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ORIGINAL ARTICLE

Preventable Cause of Vision Loss: Demographic and Clinical Findings of Penetrating Eye Injuries

Önlenebilir Bir Görme Kaybı Nedeni: Delici Göz Yaralanması Olgularının Demografik ve Klinik Bulguları

[1]Emine Tinkir Kayitmazbatir, [2]Nur Elhuda Amer, [2]Hatice Sumeyye Karpuz, [2]Emine Karakas, [2]Hanife Yiğit, [2]Hafize Ucbas, [2]Cihan Das, [2]Meliha Beyza Acar, [2]Emine Aygordu, [2]Aybuke Olmez, [2]Ahmet Emircan Unler, [2]Furkan Boz, Eren Eryilmaz,

[1]Department of Ophthalmology, Faculty of Medicine, Selcuk University, Konya, Türkiye
[2] Faculty of Medicine, Selcuk University, Konya, Türkiye

Correspondence

Emine Tinkir Kayitmazbatir, Department of Ophthalmology, Faculty of Medicine, Selcuk University, Konya, Türkiye

E-Mail: drtinkir@gmail.com

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ABSTRACT

Background/Aims: To raise awareness about the preventability of penetrating eye injuries and contribute to the implementation of appropriate protective measures by identifying the causes and risk factors of such injuries.
Methods: The files of patients admitted to the Department of Ophthalmology due to penetrating eye injuries and undergoing repair for penetrating eye injuries between 2019 and 2023 were retrospectively reviewed. Patients' age, gender, the location where the trauma occurred, the incident causing the injury, the presence of a foreign body in the eye after the injury, and the need for repeated surgeries were examined, and the follow-up periods of the patients were recorded.
Results: A total of 107 patient files were included in the study. Of 107 patients, 82.24% (n=88) were male, and 17.76% (n=19) were female. The average age of the patients was 33.5 years, with a minimum age of one year and a maximum age of 86. The median age was 30.5 years. Among the patients, 29.91% (n=32) were under the age of 18. The most common trauma location was outdoor/garden/street at 41.12% (n=44), followed by the workplace at 25.23% (n=27) and home at 23.36% (n=25). Among the causes of trauma, metal objects were the leading cause at 23.36% (n=25), followed by natural objects like wood, stone, and tree branches at 14.95% (n=16), and cutting/piercing tools at 11.21% (n=12). The most frequent injuries were corneal injuries (n=43) (40.19%). Thirty-seven patients required additional surgery, with the most common second surgery being cataract surgery (n=22) (20.56%). A foreign body inside the eye was detected in 24 patients.
Conclusions: Penetrating eye injuries are a significant cause of preventable vision loss. Public education, raising awareness, early intervention methods, and encouraging the use of protective equipment are critically important in preventing these injuries.

Keywords: Eye health, penetrating eye injuries, preventable vision loss, protective eyewear

ÖZ

Amaç: Delici göz yaralanmalarının önlenebilirliği konusundaki farkındalığı artırmak ve bu tür yaralanmaların nedenlerini ve risk faktörlerini belirleyerek, uygun koruyucu tedbirlerin alınmasına katkıda bulunmaktır.
Gereç-Yöntem: 2019-2023 yılları arasında Selçuk Üniversitesi Tıp Fakültesi Hastanesi Göz Hastalıkları Kliniğine delici göz yaralanması nedeniyle başvurarak delici göz yaralanması tamiri yapılan hastaların dosyaları retrospektif olarak tarandı. Hastaların yaşı, cinsiyeti, travmanın gerçekleştiği yer ve yaralanmaya neden olan olay, göz içinde yaralanma sonrası yabancı cisim varlığı ve tekrarlayan ameliyat ihtiyaçları olup olmadığı incelenerek hastaların takip süreleri kaydedildi.
Bulgular: Toplamda 107 hasta dosyası çalışmaya dahil edildi. Hastaların %82,24'ü (n=88) erkek, %17,76'sı (n=19) kadındı. Hastaların ortalama yaşı 33,5 yıl olup, minimum yaş 1 ve maksimum yaş 86 idi; medyan yaş ise 30,5 yıl olarak kaydedildi. Hastaların %29,91'i (n=32) 18 yaşın altındaydı. En sık travma yeri dış ortam/bahçe/sokak %41,12 (n=44) olup bunu sırası ile iş yeri %25,23 (n=27) ve ev %23,36 (n=25) takip ediyordu. Travma nedenleri arasında metal nesneler %23,36 (n=25), odun, taş ve ağaç dalı gibi doğal nesneler %14,95 (n=16), kesici/delici aletler %11,21(n=12) ilk sırada geliyor idi. En sık yaralanmalar kornea (n=43, %40,19) yaralanmaları idi. 37 hastada ek ameliyata ihtiyaç duyulmuştu ve en sık yapılan ikinci ameliyat katarakt (n=22, %20,56) ameliyatı idi. 24 hastada göz içinde yabancı cisim tespit edilmişti.
Sonuç: Penetran göz yaralanmaları, önlenebilir görme kayıplarının önemli nedenlerindendir. Toplum eğitimi, farkındalığın artırılması, erken müdahale yöntemleri ve koruyucu ekipman kullanımının teşvik edilmesi, bu yaralanmaların önlenmesinde kritik öneme sahiptir.

Anahtar kelimeler: Göz sağlığı, penetran göz yaralanmaları, önlenebilir görme kaybı, koruyucu gözlük

Introduction

Eye injuries, particularly penetrating eye injuries, are significant causes of vision impairment and loss, which adversely affect quality of life and increase workforce loss (1). As a leading cause of preventable unilateral blindness, these injuries represent a major public health issue worldwide (2). Penetrating eye injuries are especially prevalent among children, industrial workers, and victims of traffic accidents. Despite advancements in diagnosis and treatment, these injuries continue to pose serious social and economic challenges (3). The impact of these injuries extends beyond physical health, significantly affecting psychological and emotional well-being. The long-term treatment processes and the need for recurrent surgeries following an injury severely

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compromise patients' quality of life. Additionally, the economic burden of these injuries is substantial. Treatment costs, loss of productivity, and patients' rehabilitation processes impose significant strains on both individuals and healthcare systems.

Materials and Methods

Ethics

This study received approval from the Local Ethics Committee of Selcuk University Faculty of Medicine (12.03.2024 2024/155).

Participants

Records of patients who presented to the Department of Ophthalmology with penetrating eye injuries and underwent repair between 2019 and 2023 were retrospectively reviewed. Data collected included the patient's age, gender, location and cause of injury, presence of intraocular foreign bodies, need for additional surgeries, and follow-up durations.

Statistical analysis

Data analysis was performed using SPSS (version 22.0 IBM Corp. Armonk, NY, USA), with basic descriptive statistics reported as frequencies, percentages, mean ± standard deviation, and median (interquartile range). The chi-square test was used to compare categorical parameters.

Results

The patients were 82.24% male (n=88) and 17.76% female (n=19). The average age of the patients was 33.5 years, with a minimum age of 1 and a maximum age of 86; the median age was 30.5 years (Figure 1). Among the patients, 29.91% (n=32) were under the age of 18. The left eye (n=63) was more frequently affected than the right eye (n=44). The annual distribution of the total 107 patients was as follows: 23 in 2019, 15 in 2020, 18 in 2021, 21 in 2022, and 30 in 2023. Although there were fewer admissions in 2020, the pandemic year, the difference in admission numbers between 2020 and other years was not statistically significant (p=0.256).

The most common trauma location was the outdoor environment/garden/street (41.12%, n=44), followed by the workplace (25.23%, n=27) and home (23.36%, n=25) (Figure 2). Among the causes of trauma, metal objects (23.36%, n=25), natural objects like wood, stone, and tree branches (14.95%, n=16), and sharp/piercing tools (11.21%, n=12) were the most common (Figure 3). For patients under 18 years of age, the most common trauma location was the outdoor environment/garden/street (n=14, 43.75%). In this age group, the leading cause of trauma was natural objects (n=7, 21.875%). For patients aged 18 and over, the most common trauma location was the outdoor environment/garden/street, and the leading cause of trauma was metal objects (n=25, 28.38%). In this age group, 39.19% (n=29) of the patients experienced trauma in the outdoor environment/garden/street, and 32.43% (n=24) experienced trauma in the workplace.

During the strict lockdown period in our country from March 2020 to June 2021, a detailed examination of trauma cases revealed diverse locations and causes of ocular injuries. Most traumas occurred outdoors (12 cases), followed by incidents at home (8 cases), and at workplaces (3 cases), with 2 cases from unspecified locations. The causes included natural objects such as stones and branches (6 cases), sharp or penetrating objects like knives and nails (5 cases), and other objects such as hose ends and bottle caps (3 cases). Additionally, falls and impacts, including traffic accidents, accounted for 4 cases, while there was 1 case involving a firearm, 2 cases caused by metal objects, 2 by glass objects, and 1 case of

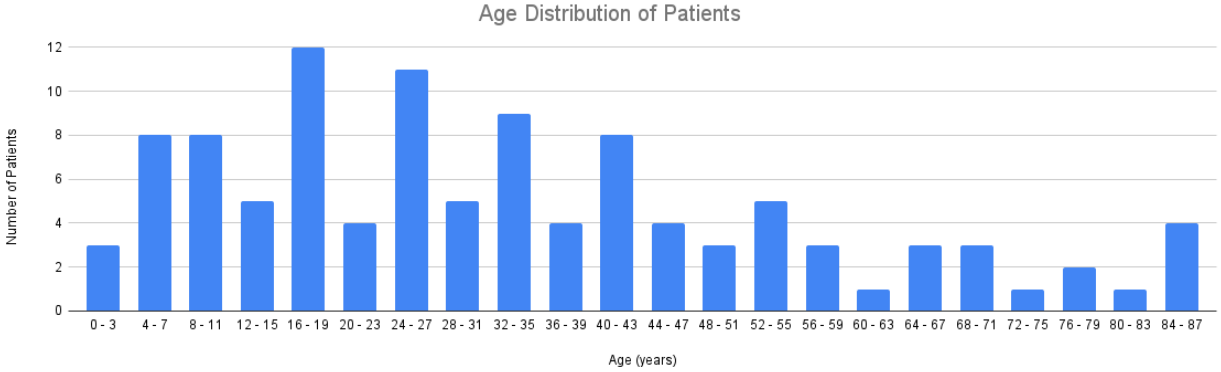

Figure 1. Distribution of patient ages. The average age of the patients was 33.5 years, with a minimum age of 1 and a maximum age of 86. The median age was 30.5 years.

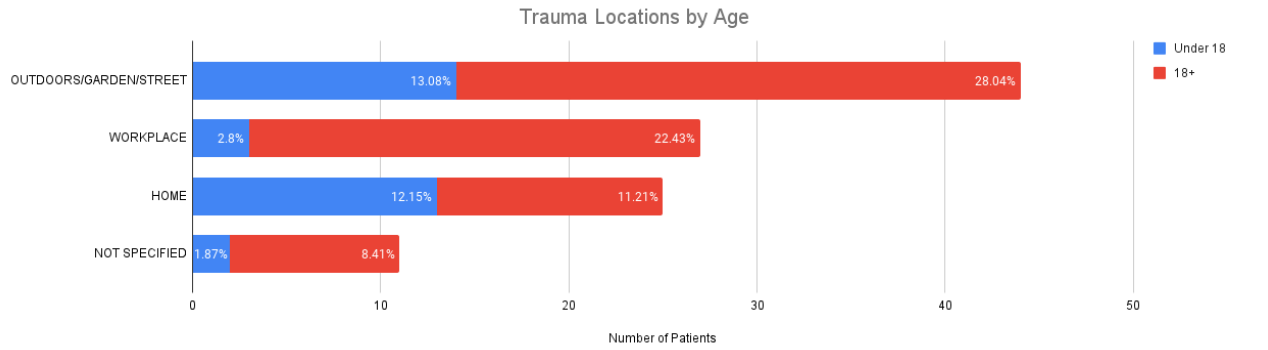

Figure 2. Trauma locations among patients. The most common trauma location was the outdoor environment/garden/street (41.12%, n=44), followed by the workplace (25.23%, n=27) and home (23.36%, n=25).

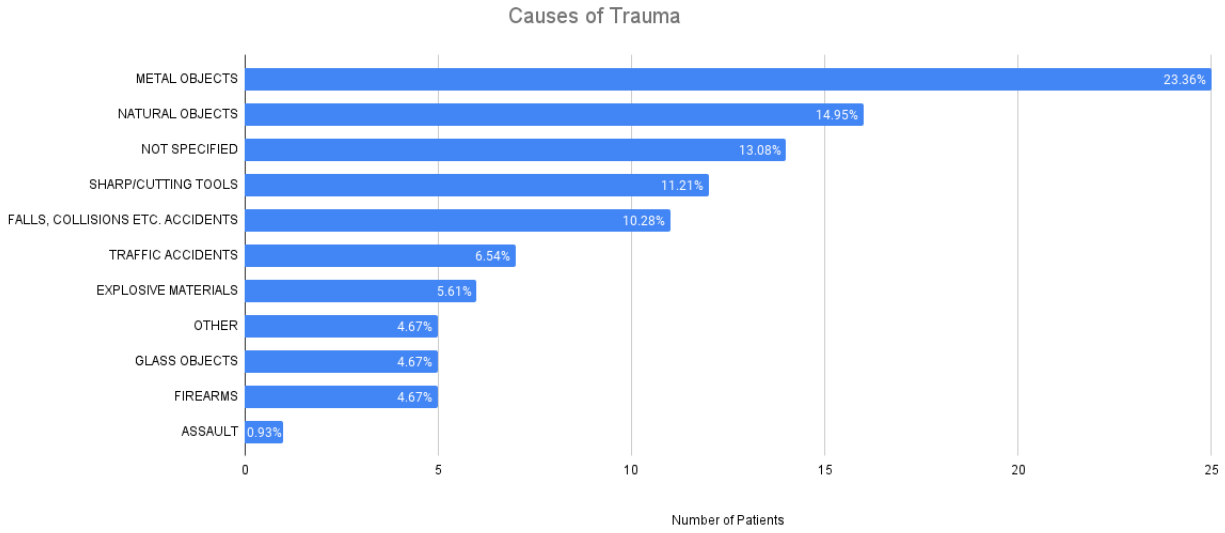

Figure 3. Causes of trauma among patients. The most common causes of trauma were metal objects (23.36%, n=25), natural objects like wood, stone, and tree branches (14.95%, n=16), and sharp/piercing tools (11.21%, n=12).

assault. The initial best corrected visual acuity (BCVA) of the patients was 1.6 logMAR, while the final BCVA improved to 1.0 logMAR. Of the 107 patients, 30 (28%) had a final visual acuity below the legal blindness threshold of 20/200.

Based on the available records, ocular trauma scores (OTS) could be definitively calculated for 9 patients. Among these, the OTS correlated with the final visual acuity in 7 patients. For the two remaining patients with an OTS score of 2, the final visual acuity was found to be 1.0 logMAR in one case and 0.4 logMAR in the other.

The most common injuries were corneal injuries (n=43, 40.19%) (Image 1). Thirty-seven patients required additional surgery, with cataract surgery being the most common second surgery (n=22, 20.56%). Foreign bodies were detected inside the eye in 24 patients. The average follow-up period for the patients was 178 days.

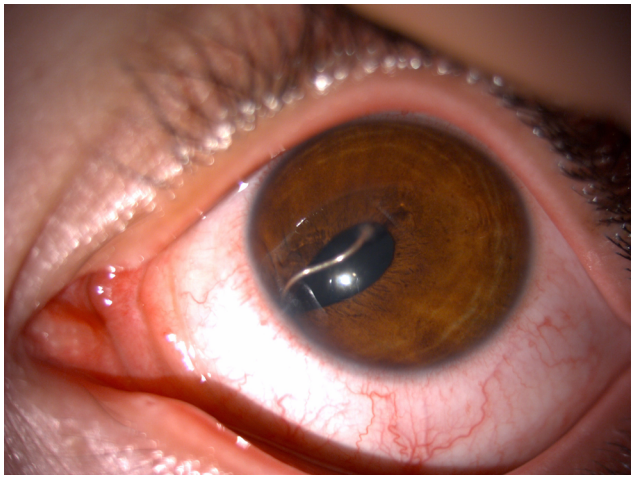

Image 1. Anterior segment photograph of a patient with corneal injury and a metallic foreign body in the anterior chamber. The image demonstrates the extent

of the corneal injury as well as the position of the foreign object, highlighting the severity of the trauma.

Discussion

Vision loss due to eye injuries accounts for 8-10% of all visual impairments and 5% of severe vision losses (4). Although eye injuries are not fatal, they can cause permanent visual impairment and are a significant cause of hospital admissions, especially in developing countries (5). It is estimated that annually, 55 million eye injuries occur, leading to more than one day of activity restriction, 750,000 cases require hospitalization, and 200,000 cases are due to penetrating eye injuries (6).

In a multicenter study including patients over 65 years old followed for ocular trauma, the most common occupations among injured males were farming (38.5%) and trade (26.9%), while 15.4% were retired. Among females, 59.3% were merchants, and 25.9% were housewives (7). Penetrating eye injuries were more common in males and the working-age population in our study.

In children, potentially preventable ocular trauma continues to be a significant cause of visual morbidity. Estimates using global population data show that 160,000 to 280,000 children under 15 years of age experience ocular trauma severe enough to require hospitalization each year (8). Although fewer articles focus on ocular trauma in children, injuries in this age group are more often preventable (9) and also more severe (10). In our study, 29.91% of the patients were under 18 years old.

A study examining ocular trauma patients during the pandemic found that the mechanisms of ocular trauma, injury locations, and demographic characteristics changed significantly during the pandemic, and eye injuries decreased in children during the total lockdown period in 2020 due to the absence of street, school, and sports activities (11). In our study, despite the decrease in admission numbers during the pandemic period, this decrease was not statistically significant compared to other years. The detailed analysis of trauma cases during the strict lockdown period from March 2020 to June 2021 provides valuable insights into the patterns of ocular injuries in our population. Notably, the majority of traumas occurred outdoors, likely reflecting increased engagement in activities such as gardening or other outdoor tasks during lockdowns when other forms of recreation were restricted. The significant number of incidents at home also underscores the role of domestic environments in injury occurrence during this period, possibly due to prolonged home confinement and engagement in household tasks. The presence of falls, traffic accidents, and other unintentional injuries further highlights the unpredictable nature of trauma, even during periods of limited mobility. Interestingly, there were also cases involving metal and glass objects, reflecting the potential risks associated with everyday household and workplace items. Understanding these trauma patterns is critical for developing targeted prevention strategies and safety guidelines, especially in times of restricted movement such as during a pandemic.

Identifying risk factors for eye trauma and taking necessary precautions is crucial due to the preventable nature of vision loss. In this study, 28% (n=30) of the patients had a final visual acuity below the legal blindness threshold of 20/200. The best treatment for occupational open-eye injuries is prevention. Most of these injuries can be prevented by the proper use of protective eyewear or other protective equipment. Numerous studies have demonstrated that the use of protective eyewear in the workplace prevents eye injuries (12, 13). Additionally, even the requirement for workers to use eye protection reduces the risk of eye injury (12).

A study analyzing the USEIR data reported that the majority of injured eyes achieved functional visual acuity levels with appropriate surgical and medical intervention. Prescription glasses and even non-prescription sunglasses provide measurable protection, resulting in fewer severe eye injuries among those wearing glasses (14). Another implied factor is that worker fatigue is a significant cause of occupational eye injuries. A previous study showed that the timing of injuries peaked twice during the workday, with most injuries occurring either before lunch or towards the end of the day (13).

To address the study limitations, several factors must be considered. First, the retrospective nature of the data collection may have introduced selection bias, as only cases that were treated and recorded in the hospital system were analyzed, potentially overlooking milder cases of ocular trauma that did not seek medical attention. Additionally, the study was conducted at a single center, which limits the generalizability of the findings to other populations or regions. Another limitation is the incomplete data regarding ocular trauma scores (OTS), as not all patients had OTS values available, which may affect the accuracy of the

correlation analysis between OTS and visual outcomes. Interestingly, two patients with low OTS scores still had relatively good visual outcomes, which could be attributed to early intervention and appropriate treatment, or the nature of their injuries being less severe than initially anticipated. This highlights the fact that while OTS is a valuable prognostic tool, individual patient factors and timely management play critical roles in recovery. Furthermore, the information on trauma causes and locations was sometimes incomplete, with some cases lacking precise details. The pandemic itself also created a unique context in which behavioral patterns, healthcare accessibility, and reporting mechanisms were affected, making it challenging to generalize these findings to non-pandemic periods. Lastly, we were unable to control for other variables such as pre-existing eye conditions or socio-economic factors that could have influenced trauma susceptibility.

Penetrating eye injuries are a significant cause of preventable vision loss. Social education, increasing awareness, adopting early intervention methods, and promoting the use of protective equipment are necessary for preventing eye injuries, especially at home and in the workplace. Future studies could allow for more personalized prevention strategies by examining injury patterns in different demographic groups in more detail.

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Declaration of Conflicting Interests

The authors declare that there is no conflict of interest.

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Author Contributions

Conception, E.T.K.; design, E.T.K., N.E.A., H.S.K., E.K., H.Y., H.U., C.D., M.B.A., E.A., A.O., A.E.U., F.B., E.E.; supervision, E.T.K.; resource, E.T.K.; materials, E.T.K., N.E.A., H.S.K., E.K., H.Y., H.U., C.D., M.B.A., E.A., A.O., A.E.U., F.B., E.E.; data collection and/or processing, E.T.K., N.E.A., H.S.K., E.K., H.Y., H.U., C.D., M.B.A., E.A., A.O., A.E.U., F.B., E.E.; analysis and/or interpretation E.T.K., N.E.A., H.S.K., E.K., H.Y., H.U., C.D., M.B.A., E.A., A.O., A.E.U., F.B., E.E.; literature review, E.T.K., N.E.A., H.S.K., E.K., H.Y., H.U., C.D., M.B.A., E.A., A.O., A.E.U., F.B., E.E.; writer, E.T.K.; critical review, E.T.K.

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