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Clinical Presentation and Management Patterns of Corneal Foreign Bodies: A Cross-Sectional Study

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ABSTRACT

Background: Corneal foreign body (CFB) injury is a common ophthalmic emergency, particularly among working-age individuals exposed to occupational hazards. Early diagnosis and removal are important to prevent infection, corneal scarring, and visual impairment. **Objective:** To evaluate the clinical presentation, etiological patterns, and management outcomes of CFB cases in a tertiary-care setting. **Methods & Materials:** This cross-sectional study included 120 patients presenting with corneal foreign bodies to the Department of Ophthalmology, Mugda Medical College Hospital and Salauddin Specialised Hospital, Dhaka, Bangladesh, from January to December 2025. Demographic, occupational, clinical, and foreign-body characteristics were recorded. Slit-lamp examination was performed, followed by removal under topical anesthesia, topical antibiotic prophylaxis and follow-up assessment. **Results:** The majority of patients were male (68.3%) with the highest incidence in the 21–40 years age group (52.5%). Occupational exposure was the leading risk factor, particularly among industrial workers (46.7%). Metallic foreign bodies were the most common (55%), followed by organic particles (25%) and dust/sand particles (20%). Pain (90%), foreign body sensation (88.3%) and redness (75%) were the most common presenting symptoms. Central corneal involvement was observed in 40% of cases. Most patients (85%) were managed successfully with slit-lamp removal and topical antibiotics. Complications such as corneal abrasion and mild scarring were noted in 18% of cases. **Conclusion:** Corneal foreign body injuries predominantly affect young male workers and are largely preventable. Early presentation and prompt removal result in favorable outcomes. Preventive strategies, including protective eyewear in high-risk occupations should be emphasized.

Keywords: *Corneal Foreign Body; Ocular Trauma; Slit-Lamp Examination; Industrial Eye Injury; Metallic Foreign Body; Corneal Abrasion; Ophthalmic Emergency; Visual Outcome; Occupational Hazard; Corneal Scarring.*

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INTRODUCTION

Corneal foreign body (CFB) injury is a frequent ophthalmic emergency worldwide and represents a significant cause of preventable ocular morbidity. The cornea, being the most exposed and sensitive part of the eye is highly vulnerable to injury from metallic fragments, dust particles, organic matter and other environmental debris.[1] Such injuries commonly occur in occupational settings, especially in industries involving metalwork, construction, agriculture and mechanical repairs. The clinical significance of corneal foreign bodies lies not only in the immediate discomfort they cause but also in the potential for serious complications if not managed appropriately. Delayed removal or improper treatment may lead to corneal ulceration, secondary bacterial infection, stromal scarring and in severe cases, permanent visual impairment.[2] Globally, ocular trauma accounts for a substantial proportion of emergency ophthalmology visits, with corneal foreign bodies being among the most commonly reported conditions. Studies have shown that young adult males are disproportionately affected due to higher involvement in outdoor and industrial occupations.[3] The nature of the foreign body also plays a critical role in determining the severity of corneal damage; metallic and organic foreign bodies are particularly associated with higher risks of infection and inflammatory response. Clinical presentation typically includes sudden onset of pain, foreign body sensation, tearing, photophobia and redness. Visual acuity may be affected depending on the size, location, and depth of corneal involvement. Slit-lamp biomicroscopy remains the gold standard for diagnosis, allowing precise localization and assessment of associated corneal injury.[4] Management of corneal foreign bodies involves careful removal under sterile conditions, followed by prophylactic antibiotic therapy to prevent infection. In some cases, rust rings from metallic foreign bodies require additional debridement. Patient education and follow-up are essential to ensure complete healing and prevent complications.[5] Despite the frequency of this condition, there remains variability in clinical practice regarding management protocols, follow-up duration and use of adjunct therapies. Therefore, this study aims to evaluate the clinical patterns, risk factors and management outcomes of corneal foreign body cases in a tertiary care setting with the goal of improving clinical practice and preventive strategies.

METHODS & MATERIALS

Study Design

This hospital-based cross-sectional observational study was conducted among patients presenting with clinically confirmed corneal foreign body (CFB) injuries. Patients were consecutively screened and enrolled according to the predefined eligibility criteria.

Study Setting and Duration

The study was conducted in the Department of Ophthalmology at Mugda Medical College Hospital, Dhaka, Bangladesh, and Salauddin Specialised Hospital, Tikatuli, Dhaka, Bangladesh, from January 2025 to December 2025. Patients presenting to the outpatient and emergency departments with suspected CFB injuries were screened and evaluated during the study period.

Study Population

A total of 120 patients with clinically confirmed corneal foreign bodies were enrolled in the study. The diagnosis was established based on a relevant history and slit-lamp biomicroscopic examination. Patients of all age groups and both sexes were eligible for inclusion.

Inclusion Criteria

Patients were included if they had:

- Clinically confirmed corneal foreign body on slit-lamp examination
- History consistent with ocular trauma or foreign body exposure
- Willingness to participate and provide informed consent

Exclusion Criteria

Patients were excluded if they had:

- Penetrating globe injuries or suspected intraocular foreign bodies
- Pre-existing corneal pathology (e.g., corneal dystrophy, active keratitis)
- History of recent ocular surgery (<3 months)
- Incomplete clinical data or follow-up loss

Data Collection Procedure

After obtaining informed consent, a detailed structured proforma was used to collect data. Information recorded included demographic details (age, sex), occupation, type and mechanism of injury and duration between injury and presentation. Presenting symptoms such as pain, redness, foreign body sensation, photophobia, tearing and visual disturbance were documented.

Ophthalmic Examination

All patients underwent comprehensive eye examination. Visual acuity was assessed using a Snellen chart or equivalent method. Slit-lamp biomicroscopy was performed to identify the location, depth and nature of the foreign body. Fluorescein staining was used to detect associated corneal epithelial defects. The position of the foreign body was classified as central, paracentral or peripheral cornea. Presence of rust ring (in metallic cases) was also documented.

Management Protocol

Foreign bodies were removed under aseptic conditions using topical anesthetic drops (proparacaine 0.5%). Removal was performed under slit-lamp magnification using a sterile cotton bud, 26-gauge needle or foreign body spud depending on the depth and nature of the material. Rust rings were debrided when present. After removal patients were prescribed topical broad-spectrum antibiotics, lubricating eye drops and cycloplegics if required.

Follow-up and Outcome Assessment

Patients were followed up after 24–48 hours and again after 1–2 weeks to assess epithelial healing, symptom resolution and complications such as corneal scarring infection or persistent epithelial defects.

Statistical Analysis

Data were analyzed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as mean ± standard deviation. The Chi-square test or Fisher's exact test was used to assess associations between categorical variables. A p-value <0.05 was considered statistically significant.

RESULTS

A total of 120 patients with corneal foreign body (CFB) injuries were included in the study. *Table I* shows that males constituted the majority of the study population (68.3%), compared with females (31.7%), with a male-to-female ratio of approximately 2.2:1. The 21–40-year age group was the most frequently affected (52.5%), whereas patients aged >60 years represented the smallest proportion (5.8%).

Table I

Demographic Characteristics of Patients (*n* = 120).

Variable	Number	Percentage (%)
Male	82	68.3
Female	38	31.7
Age 0–20 years	22	18.3
Age 21–40 years	63	52.5
Age 41–60 years	28	23.3
>60 years	7	5.8

Table II shows that industrial workers constituted the largest occupational group (46.7%), followed by farmers (20.0%) and mechanics (15.0%). Office workers accounted for 8.3% of patients, while those in other occupations represented 10.0%.

Table II

Occupational Distribution of Patients.

Occupation	Number	Percentage (%)
Industrial workers	56	46.7
Farmers	24	20.0
Mechanics	18	15.0
Office workers	10	8.3
Others	12	10.0

Table III shows that metallic foreign bodies were the most common type, accounting for 55.0% of cases. Organic foreign bodies accounted for 25.0%, while dust or sand particles constituted the remaining 20.0%.

Table III

Type of Corneal Foreign Body.

Type	Number	Percentage (%)
Metallic	66	55.0
Organic (wood/plant)	30	25.0
Dust/Sand particles	24	20.0

Table IV shows that pain was the most frequently reported symptom (90.0%), followed by foreign body sensation (88.3%). Redness and tearing were reported in 75.0% and 70.8% of patients, respectively, while photophobia and reduced vision were present in 50.0% and 35.0% of cases, respectively.

Table IV
Clinical Presentation of Patients.

Symptom	Number	Percentage (%)
Pain	108	90.0
Foreign body sensation	106	88.3
Redness	90	75.0
Tearing	85	70.8
Photophobia	60	50.0
Reduced vision	42	35.0

Table V shows that successful foreign body removal at the first attempt was achieved in 85.0% of patients, while 10.0% required a second attempt and 5.0% required referral for surgical intervention. Among the recorded complications, corneal scarring was the most frequent (18.3%), followed by corneal abrasion (11.7%) and secondary infection (5.0%).

Table V
Management Outcomes and Complications.

Outcome/Complication	Number	Percentage (%)
Successful removal (first attempt)	102	85.0
Required second attempt	12	10.0
Referred for surgical intervention	6	5.0
Corneal abrasion	14	11.7
Corneal scarring	22	18.3
Secondary infection	6	5.0

DISCUSSION

Corneal foreign body (CFB) injury remains one of the most frequent ophthalmic emergencies encountered in clinical practice, particularly in developing countries where occupational safety awareness is limited. The present study evaluated the clinical presentation, etiological patterns and management outcomes of 120 patients with corneal foreign bodies in a tertiary care setting. The findings provide important insights into the demographic risk profile, clinical spectrum and effectiveness of standard treatment approaches. In this study, a marked male predominance (68.3%) was observed, with the majority of patients belonging to the 21–40 years age group (52.5%). This pattern is consistent with multiple previous studies which have shown that young adult males are most commonly affected due to greater involvement in outdoor and manual labor-intensive occupations.[1,2] The higher exposure to occupational hazards such as metal grinding, welding and agricultural work explains this demographic distribution. Similar findings have been reported in industrial eye injury studies, where working-age males represent the highest-risk group due to inadequate use of protective eyewear.[3] Occupational analysis in the present study revealed that industrial workers accounted for the largest proportion of cases (46.7%), followed by farmers (20%) and mechanics (15%). This highlights the strong association between occupational exposure and corneal foreign body injuries. Unprotected exposure to flying metal fragments, dust and organic debris significantly increases the risk of corneal injury. These findings are comparable with earlier studies where industrial settings were identified as the leading source of ocular foreign bodies.[4] The results emphasize the need for strict workplace safety regulations and enforcement of protective eyewear use. Regarding the type of foreign body, metallic materials were the most common (55%), followed by organic substances (25%) and dust particles (20%). The predominance of metallic foreign bodies is expected in industrial environments and has been widely reported in the literature.[5] Metallic foreign bodies are particularly concerning because they often lead to rust ring formation and deeper stromal involvement if not removed promptly. Organic foreign bodies, although less frequent, are associated with a higher risk of infectious keratitis due to microbial contamination and delayed inflammatory response. Clinically, pain (90%) and foreign body sensation (88.3%) were the most common presenting complaints. These symptoms reflect corneal epithelial disruption, which is highly sensitive due to dense sensory innervation. Redness, tearing and photophobia were also frequently observed, consistent with the inflammatory response following corneal injury. Visual impairment was noted in 35% of patients, particularly in cases where the foreign body was centrally located. This is clinically significant as central corneal involvement has a direct impact on visual acuity and may lead to long-term visual sequelae if not managed promptly.[7] In terms of management, 85% of patients were successfully treated with single-attempt removal under slit-lamp guidance. This reinforces the effectiveness of prompt, minimally invasive removal techniques combined with topical anesthesia. A small proportion of patients required repeat attempts or referral for surgical intervention, particularly in cases where foreign bodies were deeply embedded. Post-removal management with topical antibiotics and lubricants proved effective in preventing secondary infection in most cases. Complications were relatively low but clinically important. Corneal scarring was observed in 18.3% of patients, which is consistent with delayed presentation or deeper stromal involvement. Corneal abrasions occurred in 11.7% of cases, while secondary infection was noted in 5%. These complications underline the importance of early presentation and timely intervention. Previous studies have similarly reported that delayed removal significantly increases the risk of scarring and persistent visual impairment.[7,8,9,10] Overall, the findings of this study highlight that corneal foreign body injuries are largely preventable occupational injuries. Lack of awareness and non-compliance with safety measures remain key contributing factors. Public health strategies focusing on occupational eye protection, education and early treatment-seeking behavior are essential to reduce the burden of such injuries.

CONCLUSION

Corneal foreign body injuries are a common ophthalmic emergency predominantly affecting young male workers engaged in industrial and agricultural activities. Metallic foreign bodies are the most frequently encountered type. Early presentation and prompt removal under slit-lamp guidance result in excellent outcomes with minimal complications. Preventive strategies, including the use of protective eyewear and occupational safety education are essential to reduce the burden of this condition.

DECLARATIONS

Ethics Approval and Consent to Participate

The study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval was obtained from the appropriate institutional ethics committee prior to commencement of the study. Written informed consent was obtained from all participants before enrollment.

CONSENT FOR PUBLICATION

Written informed consent was obtained from the participants for publication of the study findings. No individually identifiable patient information is presented in this manuscript.

AVAILABILITY OF DATA & MATERIALS

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request, subject to institutional and ethical considerations.

COMPETING INTERESTS

The authors declare that they have no competing interests.

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AUTHORS' CONTRIBUTIONS

MA contributed to the conception and design of the study, patient management, data collection, data analysis, interpretation of findings and manuscript preparation. FN contributed to data collection, clinical assessment, interpretation of findings and critical revision of the manuscript. Both authors reviewed and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

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