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Case Report

Comparison of Two Cases of Foveal Laceration Caused by a Mower

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Keywords
Open globe injury · Foveal laceration · Proliferative vitreoretinopathy

Abstract
We report and compare 2 cases of open globe injury with foveal damage incurred while mowing. Case 1 is a healthy 67-year-old man presenting with an intraocular metallic foreign body and eye pain in his right eye after using a mower. The foreign body perforated the cornea's inferior area and damaged the foveal centralis, leading to central scotoma and decreased visual acuity. 27G pars plana vitrectomy was performed, and the final corrected decimal visual acuity was 0.1, but the visual field was preserved, except for the central scotoma. Case 2 is a healthy 50-year-old man presenting open globe injury with an intraocular metallic foreign body while using a mower. The foreign body damaged the fovea and triggered extensive retinal detachment. One month after surgery, proliferative vitreoretinopathy occurred, requiring additional surgery. The final corrected decimal visual acuity dropped to 0.05, resulting in an extensive visual field defect. Both cases of eye trauma were caused by mower injury, but the visual function outcomes differed with the size of the foreign body and the injury severity at the time of onset. Mower eye trauma is preventable, and efforts to educate users on safety measures are needed.

Introduction

There have been several eye trauma epidemiological studies worldwide, and multiple factors influence the degree and prognosis of ocular trauma. In Japan, a nationwide survey of ocular globe injuries (OGIs) showed that most were work-related accidents and >70%

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occurred in male individuals [1]. The same group reported that visual function was generally worse, and the poorest prognosis was associated with eye rupture following a fall [1]. Thus, external and internal factors determine visual function prognosis in eye trauma. External factors include the environment in which injury occurs, the background and history of the injury, and the location and objects leading to the injury. Internal factors include medical history, especially a history of ocular surgery. In the most severe cases, the eyeball morphology cannot be maintained, leading to phthisis requiring enucleation. In the mildest cases, recovery proceeds with almost no effect on visual function. Even in cases in which the morphology of the eye is maintained, damage to the visual pathway, such as injury from the central cornea to the optic nerve through the macula, also causes the most severe visual dysfunction. Cases ranging from corneal perforation to bullous keratopathy, macula injury, or macula-off retinal detachment and traumatic optic neuropathy significantly affect visual function. Since patients often turn their faces or close their eyes at the moment of injury, trauma from the pupillary area to the center of the macula is relatively infrequent. Here, we report 2 cases in which a foreign body entered the eye and pierced the fovea centralis, resulting in decreased visual acuity and central scotoma. We compare the injuries and the changes in visual function in both cases.

Case Presentation

Case 1

A healthy 67-year-old man presented with sudden decreased visual acuity and eye pain in his right eye. While mowing, immediately after removing his goggles, the man was hit in the right eye with a foreign object, which led to a visual defect.

On admission, he described light perception in his right eye. The conjunctiva was markedly hyperemic and edematous, and the cornea had perforated wounds at 7 o'clock. There was no aqueous humor leakage from the wound, and the anterior chamber depth was maintained (Fig. 1A). The perforated wound was continuous with the lens, and behind the lens, a metallic foreign body was visible but could not be visualized. The foreign body was found on B-mode imaging and CT (Fig. 1B). The condition of his fundus, including retinal detachment, was also confirmed. A 27G pars plana vitrectomy was performed, and the fundus findings were confirmed. Vitreous hemorrhage and scars in the fovea and inferior retina were attributed to the collision with the foreign body. A small piece of metal (3.9 × 2.8 mm) was found in the lower retina and was removed (Fig. 1C). The metal-perforated lens and vitreous hemorrhage were resected.

The inflammatory findings gradually improved, and no complications were observed. Six months after the operation, an intraocular lens suture was performed (Fig. 1D), and the final decimal visual acuity was 0.1. The retina in the macula atrophied, and a central scotoma remained (Fig. 1E), but the peripheral visual field was intact (Fig. 1F).

Case 2

A healthy 50-year-old man visited the emergency department owing to sudden vision loss in his left eye. He complained that a foreign object had entered his left eye while using a mower at his home. He reported not wearing goggles while mowing. Visual acuity was 30 cm/HM. Examination revealed marked conjunctival hyperemia and edema in his left eye, and a perforated corneal scar was detected at 7 o'clock (Fig. 2A). No aqueous humor leakage was found. The anterior chamber was filled with hemorrhage, and the fundus could not be seen. B-mode imaging showed a foreign body with acoustic shadow, and CT images also revealed the foreign findings suspected to be metal fragments in the left eye (Fig. 2B).

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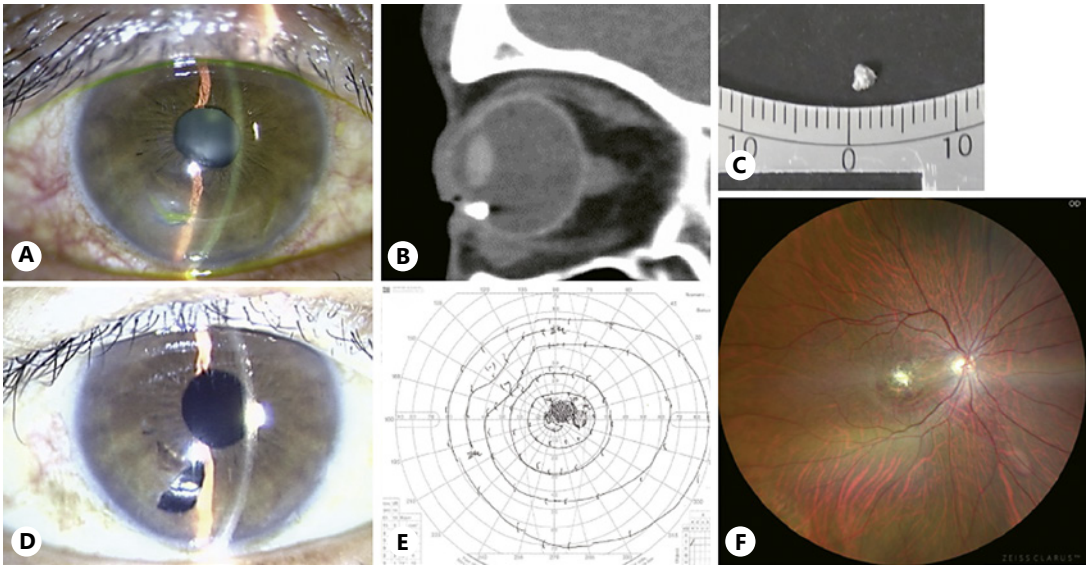

Fig. 1. Clinical findings before and after surgery in case 1. **A** Anterior segments immediately after injury. The anterior chamber was relatively clear, and the sharp metallic foreign body (~3 mm, **C**) was directly under the lens (**B**). After intraocular lens suture lysis, the IOL was fixed in the posterior chamber (**D**). Only the retina's fovea centralis was atrophied, and the visual field was maintained, except for the central scotoma (**E**, **F**).

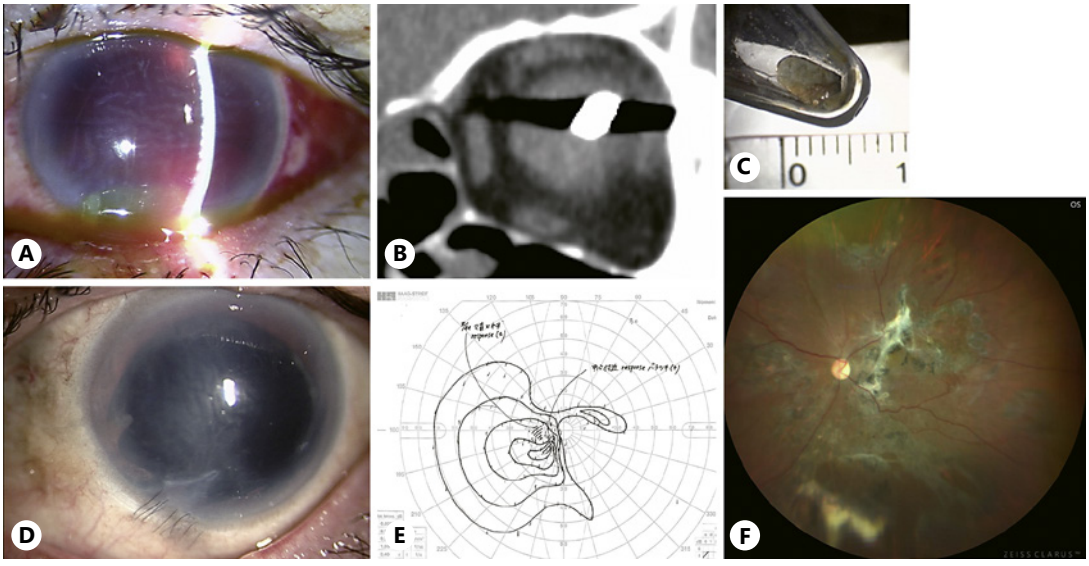

Fig. 2. Clinical findings before and after surgery in case 2. **A** The anterior chamber was maintained but filled with coagula, and the metal piece stayed in the center of the vitreous body (**B**, **C**). After the PPV for PVR, corneal opacity and iris defects remained (**D**), and an extensive visual field defect developed consistent with chorioretinal atrophy (**E**, **F**). PPV, pars plana vitrectomy;PVR, proliferative vitreoretinopathy.

A 27G pars plana vitrectomy was performed, and extensive retinal detachment, including the macula and temporal retinal field, was observed in the fundus. A metal fragment 8.1 × 5.7 mm was found in the lower retina and removed (Fig. 2C). Retinal repositioning was performed after filling the eye with 20% SF6 gas. However, a proliferative membrane gradually formed, proliferative vitreoretinopathy occurred 1 month after the operation, requiring additional

intervention. The proliferative membrane was removed, laser photocoagulation was performed, and the eye was filled again with 20% SF6 gas. Six months after the operation, the condition became stable. The latest decimal visual acuity was 0.05, showing extensive visual field defects from the central to the nasal visual field (Fig. 2D–F).

Discussion

Open globe injury is classified as rupture or laceration, based on the Birmingham Eye Trauma Terminology trauma classification [2]. The rupture type is defined as inside-out trauma caused by an increase in intraocular pressure, whereas damage to the eye caused by an external object is defined as a laceration or outside-in type of injury.

A laceration is classified by whether the foreign substance has damaged the eyewall, penetrated the eye, or remained in the eye and defined as penetration, perforation, or intraocular foreign body. Both laceration cases here are classified as intraocular foreign bodies.

Fortunately, in both cases, the wound was relatively sharp, and the perforated area was closed. The eyeball did not collapse, thus avoiding lethal deterioration of visual function. Perforating speed of the foreign body is also an essential factor in determining OGI severity. Although there are no reports about the foreign body's collision energy, it is predicted that the foreign body will penetrate the eye when the foreign body reaches the eyeball at high speed. If the foreign body pops out behind the eyeball, surgical treatment will be difficult, and the visual function prognosis will worsen. In our cases, the foreign body remained in the eye, which helped secure the visual function.

Both injuries occurred while the patients were using a mower. A mower is characterized by a circular cutter attached to the tip of a long handle called a shaft rod, and an engine rotates the blade at high speed. Mowers are widely used in ordinary households because they are efficient in mowing grass quickly. Eye injuries caused by mowers typically occur when the machine hits stones, metals, or plastics or when the mower blade is chipped. Because of this risk, instruction manuals advise users to always wear safety goggles while mowing and only remove the goggles after the engine has completely stopped.

In both cases presented here, the metal pieces that caused the optic trauma seemed to be parts of the mower blade and both stabbed into the fovea centralis, resulting in marled marked visual loss and scotoma. In the first case, after mowing and turning off the switch, the injury occurred the moment the goggles were removed before the mower stopped. In the latter case, the patient did not use goggles when using the machine. Mower-induced trauma is relatively uncommon and often has very serious outcome, but most eye traumas can be avoided by wearing goggles, that is, injuries can be prevented by the patients themselves using the machine correctly.

Although visual acuity deteriorated in the first case, the visual field defect was limited to a very narrow area in the central visual field. In the second case, the visual field defect occurred in > half of the visual field because of extensive retinal detachment, including the fovea. The metal pieces' shape determined the trauma magnitude. In the first case, the piece had a sharp triangular shape, whereas the foreign body in the second case was a large quadrangle with rounded corners, causing more significant damage. The second case also experienced extensive retinal detachment and proliferative vitreoretinopathy after the initial operation. Thus, the residual visual function in this case was worse than that in the first case.

Poor visual function prognosis (defined as 1.3 < logMAR visual acuity) due to foreign bodies in the eye is associated with age (>50 years), low visual acuity before treatment,

retinal break, endophthalmitis, vitreous surgery, and intraoperative C3F8 gas tamponade use [3]. There was no reported link between foreign body size and visual function prognosis, although wounds <4 mm are associated with improved visual function prognosis. In the case of eye injury caused by the entry of a foreign substance, the wound is at least equal to the foreign substance diameter. Therefore, if the foreign substance is <4 mm, the visual function prognosis is considered good. Intraocular foreign body, intraocular hemorrhage, and preoperative retinal detachment were also reported as prognostic factors [4]. Another study revealed the dimension of the intraocular foreign body is correlated with final visual acuity [5].

In the second case, almost all of these factors associated with poor visual function prognosis applied to the patient outcome: age, preoperative visual acuity (hand motion), intraocular hemorrhage, gas tamponade, retinal detachment, vitreous surgery, and foreign body size (length >4 mm). It is also characteristic that in both cases, the foreign body entered from the lower corneal limbus. Since the foreign body penetrated diagonally, it was easy to close the wound, and because the cornea center's clarity was maintained, fundus visibility during surgery was ensured. However, it can also be interpreted that the foreign body pierces the macula at an angle and reaches the macula, causing the prognosis of visual function to deteriorate compared to the findings of the anterior eye segment.

Conclusion

We reported 2 cases of OGI with foveal injury. The cause was the same in both cases, but the final visual function was different because of the various factors associated with the trauma. Also, mower eye trauma is preventable by educating users on the safe use of machines.

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Statement of Ethics

This work has been performed according to the World Medical Association Declaration of Helsinki. All patients have given informed consent to publish the cases, and written informed consent was obtained from patients for publication of this case report. In addition, the need for approval for the case report was waived by Kobe University Hospital Clinical and Translational Research Center.

Conflict of Interest Statement

The following authors have no financial disclosures: K.U., T.N., A.C., Y.S., R.N., and M.N.

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Author Contributions

K.U. conceptualized the study, curated the data, and wrote the manuscript. T.N. reviewed and edited the manuscript. K.U., A.C., Y.S., R.N., and T.N. examined the patients. M.N. supervised the cases.

Data Availability Statement

All data generated or analyzed during this study are included in this article. Further inquiries can be directed to the corresponding author.

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