

Corneal Metallic Foreign Bodies among Jordanian Soldiers

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ABSTRACT

Objective: To review the spectrum of metallic foreign bodies among Jordanian soldiers and the efficacy of treatment.

Methods: A retrospective review was conducted at Prince Rashid Bin Al-Hassan Hospital between August 2011 and March 2012. File and photographs review of 55 patients who attended the ophthalmology clinic and found to have corneal metallic foreign body were included in this study. The following data were extracted and analyzed: age, gender, past ocular history, mechanism and time of injury and whether any eye protective measures were taken for those who were exposed to trauma during work, time to receive treatment, method of corneal foreign body removal, number of foreign bodies, location, depth of foreign body in the cornea, whether the eye was patched or not after removal of corneal foreign body, associated ocular injury, presence of Bell's phenomenon, complications, and duration of absence from work.

Results: All patients were males and the age ranged between 17 and 55 years (mean 31.3 years). Eighty-two percent of eye trauma occurred during work and all of them did not use any protective measure during their work activity. The mid third of the cornea was involved in 39% of patients followed by the paracentral zone in 27%. Corneal foreign bodies were removed by 27 gauge needle in 68% of patients. Eye patch was not used in 48% of patients after removal of foreign body. The most common associated finding was corneal rust in 63% of cases. Absence from work ranged between two to nine days.

Conclusion: Corneal foreign bodies are potentially sight threatening that occurs mostly as a result of occupational accidents in male workers who do not comply with the use of eye protection. Educational and safety programs and patient counselling on proper eye protection are essential and must be implemented in the work places to prevent serious eye injuries and work loss.

Key words: Cornea, Metallic, Foreign body, Jordanian patients.

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Introduction

Corneal foreign body (FB) is usually a preventable work-related cause of visual morbidity and blindness in developing countries.⁽¹⁾ It is one of the important causes of attendance at the ophthalmic emergency clinic in

the military hospitals of Jordan. Once it is diagnosed it should be removed immediately to prevent the adverse impacts on the cornea that may be sight threatening as a result of corneal scarring, infectious keratitis and endophthalmitis.⁽²⁾ These adverse impacts may

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lead to loss of productive power as well as social and medical costs.⁽³⁾ Most of the corneal foreign bodies are metallic in nature and occur during work at industrial facilities or construction workshops.⁽⁴⁾ The metallic FB may be adherent superficially to cornea or embedded in the corneal layers and if not removed, rust ring may develop within hours that may cause permanent staining and scarring of the cornea.⁽⁵⁻⁷⁾ Management of corneal FB injuries includes detailed history about the mechanism of trauma and thorough examination of the eye to rule out eye penetrating eye injury. Removal of the FB is attempted initially, if it is located superficially on the cornea, by using a cotton-tipped swab soaked in saline after instilling topical anesthesia, if this fails or if the FB is embedded deeply in the cornea it can be removed by using 27 gauge needle followed by antibiotic eye ointment, as a soothing agent and prophylaxis, with or without eye patching.^(8,9) The aim of this study was to review the spectrum of metallic foreign bodies among Jordanian soldiers and the efficacy of treatment.

Method

A retrospective review was conducted at Prince Rashid Bin Al-Hassan Military Hospital between August 2011 and March 2012. File and photographs review of 55 patients who attended the ophthalmology clinic and found to have corneal metallic foreign body were included in this study. The following data were extracted and analyzed: age, gender, past ocular history, mechanism and time of injury and whether any eye protective measures were taken for those who were exposed to trauma during work, time to receive treatment, method of corneal foreign body removal, number of foreign bodies, location, depth of foreign body in the cornea, whether the eye was patched or not after removal of corneal foreign body, associated ocular injury, presence of Bell's phenomenon, complications, duration of sick leave. Exclusion criteria included patients with corneal non - metallic FB, penetrating eye injuries, rust ring without FB, patients who were treated in other hospitals and came for regular follow up at Prince Rashid Bin

Al Hassan Military Hospital, and patients with incomplete information records. The local ethical committee of the Royal Medical Services approved the study.

Results

All patients were males and the age ranged between 17 and 55 years (mean 31.3 years). Figure 1 summarizes the distribution of patients among different age groups. One patient had multiple FBs on the same cornea and one had bilateral FBs while the remaining patients had only one FB (Fig. 2).

The time from the onset of FB symptoms to attendance to the eye emergency clinic ranged between three hours and four days; 30.9% of patients attended within few hours, 52.7% in the first day and the remaining patients attended between second and fourth day. Table I shows the presenting symptoms. Table II shows the place where the trauma occurred. Table III demonstrates the causes of trauma. All patients who had trauma at work sites did not use any protective measure during their work activity.

The best corrected visual acuity ranged from 6/6 to 6/12 and after one week of treatment it improved to normal in all patients.

Kaye - Wilson corneal location coding system⁽¹⁰⁾ was used for the distribution of FBs on the cornea among the patients, where zone I represents the central part of the cornea, zone II represents the paracentral third of the cornea, zone III represents the mid third of the cornea, zone IV represents the peripheral third of the cornea, zone V represents the limbal area, the black filled circles represent the right eyes foreign bodies and the black empty circles represent the foreign bodies in the left eyes (Fig. 2).

In both eyes the commonest site for corneal foreign bodies was in zone III (39%) followed by zone II (27%), zone IV (14%), zone V (13%) and zone I (7%). If we draw an imaginary line between two and 10 o'clock and another line between four and eight o'clock, the cornea will be divided into three parts; zone A above the 1st line, zone B between the two lines (inter-palpebral fissure) and zone C below the two line.

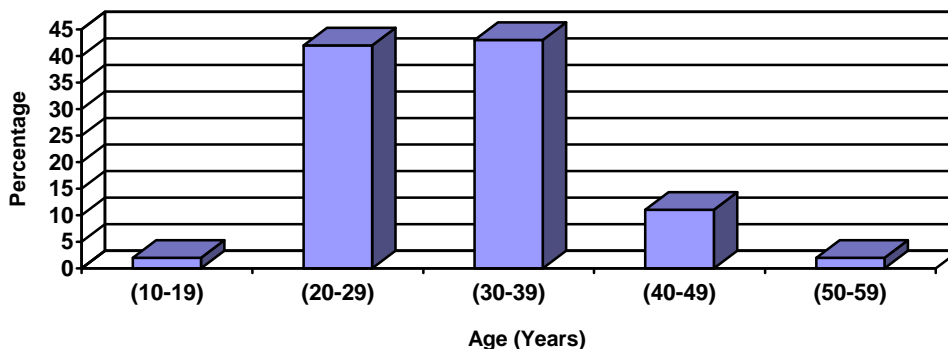


Fig. 1: The distribution of patients among different age groups

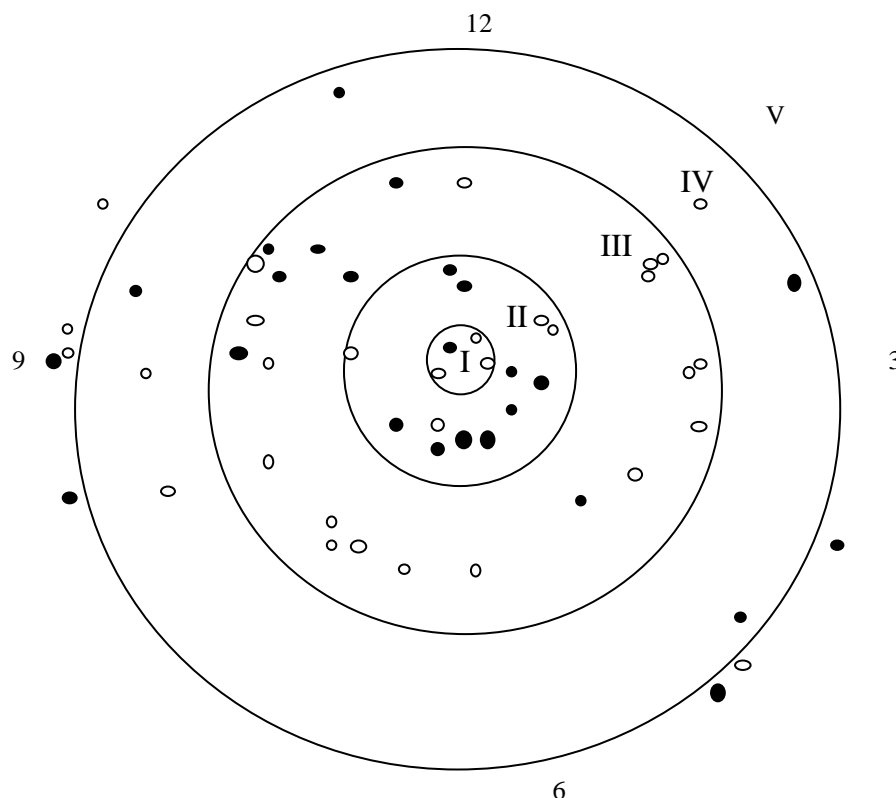


Fig. 2: Corneal foreign body distribution using Kaye-Wilson corneal location coding system.

The foreign bodies were located in zone B in 63% of cases, zone C in 23%, and zone A in 14%. Most of the embedded corneal FBs extended from the epithelial layer to the anterior stromal layer (60%), and the remaining 40% were located within the epithelial layer of the cornea. The associated findings are summarized in Table IV. Corneal infiltrates were noticed in 30% of patients and all of them had associated rust ring on the cornea. Rust ring was present in 63% of patients. Bell's phenomenon was negative

in six (11%) patients, three of them the foreign body was located in zone III, two in zone II and one in zone IV. And if we use the horizontal planes for distribution of foreign bodies; three of them were in zone A and two in zone C. Corneal foreign bodies were removed by cotton swabs in 32% of patients while the remaining foreign bodies were removed by 27 gauge needle. Eye patch was used in 52% of patients after removal of the FB and remaining 48% were left unpadded.

Table I: The presenting symptoms

Presenting symptom	%
Pain	100
Lacrimation	43.6
Redness	56.4

Table II: The place where the trauma occurred

Place Where The Trauma Occurred	Constructive Workshops	Walking Activity	Patients Did Not Report Or Remember How They Got the Eye Trauma
Percentage	82	9	9

Table III: The causes of trauma

Cause of Trauma	Grinding	Drilling	Welding	Nailing
Percentage	51	21.9	18.2	9.1

Table IV: The associated corneal findings

Associated finding	%
None	27
Old corneal scar from old foreign body	4
Corneal abscess	9
Corneal infiltrates	30
Rusting	63

Table V: Shows the relationship between the locations of the corneal foreign bodies within the corneal layers, duration of healing with and without eye patch use and of sick leaves

FB location within the corneal layers	Number (Percentage)		Healing period (days)		Sick Leave Duration (days)
			Eye Patch Use	No Eye Patch Use	
Epithelial	22 (40)	22 (40)	2	2	2
Epithelial and anterior stromal	33 (60)	12 (22)	2	2	2-4
		17 (31)	3- 7	3- 7	4- 8
		4 (7)	8- 9	8- 9	9
Total	55 (100)	55 (100)			

None of the patients who did not use eye patch had significant eye pain after removal of FBs and the healing rate was the same as those who did not use eye patch, Table V. Patients were given sick leave and followed up after two days. The duration of treatment ranged from two to nine days (mean 3 days). After removal of the foreign body, complete healing of corneal erosion was noticed in 62% of patients in two days, 93% in seven days, and 100% in nine days. The absence from work ranged from two to nine days with an average of four days (Table V).

Discussion

Corneal FB injury is responsible for about 26% of the worldwide 55 million eye injuries that occur annually.⁽¹¹⁾ It is usually a preventable work-related cause of visual morbidity and males are usually more affected than females. In

our study all affected patients were males who did not use protective eyewear and their age ranges between 20 and 40 years in more than 80% of cases (Fig. 1), and the majority occurred during work. This is because most of the people who work in military workshops are males and belong to this age group while females usually work in medical and administrative fields. These findings agree with other previous studies, which reported that males are affected in more than 90% of the cases between the third and fourth decades of life and most of them occurred during work.^(2,10) Smith *et al.*⁽¹²⁾ hypothesized that differences in protective eyewear use between men and women may contribute to differences in eye injury rates. Eighty-two percent of eye trauma occurred at industrial facilities or constructive workshops during grinding, drilling, welding or nailing.

Ninety percent of them did not use any protective measure during their work activity, and the remaining 10% did not use proper glasses with side shields. The presenting symptom was pain in the majority of patients and 83% of them attended the clinic within two days from the onset of pain. This can be explained by the location of the FB on and within the cornea. Two thirds of the FBs were located in zone II and III, which have higher density of sensory nerve fiber endings than zones IV and V, and 61% were embedded deep in the cornea and reaching the anterior stromal layer where nerve endings located and these will cause more pain sensation. Although the commonest site for corneal foreign bodies was zone III (39%), the central and para-central zones (I and II) represented 41% of cases, which means that vision was threatened in these cases. Regarding foreign bodies distribution in the horizontal planes 63% of the foreign bodies were located in zone B, 23% in zone C and 14% in zone A, this means that in most of the cases foreign bodies were located within the palpebral fissure area and this reflects the major protective role of the eyelids. We found that there was a proportional relationship between the depth of the FBs within the cornea and the duration of sick leave. The deeper the FB embedded in the cornea the longer the duration of absence from work as these cases need longer time to heal after the removal of the corneal foreign body and there is a higher possibility of corneal scarring that may interfere with vision. All patients with epithelial layer FBs healed within 2 days, in comparison with 22% of patients with epithelial and anterior stromal FBs. About 7% of patients with epithelial and anterior stromal FBs had a sick leave for 9 days due to delayed healing after removal of the FBs and scar formation.

The most common associated finding was rust ring which was found in about two thirds of cases, this was not surprising because rust ring usually develops within few hours as a result of oxidation of ferrous containing foreign bodies.^(5,6,8) It is recommended to remove rust from the cornea as early as possible to prevent tissue permanent staining, necrosis, and scarring.⁽¹³⁾ Rust ring can be removed with chelating agent, desferrioxamine, eye ointment but this method proved to be less effective than surgical removal.⁽⁵⁾ Another method is the use of

electric drill which is very effective,⁽⁶⁾ but, unfortunately, it is not available in our hospital, so removal by 27 gauge needle remains the treatment of choice. Corneal abscess was found in 9% of patients and it was treated aggressively to prevent permanent corneal opacity or endophthalmitis.⁽²⁾ Bell's phenomenon was negative in 6 patients and the most common site of corneal foreign bodies was in zone III (50%) followed by II (33%) and IV (17%). This distribution was very similar to that found in Bell's positive patients. When horizontal planes distribution was studied the commonest site for foreign bodies in Bell's negative patients was in zone A (50%) followed by zone C (33%) and zone B (17%), while in Bell's positive patients, 63% foreign bodies were found in zone B, 23% in zone C and 14% in zone A, this emphasizes the importance of Bell's phenomenon in protecting the cornea. Eye patch was not used in almost half of the patients and there was no difference in rate of corneal erosion healing or decrease of pain after removal of the foreign bodies between this group and the group of patients who used eye patch, Table V. On the contrary patients who did not use eye patch were more satisfied as they had better binocular vision.⁽⁹⁾ A meta-analysis of seven studies was done by Turner and Rabiou,⁽¹⁴⁾ by searching the Cochrane Central Register of Controlled Trials and they concluded that treating simple corneal abrasions with a patch does not reduce pain, it results in a loss of binocular vision, and they discourage the use of eye patch for simple corneal abrasions. Complete healing was noticed in 62% of patients after two days of complete surgical

removal of corneal foreign bodies while 36% of patients were still complaining of pain; two thirds of them was due to incomplete healing of the corneal erosion and one third was mostly due to incomplete removal of the rust and to a lesser extent due to the presence of corneal abscess. At the end of treatment, 82% of patients were treated successfully without any residue on the cornea while 18% of patients had faint corneal opacity that did not interfere with best corrected visual acuity. Efficient prevention can prevent irreversible damage to the eye, loss of wages and work, and it saves the cost of the health care to be presented to those injuries. In our study the

absence from work ranged from two to nine days. Fong *et al.*⁽¹³⁾ in his survey of all eye injuries in Australia, found that the use of safety eyewear resulted in annual cost savings of \$59 million.

Conclusion

This study showed that corneal metallic foreign bodies are potentially sight threatening that occurs mostly as a result of occupational accidents in male workers who do not comply with the use of eye protection. Educational and safety programs and patient counselling on proper eye protection are essential and must be implemented in the work places to prevent serious eye injuries and work loss. Further studies are needed to find out why workers do not comply with safety measures to protect the eyes in work.

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