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Demographic and Clinical Profiles of Patients with Ocular Trauma at Haji General Hospital East Java Indonesia

Ilhamiyati*, Esty Dwi Nurmalitta

Department of Ophthalmology, Haji General Hospital, East Java, Indonesia

Email: ilhamiyati@gmail.com; esty.dwi.nur@gmail.com

*Corresponding author details: Ilhamiyati; ilhamiyati@gmail.com

ABSTRACT

Background: Ocular trauma is a leading cause of visual impairment worldwide, where occupational and accidents in the home environment are the main contributors. Understanding the demographic and clinical patterns of ocular trauma is essential for improving prevention and management strategies. ***Methods:*** This retrospective descriptive study analyzed the demographic distribution, clinical features, and patterns of ocular trauma among patients treated at Haji General Hospital, East Java, Indonesia, from January 2022 to July 2025. A total of 248 patients were included. Data collected included age, gender, environment of trauma, etiology of trauma, type of trauma, and ocular structures involved. ***Results:*** Ocular trauma predominantly affected young adults aged 21–30 years (22.98%) and was more common in men (80.65%), especially those in industrial occupations (46.8%). Most superficial foreign body cases involved the cornea (78.5%), with metal fragments identified as the most common causative agent (59.9%). Subconjunctival hemorrhage represented the most frequent presentation among adnexal injuries (40%). Among closed globe injuries, contusion was identified as the most prevalent type of injury (87,5%). Chemical injuries were predominantly caused by acid exposure (60%). All thermal injuries were caused by hot liquid contact, while all cases of radiation burns resulted from welding arc exposure. ***Conclusion:*** Most cases of ocular trauma took place in industrial settings and were related to occupational activities. The most frequent type of ocular trauma was a superficial foreign body. As most cases are preventable, enhancing awareness and consistent use of protective eyewear are essential to reduce the incidence of work-related ocular injuries.

Keywords: trauma oculi; industrial occupation; superficial foreign body; subconjunctival hemorrhage; closed globe injury

INTRODUCTION

Ocular trauma is a major cause of visual impairment worldwide, particularly in developing countries where occupational and injuries in the home environment are common. Globally, it is estimated that more than 55 million eye injuries occur each year, resulting in approximately 1.6 million cases of blindness, 2.3 million cases of bilateral visual impairment, and around 19 million cases of unilateral vision loss [1]. In Indonesia, data from the 2018 National Basic Health Survey (Riskesdas) reported an ocular injury prevalence of 0.5%, equivalent to an estimated 46,488 cases annually. The majority of affected individuals are male, with the highest incidence observed among those aged 55–64 years. In East Java, approximately 8,236 ocular trauma cases are reported each year [2].

Ocular trauma can be caused by mechanical or non-mechanical factors, such as chemical exposure or thermal burns, most often involving the anterior segment of the eye, including the conjunctiva, cornea, sclera, iris, and lens [1,3].

Mechanical ocular injuries are commonly classified as open globe and closed globe. Close globe injuries are characterized by an intact outer wall of the eyeball without a full-thickness defect, while open globe injuries involve rupture or laceration that penetrates the entire thickness of the eye wall [4]. Further subclassifications are based on the anatomical structures involved, including adnexal injuries and globe injuries affecting either the anterior or posterior segment [4]. The most frequently encountered ocular injuries include intraocular foreign bodies, corneal epithelial defects, and chemical burns. Occupational accidents are the leading cause of ocular trauma, followed by domestic incidents. Importantly, nearly 90% of these injuries are preventable through basic safety measures, particularly the consistent use of personal protective equipment (PPE) [1,3]. Comprehensive ophthalmologic evaluation is crucial in all ocular trauma cases and should include examination of both eyes, starting with a detailed medical and trauma history.

Documentation should encompass the mechanism of injury, event circumstances, occupational context, witness accounts, prior ocular history, systemic health conditions, current medications, and tetanus immunization status [5]. A comprehensive physical examination is essential in assessing ocular trauma, beginning with visual acuity testing followed by meticulous inspection and palpation of the periorbital area to detect any structural deformities. Evaluation of the eyelids and lacrimal drainage system, including canalicular patency, should be performed to identify associated injuries. Examination of extraocular movements and pupillary reactions, particularly the light reflex and any irregularities in size or shape, provides critical diagnostic information. The conjunctiva and cornea must be assessed for trauma indicators such as lacerations, perforations, or foreign bodies. Furthermore, evaluation of the anterior chamber, lens, and posterior segment is necessary to determine the extent of intraocular involvement. When more serious structural damage is suspected, imaging techniques such as ultrasonography or computed tomography (CT) should be employed to guide management decisions [5].

Severe ocular trauma requires prompt and comprehensive assessment to prevent irreversible complications, including vision loss or enucleation. Visual impairment secondary to eye injury has profound effects, not only diminishing an individual's quality of life but also imposing significant socioeconomic and psychological burdens on patients and their families [3]. Therefore, enhancing public awareness regarding the consistent use of personal protective equipment (PPE), identification of occupational hazards, and recognition of potential risk factors is crucial for preventing ocular trauma [6]. Despite numerous studies worldwide, data on the patterns and outcomes of ocular injuries in low-resource settings remain scarce. Detailed epidemiological analyses are vital to guide preventive efforts, inform clinical management, and improve prognostic evaluation following ocular trauma [6].

RESEARCH METHODOLOGY

The research was carried out at Haji General Hospital, East Java, from January 2022 to July 2025. This study used a retrospective descriptive design. The study started by identifying patients about the epidemiological data, environment, type of injury, any prior trauma or surgery, and any treatment received before attending the hospital.

The population in this study was all patients with ocular trauma at Haji General Hospital, East Java. The research sample was taken by total sampling of ocular trauma patients who came to the ophthalmology department and were recorded in the medical records during the study period as an inclusion criterion. Patients with incomplete medical records were excluded from the study. The type of data used in this research is secondary data. The data used in this study include age, gender, environment of trauma, etiology of trauma, type of trauma, and ocular structures involved.

Data obtained from medical reports on hospital. The data were processed and analyzed by computer using SPSS software version 27. The analysis was carried out descriptively. Descriptive analysis is presented in the form of graphs and tables.

RESULTS

The research data collection was carried out from January 2022 to July 2025. The data obtained were secondary data. Data obtained from patients who were attended with ocular trauma at Haji General Hospital, East Java, included 255 patients. Seven patients with incomplete medical records were excluded from the study. The number of patients who were included based on the inclusion criteria was 248 patients.

Age and Gender

Most of the patients (22,98%) were early adults aged 21-30 years old (Table 1). The mean age of patients in this study was 36,21 with a standard deviation of + 16,934, and most of them were men (80.65%). Meanwhile, in woman, most of them were middle-aged adults aged 51-60 years old, as many as 11 patients (4,11%).

Types of Ocular Trauma

Most of the patients in this study experienced ocular trauma with a superficial foreign body, as many as 167 cases (67,3%). This was followed by adnexal injuries and chemical injuries, with 35 cases (14,1%) and 20 cases (8,1%) reported cases, respectively (Table 2). In this study, no patient with electrical injury, ultrasonic injury, or barometric injury was found.

Superficial Foreign Body

Ocular superficial foreign bodies involving the cornea were the most common compared to those involving the conjunctival as many as 131 cases (78,5%).

TABLE 1: Distribution of patients by age and gender.

Age	Gender				Total		Mean ± SD
	Men		Woman				
	n	%	n	%	n	%	
1 – 10	14	5,65	4	1,61	18	7,26	36,21 ± 16,934
11 – 20	20	8,06	9	3,63	29	11,69	
21 – 30	48	19,35	9	3,63	57	22,98	
31 – 40	34	13,71	4	1,61	38	15,32	

Age	Gender				Total		Mean ± SD
	Men		Woman				
	n	%	n	%	n	%	
41 – 50	41	16,53	6	2,42	47	18,95	
51 – 60	31	12,50	11	4,11	42	16,94	
61 – 70	9	3,63	3	1,21	12	4,84	36,21 ± 16,934
71 – 80	3	1,21	2	0,81	5	1,61	
Total	**200**	**80,65**	**48**	**19,35**	**248**	**100**	

TABLE 2: Distribution of patients based on types of ocular trauma.

Types of Ocular Trauma	n	%
- Superficial Foreign Body	167	67,3
- Adnexal Injury	35	14,1
- Close Globe Injury	16	6,5
- Open Globe Injury	4	1,6
- Chemical Injury	20	8,1
- Thermal Injury	3	1,2
- Radiation Burns	3	1,2
Total	**248**	**100**

TABLE 3: Distribution of patients with superficial foreign body based on the ocular structure involved and etiology.

Superficial Foreign Body	n	%
Ocular Structure Involved		
- Conjunctival	36	21,5
- Cornea	131	78,5
Etiology		
- Insects	3	1,8
- Metal fragment	100	59,9
- Dust particle	51	30,5
- Wooden fragment	4	2,4
- Food particle	1	0,6
- Cosmetics	5	3,0
- Plastic fragment	3	1,8
Total	**167**	**100**

TABLE 4: Distribution of patients with adnexal injury based on type and etiology.

Adnexal Injury	n	%
Type of Adnexal Injury		
- Palpebral Edema	4	11,4
- Palpebral Hematoma	9	25,7
- Palpebral Laceration	8	22,9
- Subconjunctival haemorrhage	14	40,0
Etiology		
- Traffic Accident	11	31,43
- Physical Assault	3	8,57
- Fall	19	54,26
- Ceramic Splinter	1	2,86
- Animal Fur	1	2,86
Total	**35**	**100**

Superficial foreign body was most commonly caused by metal fragments as many as 100 cases (59,9%). This was followed by dust particles and cosmetics, with 51 cases (30,5%) and 5 cases (3,0%) reported cases, respectively (Table 3).

Adnexal Injury

In this study, adnexal injuries were most frequently represented by subconjunctival hemorrhage, compared with other adnexal injury patterns, as many as 14 cases (40%). Falls were identified as the most common etiological factor associated with adnexal trauma, as many as 19 cases (54.26%). This was followed by traffic accident and physical assault with 11 cases (31,43%) and 3 cases (8,57%) reported cases, respectively (Table 4).

Ocular Trauma according to the Birmingham Eye Trauma Terminology (BETT) System

Based on the BETT system, closed globe injury represented the majority of cases in this study, as many as 16 cases (80%). In closed globe injury, most patients occurred contusion as many as 14 cases (87,5%). In open globe injury, most patients experienced rupture in as many as 3 cases (75%) (Table 5).

Chemical Injury, Thermal Injury, and Radiation Burns

Chemical injuries were predominantly caused by acid exposure, accounting for 12 cases (60%). All thermal injury cases were attributed to contact with hot liquid in as many as 3 cases. Meanwhile, all radiation burns were caused by welding arc exposure in as many as 3 cases (Table 6).

TABLE 5: Distribution of patients with ocular trauma according to to the Birmingham eye trauma terminology (BETT) system.

Ocular Trauma	n	%	Total (%)
Close Globe Injury			
- Contusion	14	87,5	16 (80%)
- Lamelar Laceration	2	12,5	
Open Globe Injury			
- Laceration			
• Penetrating	-	-	4(20%)
• IOFB	1	25,0	
- Rupture	3	75,0	

TABLE 6: Distribution etiology of chemical injury, thermal injury and radiation burns.

Etiology of Ocular Trauma	n	%	Total (%)
Chemical Injury			
- Alkali Trauma	8	40,0	20 (76,9)
- Acid Trauma	12	60,0	
Thermal Injury			
- Hot Liquid	3	100	3 (11,5)
Radiation Burns			
- Welding Arc	3	100	3 (11,5)

Environmental Profiles of Ocular Trauma

In this study, the environment where ocular trauma occurred mostly in Industrial as many as 116 cases (46.8%). Environmental patterns of ocular trauma in this study showed that superficial foreign body cases were predominantly observed in industrial settings, with a total of 103 cases (61,7%). Adnexal injuries were mostly reported in home environments, as many as 15 cases (42,9%). Close globe injury cases were primarily associated with traffic accidents, as many as 7 cases (43,8%). Open globe injuries occurred more frequently in industrial settings, as many as 2 cases (50%). Chemical injuries were also mainly reported in home environments, as many as 14 cases (70%). All thermal injury cases occurred in home environments. While all radiation burn cases were reported in industrial environments (Table 7).

DISCUSSION

Several systems have been developed to classify ocular trauma, including the Birmingham Eye Trauma Terminology (BETT) system, the Ocular Trauma Classification System (OTCS), and the classification by Shukla and several others [10,4]. These classification systems are used to facilitate optimal patient management, enable further analysis of the effectiveness of medical and surgical interventions, support the development of research projects such as the Ocular Trauma Score (OTS), assist in planning clinical trials in the field of ocular trauma, and ensure clear communication among ophthalmologists [10]. In this study, ocular trauma was classified according to the BETT system into closed globe and open globe injuries, as shown in Figure 1. According to the terminology and definitions in the BETT system, a closed globe injury

is defined as ocular trauma without a full thickness wound of the eyewall, whereas an open globe injury refers to ocular trauma involving a full-thickness defect of the eyewall [10]. The term eyewall in this context encompasses the cornea and sclera. Although the eyewall anatomically consists of three layers posterior to the limbus, for clinical and practical purposes, only disruption of the outermost coat is considered relevant to the classification [10].

A newer classification proposed by Sukhla et al. divides ocular trauma into mechanical and non-mechanical injuries. Mechanical injury is ocular injury caused by the application of an external physical force resulting in structural damage to the globe or ocular adnexa [15]. Mechanical trauma may occur through mechanisms such as blunt force, sharp penetration, or intraocular foreign bodies [15]. Mechanical injuries are further categorized into adnexal injury and globe injury. In adnexal injuries, classification is performed based on the specific structure involved, such as the orbit, eyelids, lacrimal system, and conjunctiva. In contrast, globe injuries are further categorized according to the anatomical region affected, namely the anterior segment or posterior segment. Globe injuries are also classified based on their pathological characteristics into closed globe injury, open globe injury, and destructive globe injury, and the classification of closed globe and open globe injury is similar to the BETT system [15]. Non-mechanical ocular trauma refers to ocular injury that occurs without the involvement of an external physical force or disruption of the eyewall. This category includes injuries caused by chemical agents, thermal exposure, electrical sources, and radiation [15].

Age and Gender

Highest incidence of ocular trauma was observed among individuals aged 21–30 years, accounting for 57 cases (22.98%) of the total patients. The majority of affected patients were male, comprising 200 cases (80.65%). These findings align with the report by Naskar et al., who noted that most ocular trauma cases occurred in the 21–30 years age group (23.6%) and were similarly more common in males (74.7%) [10]. Comparable age and gender related patterns were also documented by Novityari et al. and Widjaja et al. [3]. This trend likely reflects the greater exposure of individuals in this productive age range to outdoor and occupational activities, which increases their risk of sustaining eye injuries compared to other age groups [1,7].

The predominance of ocular trauma among males is consistent with global epidemiological data. El-Sobky et al. reported that men are approximately twice as likely to experience ocular trauma, largely due to their higher participation in physically demanding jobs and high-risk activities or recreational pursuits [3]. Furthermore, men are generally more active in outdoor environments and may exhibit lower compliance with personal safety practices, such as the use of protective eyewear, during work or daily tasks, consequently heightening their vulnerability to ocular injuries compared to women [7].

Types of Ocular Trauma

The most common type of ocular trauma was superficial foreign body injury, accounting for 167 cases (67,3%). This finding is consistent with the study by El-Sobky, H.M.K., et al., which reported that 58,2% cases were superficial foreign bodies [3]. Superficial foreign bodies often occur during daily activities or occupational exposure, particularly in environments involving metalwork, woodworking, agriculture, or construction, where small particles are easily dispersed and come into contact with the ocular surface.

TABLE 7: Distribution of environment ocular trauma.

Types of Ocular Trauma	Environment					
	Agricultural	Casual/ Home	Criminal	Industrial	Traffic Accident	Recreational
	n (%)					
Superficial Foreign Body	5 (3,0)	58 (34,7)	-	103 (61,7)	-	1 (0,6)
Adnexal Injury	2 (5,7)	15 (42,9)	2 (5,7)	2 (5,7)	12 (34,3)	2 (5,7)
Close Globe Injury	-	5 (31,2)	-	3 (18,8)	7 (43,8)	1 (6,2)
Open Globe Injury	-	1 (25)	-	2 (50)	1 (25)	-
Chemical Injury	3 (15)	14 (70)	-	3 (15)	-	-
Thermal Injury	-	3 (100)	-	-	-	-
Radiation Burns	-	-	-	3 (100)	-	-
Total	**10 (4,0)**	**96 (38,7)**	**2 (0,8)**	**116 (46,8)**	**20 (8,1)**	**4 (1,6)**

The cornea and conjunctiva are highly exposed anatomical structures that lack protective barriers other than the blink reflex and eyelids, making them more susceptible to external particulate contact [10].

The higher incidence of superficial foreign body is often associated with limited awareness and inconsistent use of personal protective equipment (PPE) among at-risk workers.

As shown in Table 7, in this study, 61,7% of superficial foreign body injuries in this study occurred in industrial environments. A study from Singapore reported that among individuals who sustained foreign body injury, only 21.7% were wearing protective eyewear at the time of injury, 43.7% had been provided with protective devices but did not use them, and 34.6% lacked access to any form of eye protection, resulting in a substantially higher rate of foreign body injury [8].

Superficial Foreign Body

Superficial foreign body involving the cornea was found to be considerably more common than trauma affecting the adnexa or conjunctiva, representing 131 cases (78,5%). This observation is in agreement with the findings of Sukla et al., who reported that mechanical ocular trauma, which predominantly involving cornea, accounted for 53,1%, while involving the conjunctiva in superficial foreign body accounted for 29% [4]. Superficial foreign body arises when an external object or material, whether through accidental, occupational, or intentional (assault-related) exposure, comes into direct contact with the ocular surface while the eye is open. Given that the corneal epithelium constitutes the most anterior and exposed structure of the eye, it is particularly vulnerable to such mechanical insults [8].

Superficial foreign bodies were most commonly caused by metal fragments, accounting for 100 cases (59,9%). This is consistent with the study conducted by Hoskin, A.K., which reported 51,7% foreign bodies caused by metal fragments. The study conducted by Brendon, W.H also reported 58,5 % caused corneal foreign body. Superficial foreign bodies typically occur when the superficial ocular structure comes into contact with high-speed small projectiles. Such injuries are therefore common in occupational settings, particularly among metal workers and individuals using power tools [5].

The predominance of metal-related corneal injuries highlights the occupational hazard associated with high-velocity projectiles. These injuries not only pose a risk to the cornea itself but can also affect surrounding ocular structures, potentially leading to significant morbidity if not managed promptly. The mechanism of injury emphasizes the importance of preventive measures, particularly the use of appropriate eye protection in workplaces where metal fragments or similar projectiles are likely to occur [9].

Adnexal Injury

Subconjunctival hemorrhage was most commonly observed in adnexal injuries, accounting for 14 cases (40%). This finding is consistent with the study conducted by Brendon, W.H., which reported conjunctival hemorrhage in adnexal injuries in 224 cases (42.3%). The high incidence of subconjunctival hemorrhage in adnexal trauma can be explained by the fact that the eyelids, periorbital sac, and conjunctiva are highly vascular and superficial, making even minor trauma sufficient to rupture blood vessels [10].

Moreover, subconjunctival hemorrhage can occur without significant damage to the globe itself, as injury to the adnexa alone is enough to produce this vascular manifestation. Because subconjunctival hemorrhage is readily visible as a “red spot” on the white of the eye, it often serves as an early or mild sign of more extensive adnexal injury [10].

Ocular Trauma according to the Birmingham Eye Trauma Terminology (BETT) System

According to the BETT System, mechanical ocular trauma is divided by close globe injury and open globe injury. In this study, closed globe injuries were found to be more common than open globe injuries, accounting for 16 cases (80%). This finding is consistent with the study by Widjaja et al, which reported that close globe injuries comprised 80.3% of mechanical ocular trauma cases were higher than the incidence of open globe injuries [12]. This predominance may be explained by the protective anatomical structures of the eye. The eyeball is shielded by the bony orbit and eyelids, which serve as natural barriers against external impact. In addition, the sclera possesses a strong, collagenous structure capable of withstanding high-energy trauma. Therefore, closed globe injuries are more frequently encountered than open globe injuries, which typically require a greater amount of force or a sharper penetrating mechanism to occur [13].

In closed globe injuries, contusions were the most frequently observed, accounting for 14 cases (87,5%). This finding is consistent with the study conducted by Sukhla et al., which reported contusions in 180 cases (66.6%) of closed globe injuries. Contusions occur when a blunt object strikes the eye, causing compression in the anterior-to-posterior direction and equatorial expansion of the globe.

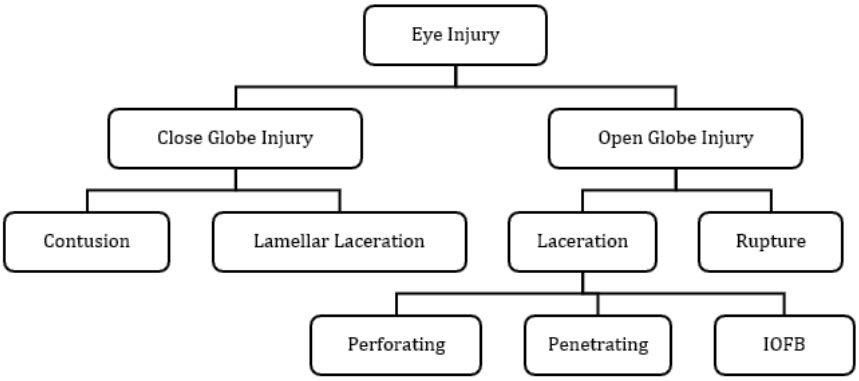

FIGURE 1: Birmingham eye trauma terminology (BETT) system.

This generates shearing forces and stress that can damage blood vessels and internal ocular structures. In close globe injuries, the eye wall (cornea and sclera) remains intact, without full-thickness laceration. Consequently, the energy from the impact is absorbed by internal structures such as the iris, lens, zonules, vitreous, retina, and intraocular blood vessels. This type of internal damage is classified as a "contusion" according to the Birmingham Eye Trauma Terminology (BETT).

Chemical Injury, Thermal Injury, and Radiation Burns

Chemical trauma was found to be more common than other types of non-mechanical ocular trauma, as many as 20 cases (76.9%). This finding is consistent with the results of the study by Sukla et al, which reported that chemical trauma constituted 31.8% of all non-mechanical ocular injuries were higher than other non-mechanical causes [4]. This may be explained by the wide exposure to chemical substances both in domestic and industrial environments, such as detergents, disinfectants, and floor cleaners, which increases the likelihood of accidental splashes compared to other types of non-mechanical exposure [14]. This finding is further supported by data from the present study, in Table 7, which showed that most chemical ocular trauma occurred in the home environment, accounting for 14 cases (70%). Chemical injuries in this study were predominantly caused by acids (60%), which is consistent with previous reports indicating that such injuries often occur at home due to household cleaning and personal care products. These injuries are also more frequent among younger individuals who may lack experience in handling hazardous chemical substances [17].

Alkaline agents, in contrast, cause saponification of cell membranes due to their lipophilic nature. The hydroxyl ions in alkali lead to cell membrane lysis, allowing rapid penetration into the anterior segment of the eye, including the iris, ciliary body, trabecular meshwork, and crystalline lens. The resulting inflammatory response progresses quickly due to the release of proteolytic enzymes from the injured tissues, and associated vascular damage can cause ischemia. Acids, on the other hand, coagulate and fix superficial tissues, which limits the deeper penetration of the chemical agent [17].

All thermal trauma cases in this study were caused by hot liquid exposure and occurred exclusively in household settings. This finding is consistent with a large study from New Delhi by Kaufman, S.C. et al., which reported that 42 % of thermal burn cases were attributed to boiling fluids [5]. Thermal injury to the cornea typically occurs following direct contact with a flame, hot object, or hot liquid, often involving a projectile mechanism. The etiology of such contact burns may be occupational, such as exposure to soldering materials or heated metallic particles, or home environments, including injuries caused by cooking activities, curling irons, or fireworks [5].

Thermal injuries generally involve the external surfaces of the eye. Most superficial thermal injuries are self-limiting and typically resolve within approximately 48 hours with appropriate management, including debridement, topical antibiotics, cycloplegics, and pressure patching [10]. However, limbal involvement remains a critical prognostic factor, as damage in this region may impair epithelial recovery and result in long-term complications [5].

All radiation burn cases in this study were caused by the welding arc. This finding is consistent with Naskar, et. al. reported that all radiation burns cases caused by welding arcs, as many as 20 cases 90% cases occurs in the industrial environment [1]. Welding-related ocular injuries may result from exposure to heat, radiation, gas, or metal particles generated during the welding process [18]. During welding activity, the eye is exposed to approximately 60% infrared radiation, 30% visible light, and 10% ultraviolet radiation [18]. Infrared radiation is associated with symptoms such as a foreign body sensation ("sand in the eyes") and may lead to damage of the cornea and lens. In contrast, ultraviolet radiation can cause corneal epithelial injury, blurred vision, cataract formation, and iris damage [18].

Both ultraviolet and infrared rays can cause radiant injury to the eye [15]. Burns from ultraviolet rays occur more frequently and often result from reflected sunlight or welding light [15]. Welding arc emits high-intensity visible light, ultraviolet (UV) radiation, and thermal energy, all of which can damage ocular tissues, particularly the corneal epithelium and conjunctiva, leading to flash burns or photokeratitis [15]. A significant number of cases are also due to direct exposure without appropriate eye protection (PPE), such as welding helmets or safety goggles, which markedly increases the risk of ocular trauma. Exposure to the high-energy welding flash can cause immediate corneal and conjunctival damage [9].

Environmental Profiles of Ocular Trauma

The majority of ocular trauma cases were reported in industrial settings, comprising 116 cases (46.8%) of the total patients. This observation is consistent with the findings of Hoskin et al., who emphasized that occupational ocular injuries are both prevalent and diverse in nature. Similarly, Voon, See, and Wong (2001), in their study, reported that 71.4% of ocular trauma cases presenting to the emergency department were work-related or industrial in origin [8]. Occupational activities involving metal work, such as hammering, grinding, and cutting, have been identified as major contributors to industrial eye injuries [9]. Moreover, other high-risk sectors frequently associated with occupational ocular trauma include construction, agriculture, forestry, fisheries, and mining industries [9]. The findings of this study demonstrate a distinct relationship between ocular trauma types and the environments in which they commonly occur. Case of superficial

foreign body, open globe injury, and radiation burns were predominantly reported in industrial settings. This pattern likely reflects the higher exposure to occupational hazards, including airborne metal particles, heavy machinery, and welding radiation, which are well-established contributors to work-related ocular trauma [5,8].

Adnexal injury, chemical injury, and thermal injury were more frequently identified in home environments. Everyday household activities such as cooking, handling cleaning agents may increase the likelihood of ocular exposure to hot liquids, sharp objects, or irritant chemicals [10,18]. The frequent absence of preventive measures, such as protective eyewear, may also contribute to this trend [10].

Meanwhile, close globe injuries were predominantly observed in traffic-related environments. Blunt trauma resulting from road accidents is a known mechanism leading to nonpenetrating ocular injury, particularly due to forceful impact and sudden acceleration–deceleration mechanisms during collisions [13]. These findings reinforce the importance of road safety measures and the use of protective equipment such as helmets and vehicle safety features [10].

Overall, these findings reflect how the nature of environmental exposure contributes to the variability in ocular trauma patterns. Understanding these associations is essential for directing preventive strategies tailored to specific environments, such as implementing stricter occupational safety protocols, promoting household eye protection awareness, and strengthening traffic safety measures [10].

CONCLUSION

Ocular trauma was most commonly observed among early adult patients and occurred more frequently in males. Most cases of ocular trauma took place in industrial settings and were related to occupational activities, with injuries generally limited to the eye itself. The most frequent type of ocular trauma was superficial foreign bodies that primarily caused by metal fragments. In closed globe injuries, contusions represented the majority of cases. Chemical injuries, particularly those caused by acidic agents, were predominant. Most ocular trauma cases are preventable through the use of protective equipment; therefore, attention should be given to the consistent use of eye protection during high-risk activities.

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