

Review Paper

# Eye Foreign Body Injuries: Epidemiology, Clinical Challenges, and Protective Interventions

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## Abstract

Eye foreign body injuries are among the most common ophthalmic emergencies and remain a significant cause of preventable visual morbidity worldwide. These injuries occur when external materials such as metal fragments, glass, dust, wood, or plant matter come into contact with or penetrate the ocular structures. While superficial foreign bodies often cause minor discomfort and can be managed effectively, deeper or intraocular foreign bodies may lead to severe complications, including corneal scarring, infection, retinal detachment, endophthalmitis, and permanent visual loss. This review aims to provide a comprehensive overview of ocular foreign body injuries, focusing on their classification, epidemiology, risk factors, clinical presentation, diagnostic evaluation, management strategies, complications, and preventive interventions. Foreign bodies are classified based on anatomical location, composition, and mechanism of injury, with occupational exposure being a major risk factor, particularly among young adult males working in construction, welding, and industrial settings. Early diagnosis through detailed patient history, slit-lamp examination, fluorescein staining, and advanced imaging techniques such as CT and ultrasonography plays a crucial role in preventing vision-threatening complications. Management depends on the type, location, and severity of injury, ranging from simple surface removal to urgent surgical intervention for intraocular cases. Preventive strategies, including protective eyewear, workplace safety measures, and public awareness programs, remain essential in reducing the burden of ocular foreign body injuries. Timely intervention and multidisciplinary care are key to improving visual outcomes and preserving ocular health.

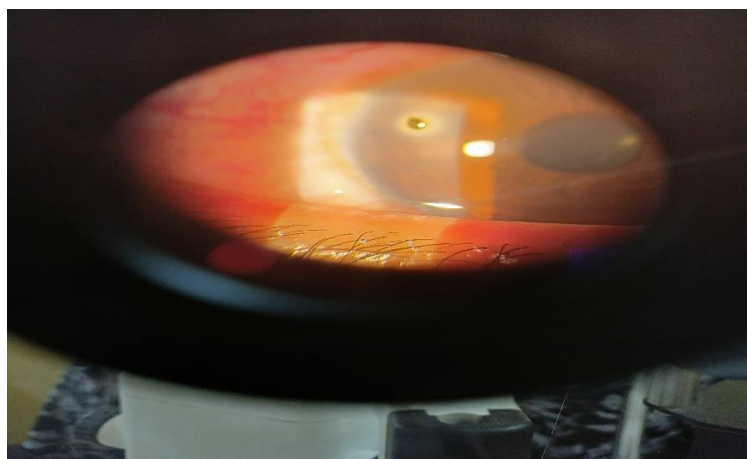
**Keywords:** Eye foreign body, injuries, corneal foreign body, penetrating injury, Ruptured globe

## Introduction

Foreign bodies stuck in the eye show up often in emergency clinics, causing avoidable vision problems across the globe, as shown in figure1. When bits like metal shards, splinters, broken glass, rock dust, or plant material get trapped on the eye's surface or poke into it, trouble follows. Some cases barely scratch the outer layer. Others move deep inside the eyeball, endangering lasting sight damage unless spotted fast and handled right away <sup>1,2</sup>.

One of the most common eye injuries involves foreign objects, especially common in jobs like welding or construction. People working with metal or heavy machinery has higher at risks. Men in early adulthood show up more in injury reports - likely tied to job demands and skipping safety goggles <sup>3,4</sup>. Corneal foreign bodies account for the majority of ocular foreign body injuries, whereas intraocular foreign bodies are less common but are associated with more severe visual complications. Occupational corneal foreign body injuries continue to represent a major cause of emergency eye care visits<sup>5,6,7</sup>. When something lands on the surface of the eye, quick removal often solves the problem. Trouble starts if the object slips inside the eyeball itself. That kind of damage brings serious issues: infections deep inside the eye, bleeding in the gel-like centre, tears in the retina, even losing sight. Doctors watch these cases closely - they're harder to treat and carry bigger dangers <sup>8,9</sup>.

Taking precautions like wearing proper eyewear and following job site safety measures helps in spreading public awareness to reduce the risk <sup>10</sup>. Even with better tools like slit-lamp exams, AS-OCT scans, CT imaging, and eye ultrasounds spotting foreign objects faster, leading to quicker care and stronger sight results <sup>11,12</sup>, the real win still lies in stopping harm before it happens.



**Figure1:** Slit-lamp biomicroscopic image demonstrating a corneal foreign body embedded in the corneal surface during anterior segment examination.

**Source:** Authors' own clinical photograph

### **Classification of Eye Foreign Bodies**

Most eye foreign objects get sorted by where they sit in the eye, what they're made of, or how they got there - since each detail shapes how doctors respond and how well vision recovers later <sup>1</sup>.

#### **Anatomical Classification**

Depending on where they settle, eye foreign bodies fall into two types: surface-level or inside the eyeball. Sitting on the outer part, these specks affect either the clear front layer or the thin membrane covering the white, often coming out without much trouble. When something gets deeper, breaching the eye's main structure, it might travel through the front space, hit the lens, drift into the gel centre, or reach the back lining. That kind of intrusion raises danger - possible internal infection, a torn light-sensing sheet, or lasting sight damage <sup>5,6</sup>.

#### **Classification Based on Composition**

Though tiny, metal bits like iron or copper show up often where people work. Glass, wood, plastic, stone - that count too, just without metal inside. A splinter of wood or leftover plant matter might bring germs more easily than a shard of steel would. While rusting iron can poison tissue slowly over time, certain metals leave harmful traces when they stay put. Infections tend to follow organic specks; heavy elements do different damage. Each type behaves unlike the others once under the skin <sup>5,6</sup>.

### **Classification Based on Mechanism of Injury**

From how the harm happens, eye injuries with foreign objects can come from fast or slow impacts. When things move quickly - like during welding or grinding - the damage often pushes deeper, leaving bits behind inside the eye. Slower accidents tend to trap surface-level debris, such as specks of dust, grains of sand, or pieces from plants.

### **Epidemiology of Eye Foreign Body Injuries**

Eye foreign body injuries are really common. Can cause a lot of problems with our vision. They are a reason why people visit the emergency room for eye problems<sup>3,4</sup>. Most of the time, the foreign body is in the cornea. Sometimes it can get inside the eye, which is more serious and can cause bigger problems with our vision. The kind of thing that gets in our eye depends on how the injury happened. At work, it is usually a piece of metal that gets in our eyes. If we are working outside, like on a farm, it might be a piece of wood or a leaf that gets in our eye. This can be more serious because it can cause an infection <sup>5,6</sup>. A lot of men, especially those between 20 and 40 years old, get eye foreign body injuries. This is because they often work in jobs that involve labour, like construction or welding. People who work in these jobs are at risk of getting hurt by small pieces of metal. Intraocular foreign bodies are associated with a higher risk of serious complications such as vitreous haemorrhage, retinal detachment, endophthalmitis, and permanent visual loss if not managed promptly <sup>8,9</sup>. Not wearing eyewear is also a big reason why people get hurt on the job. Even though we have gotten better at keeping people safe at work, eye foreign body injuries are still a problem, especially in countries where people do not have access to good healthcare and are not aware of the dangers. Eye foreign body injuries are a concern for eye foreign body injuries<sup>10</sup>.

### **Risk Factors**

- Out there among crops, digging soil or chopping trees - watch how splinters fly. A tiny bit of bark or leaf might poke the eye, and then swelling starts fast. Sometimes it turns worse without warning <sup>5,6</sup>.
- Occupational exposure, particularly among construction workers, welders, and metal industry workers, is one of the major risk factors for eye foreign body injuries because of frequent exposure to high-velocity metallic particles <sup>7</sup>.
- Something stuck in your eye could lead to trouble later unless help is found quickly. Without visiting a medical professional, vision may slowly fade or discomfort grows stronger over time. Infections sometimes start small but become serious when ignored too long <sup>8,9</sup>.
- Jobs or daily habits might expose you to tiny bits flying into your eyes. Location matters, sure, but routine choices play a part too. Living near dusty roads? That counts. Swinging a hammer without shielding? Risk climbs. Even grinding metal at home adds up. Some tasks

just stir more trouble than others. Protection slips aside, it is these normal moments piling on chances <sup>10</sup>.

- Older folks face fewer risks, yet young males see more harm. Workers aged twenty to forty suffer most, simply due to risky tasks on duty. Jobs involving force or speed tend to affect this group the strongest - simply put, their roles carry higher stakes <sup>10</sup>.
- Eye protection skipped? That opens the door to trouble. Skipping it - or wearing it wrong - means dust, debris, or worse can reach your eyes more easily <sup>10</sup>.
- Most folks using tools or machinery face greater chances of eye harm. Take welding crews or construction workers - those kinds often deal with sharp debris zipping through the air. Handling steel parts means constant exposure to small bits ready to strike the eyes without warning <sup>11,12</sup>.

### Clinical Presentation

The way foreign body injuries affect the eye can be really different. This is because the size of the body, the location of the foreign body the depth of the foreign body and what the foreign body is made of can all be different. Patients feel the following signs and symptoms <sup>5,6</sup>.

- **Foreign body sensation:** Patient usually complain they feel like something is stuck in their eye. This is the most common complaint <sup>5</sup>.
- **Foreign body or rust ring:** If a metallic object is stuck in the cornea for a while, it can leave a rust ring <sup>5</sup>.
- **Pain:** The pain can be mild or really bad, especially if the cornea is hurt <sup>5,6</sup>.
- **Occupational eye foreign body injuries** commonly present with pain, watering, redness and foreign body sensation, particularly among welders and construction workers <sup>7</sup>
- **Patients with intraocular foreign bodies** may initially have minimal symptoms but can later develop serious vision-threatening complications if diagnosis is delayed <sup>8</sup>.
- **Vision:** Blurry vision depends on the location of the foreign body and if the eye is damaged occurred <sup>9</sup>.
- **Early recognition** of these symptoms is important for prompt management and better visual outcomes <sup>10</sup>.
- **Congestion:** The eye can get red and teary because it is irritated <sup>11</sup>.
- **Photophobia:** Some people are sensitive to light, especially if the cornea is injured <sup>11</sup>.
- **Blepharospasm:** The eyelid can squeeze shut without the person wanting it to because of pain and irritation. This can make it hard to examine the eye <sup>12</sup>.

### Clinical Challenges

- Eye foreign body injuries are a problem for doctors. They can make it hard to figure out what is wrong to give the treatment and to help people see properly <sup>1</sup>.
- Standardized classification of ocular trauma is important because proper classification helps doctors assess the severity of the injury and plan appropriate management <sup>2</sup>.

- Eye injuries remain an important public health problem worldwide, and delayed recognition may increase the burden of visual impairment <sup>3</sup>.
- Work-related eye injuries continue to present significant clinical and occupational challenges because of their high incidence and associated visual disability <sup>4</sup>.
- Eye foreign body injuries can also lead to infections. If the foreign body is made of material like wood, it can cause big problems <sup>5,6</sup>.
- Occupational eye injuries are frequently associated with metallic foreign bodies and delayed presentation, making diagnosis and management more challenging <sup>7</sup>.
- Sometimes eye foreign body injuries can cause problems with the eye. For instance, the cornea can get hurt, there can be bleeding inside the eye, the retina can detach the lens can get. The whole eye can get hurt. These problems can make it hard for people to see.
- Doctors have a hard time treating eye foreign body injuries. They need to know how big the foreign body is, where it is, what it is made of and how deep it is. If the foreign body is not deep, doctors can usually remove it in the office. If it is deep inside the eye, doctors need to do surgery right away. They may need a doctor to do the surgery. Eye foreign body injuries are a deal, and doctors need to be careful when treating them. Eye foreign body injuries require attention from doctors <sup>8,9</sup>.
- If people wait too long to go to the doctor, they can get infections, get inflamed and have problems seeing forever. Early diagnosis and timely referral are important to improve the visual outcome <sup>10</sup>.
- There is an issue with eye foreign body injuries. For example, it can be hard to find bodies that are small or deep inside the eye. This can happen if the person does not have symptoms. It is also hard to find bodies that are inside the eye. If something punctures the eye it may not be easy to see from the outside. Doctors need machines to see what is going on inside the eye <sup>11,12</sup>.

### **Diagnostic Evaluation**

- To figure out what is going on with an eye foreign body injury, the doctor needs to know where the problem is, how deep it is and how bad it is. This way the doctor can take care of it away and prevent things from getting worst <sup>1</sup>.
- A standardised assessment of ocular trauma helps the doctor identify the type and severity of injury before planning treatment <sup>2</sup>.
- Early diagnosis is important because delayed detection of eye injuries can increase the risk of permanent visual impairment <sup>3</sup>.
- A detailed evaluation is especially important in work-related eye injuries, where high-velocity foreign bodies are common <sup>4</sup>.
- Patient history is very important. The doctor needs to ask the patient what happened, what kind of thing got in their eye, if they were wearing any protection and when their symptoms started. This information helps the doctor decide what to do <sup>5,6</sup>.

- The doctor also needs to check the patient's vision before doing anything. This gives the doctor an idea of how bad the injuries provide a starting point to see if the patient is getting better <sup>6</sup>.
- Occupational eye injuries often require careful examination because metallic foreign bodies may not be immediately visible and may require further evaluation <sup>7</sup>.
- Finally, the doctor will do an examination of the back of the eye to check for problems like tears in the retina, bleeding in the eye or the foreign body itself. The doctor does this by dilating the patient's eyes and using a tool to look at the back of the eye <sup>8,9</sup>.
- Timely and accurate diagnostic evaluation is essential for selecting the appropriate management and improving visual outcomes <sup>10</sup>.
- The doctor will use a tool called a slit-lamp to look really closely at the eye. This helps the doctor find the problem, see if the cornea is damaged and check for issues like scratches on the cornea or rust rings <sup>11</sup>.
- The doctor may also use a dye called fluorescein to see if there are any scratches on the cornea. This dye can also help the doctor figure out if there is a hole in the eye <sup>11</sup>.
- If the doctor thinks the problem is inside the eye, they may use machines like a CT scanner to get a better look. The doctor may also use tools like a special kind of photography or ultrasonography to see exactly where the problem is and how deep it is <sup>11,12</sup>.

### Management Strategies

#### Foreign body on the surface of the eye

Wash loose foreign bodies from the surface of the eye using normal saline or clean water <sup>14</sup>

#### **For a corneal foreign body (FB):**

Anaesthetise the eye. Use the edge of a clean piece of paper to remove the foreign body or the tip of a sterile 25G needle. Evert the upper eyelid to check for any additional foreign particles. Use antibiotic eye drops and ointment (erythromycin or tetracycline). Pad the eye <sup>14</sup>.

#### **Penetrating injury (open injury of the globe)**

An open globe injury is an emergency condition. It needs immediate referral to an ophthalmologist. Place a metal or plastic shield over the injured eye. Avoid any pressure on the eye and do not use an eye pad. Do not instil any medication into the eye <sup>14</sup>.

#### Ruptured globe

Immediately protect the eye with a plastic or metal shield and administer tetanus toxoid. Refer to a specialist very urgently <sup>14</sup>.

#### Perforating injury

This presents with haemorrhagic chemosis, a shallow anterior chamber, hyphaemia, irregular pupil, poor view of the fundus and a positive Seidel's test. For primary treatment: Immediately protect the eye with a rigid eye shield. Refer immediately <sup>14</sup>.

#### **Intraocular Foreign Body (IOFB)**

An intraocular foreign body is any object that penetrates the eye and remains inside the eyeball.

**Treatment**

- Place a rigid eye shield over the injured eye.
- Provide systemic analgesics.
- Administer tetanus toxoid.
- Advise ocular ultrasound or CT scan; an orbital X-ray may also be necessary.
- Refer to an ophthalmologist immediately <sup>14</sup>.

**Closed globe injury from contusion or lamellar laceration**

Patients with a Relative Afferent Pupillary Defect (RAPD), reduced visual acuity, restricted ocular movement and proptosis should be referred immediately to an ophthalmology service for a thorough intraocular examination and orbital assessment. Patients with hyphema, lens injury and loss of the red reflex should also be referred urgently. Use Predforte or Maxidex eye drops four times per day and a cycloplegic eye drop to relieve painful ciliary spasm. IOP should be closely and regularly monitored <sup>1</sup>. In blunt injury conjunctival edema, hyphema in the anterior chamber and irregular pupil can occur. Immediately protect the eye with a plastic or metal shield. Advise patients with hyphema to bed rest and limit daily activities with the head raised 30–45 degrees to allow blood to settle inferiorly. Refer urgently <sup>13,14</sup>.

**Lamellar laceration**

Partial thickness laceration of the cornea or sclera needs repair unless edges are already sealed. Place an eye pad and rest for 24 hours.

- Broad-spectrum antibiotics
- Cycloplegic eye drops if painful ciliary spasm is present
- Oral analgesics to reduce pain <sup>13,14</sup>

**Chemical injury to the eye**

The first step in managing a chemical injury to the eye is to immediately wash the affected eye with a large amount of Ringer's lactate or normal saline (or clean tap water if these fluids are not available)<sup>14</sup> after instilling local anaesthetic drops. The patient should lie flat while cleaning the eye with the solution for at least 15 minutes. After this time examine the eye with fluorescein dye in slit lamp to check for corneal damage or corneal ulcers. Advise topical antibiotics, an eye pad and daily monitoring to check healing.

Many chemical injuries are caused by acids which only damage the superficial layers of the cornea. Alkali injuries (e.g. household bleach, ammonia-containing products, lime, etc.) are less common but more severe and should be referred to an ophthalmologist immediately as they may require topical steroids, tetracycline and vitamin C <sup>15</sup>.

**Complication****Early complications**

- Corneal ulcer
- Hyphema
- Lens injury

- Subconjunctival haemorrhage
- Anterior uveitis
- Vitreous haemorrhage <sup>13</sup>

**Late complications**

- Cataract
- Glaucoma
- Retinal detachment
- Endophthalmitis
- Metal toxicity
- Sympathetic ophthalmia
- Permanent visual loss <sup>9</sup>

**Protective Interventions**

- Polycarbonate safety goggles
- Face shields
- Protective sports eyewear
- Welding helmets with protective lenses
- Eye safety in workplace
- Occupational eye safety training
- Risk assessment protocols<sup>13,14,15</sup>

**Public Health Measure**

- Awareness campaigns
- Eye safety awareness programmes in schools
- Public or community eye health measures
- Protective eyewear and preventive efforts mostly reduce the incidence and impact of eye foreign body injuries <sup>14,15</sup>

**Conclusion**

Eye foreign body injuries are a frequent cause of avoidable unilateral or bilateral vision loss. Misdiagnosis or delayed management leads to devastating eye conditions such as corneal scarring, infection, retinal damage and even total visual disability<sup>1</sup>. Early identification, meticulous examination and timely intervention are paramount for visual recovery <sup>2,3</sup>. Eye foreign body injuries are a frequent cause of avoidable unilateral or bilateral vision loss. They are both an occupational hazard and a public health problem with an enormous impact on individuals, society and the economy worldwide. <sup>4</sup> Thorough patient history taking, meticulous examination and early diagnosis of corneal and intraocular foreign bodies are of extreme importance <sup>5,6</sup>. Occupational exposure to metallic foreign bodies and delayed presentation are significant predisposing factors for eye injuries <sup>7</sup>. Prompt referrals and proper management of these injuries are essential due to the high risk of

developing debilitating visual consequences such as retinal detachment, vitreous haemorrhage and loss of vision<sup>8</sup>. Collaborative efforts and continued research in the management of eye foreign body injuries will significantly improve the quality of care provided to patients presenting with such injuries, thus reducing the global burden of the condition<sup>9,10</sup>. Moreover, advances in slit lamp examination, imaging, CT scanning and ultrasonography have aided in the early diagnosis of foreign bodies in the eye, thus improving visual prognosis<sup>11,12</sup>.

Vision can be saved by using the appropriate eye protection, timely and proper management, as well as prompt referrals for specialised care when needed. Continued promotion of eye shield usage and eye safety programs in the workplace are the most effective interventions in minimising the effects of ocular foreign body injuries<sup>13,14,15</sup>.

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