are supplemented into the perfusion fluid to prevent infection, opaque refractive media and inflammatory factors are thoroughly removed, and conditions are provided for the removal of intraocular foreign body under direct vision and visual acuity recovery. Second, it is unnecessary to make new incisions for removing different foreign bodies. It is not affected by the properties of the foreign bodies, yields mild surgical injuries, and effectively restores visual function. Third, it is more convenient to prevent or treat complications, such as vitreous hemorrhage or tractional retinal detachment induced by fibroproliferation, and even simpler to treat the retina compared with other techniques<sup>4</sup>. In this study, intraocular foreign bodies have been successfully removed by this surgical method, which is efficacious for alleviating the severity of diseases and psychological problems<sup>9</sup>. In total, 46 patients had improved visual acuity postoperatively for an overall efficacy rate of 88.46%.

Besides the removal of intraocular foreign bodies, postoperative complications should be equally treated. Retinal detachment is a common complication caused by foreign bodies at the posterior global

wall, resulting from a variety of factors, such as iatrogenic retinal breaks, traction of retinal breaks, missing retinal breaks, and proliferative vitreoretinopathy. After vitrectomy, retinal detachment is likely to occur due to the lack of vitreous support<sup>10</sup>. The retinal detachment should be immediately handled to prevent the incidence of funnel-shaped retinal detachment. Different measures, including scleral condensation, scleral compression, inertia gas filling, repeated vitrectomy, membrane separation and silicon oil filling, can be chosen according to each patient's actual situation to gain satisfactory efficacy.

Six cases had retinal restoration. In addition, postoperative complications including elevated and decreased intraocular pressure were also observed with a low overall incidence. These symptoms were properly treated by corresponding approaches. To sum up, all participants had better postoperative visual acuity and the overall treatment efficacy achieved up to 88.46%. vitrectomy is safe and efficacious for treatment of perforating ocular injuries complicated with foreign bodies at the posterior global wall.

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