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Н.О. Байрамова, Е.М. Гасимов
National Ophthalmology Center named after Academician Z. Aliyeva, Baku, Azerbaijan

ANALYSIS OF EYE AND ITS ADNEXA INJURIES INVOLVING INTRAOCULAR FOREIGN BODIES

e-mail: med_avtor@mail.ru

An analysis was conducted on the structure of injuries of eye and its adnexa involving foreign bodies among patients hospitalized at the National Ophthalmology Center named after Academician Zarifa Aliyeva. A total of 2,225 inpatient records from 2019 to 2023 were reviewed, among which 394 cases involved the presence of superficial or intraocular foreign bodies. In cases of closed globe injuries, superficial foreign bodies were identified in 29.3 % of cases (n=194), with the cornea being the most frequent site of localization (57.7 % of all such cases). In open globe injuries – a statistically significant portion of all injuries – 64.8 % of cases involved foreign bodies localized in the vitreous body. Among all injuries affecting the ocular adnexa, foreign bodies were noted in the eyelid region in 12 cases (6.9 %). The composition of foreign bodies varied depending on the site where the injury occurred. The predominantly organic nature of the foreign bodies highlights the importance of assessing the timeliness of patient presentation to prevent bacterial complications in the injured eyes.

Key words: eye injuries, penetrating, nonpenetrating, intraocular foreign bodies.

Х.О. Байрамова, Е.М. Гасимов **АНАЛІЗ ТРАВМ ОКА ТА ЙОГО ПРИДАТКОВОГО АПАРАТУ** **З НАЯВНІСТЮ СТОРОННІХ ТІЛ**

Проведено аналіз структури травм ока та його придаткового апарату з наявністю чужорідних тіл у пацієнтів, госпіталізованих до Національного центру офтальмології імені академіка Заріфи Алієвої. Було вивчено 2 225 історій хвороби за період з 2019 по 2023 рік, з яких у 394 випадках відзначалася наявність поверхневих або внутрішньоочних чужорідних тіл. За закритих травм ока поверхневі чужорідні тіла виявляли в 29,3 % випадків (n=194), причому найчастішою їх локалізацією була рогівка (57,7 % від усіх вивчених закритих травм). За відкритих травм очного яблука, які склали статистично значущу частку всіх травм, у 64,8 % випадків чужорідні тіла локалізувалися в склоподібному тілі. Серед усіх травм, що зачіпають придатковий апарат ока, у ділянці повік чужорідні тіла відмічено в 12 випадках (6,9 %). Склад чужорідних тіл варіював залежно від місця отримання травми. Переважно органічний характер чужорідних тіл підкреслює важливість своєчасного звернення пацієнтів за медичною допомогою з метою запобігання бактеріальних ускладнень пошкодженого ока.

Ключові слова: травми ока, проникаючі, непроникаючі, внутрішньоочні чужорідні тіла.

Ocular trauma with the presence of foreign bodies in open and closed globe injuries is one of the most complex and dangerous forms of eye injuries that require immediate specialized care [3, 8]. Nowadays, the relevance of this problem throughout the world and in Azerbaijan is due to both the high level of ocular trauma and the complexity of treatment, which requires a highly qualified approach and the use of advanced diagnostic technologies. According to various authors, there is currently an increase in the number of cases of traumatic eye injuries, which is associated with the expansion of industrial activity, an increase in road accidents and an increased interest in sports [1, 7]. In addition, in various branches of agriculture, there has also been an increase in the number of cases associated with the penetration of foreign bodies into the eye area. An increase in the frequency of eye injuries among the elderly is also of great

concern. However, despite the improvement of existing diagnostic methods and the development of ophthalmological science, the diagnosis and treatment of trauma with the presence of foreign bodies still pose a serious challenge for ophthalmologists.

It is known from numerous literary sources that eye injuries with the presence of foreign bodies can be accompanied by complications such as infectious processes, increased intraocular pressure, etc., ultimately leading to disability as a result of decreased or complete loss of vision [5, 9]. In this regard, rapid identification and timely removal of a foreign body from the eye directly affects the prognosis and outcome of the disease. And knowledge of the mechanisms and nature of ophthalmic trauma with the presence of a foreign body can play a key role in minimizing the risk of loss of vision of the patient and in ensuring a successful outcome of treatment.

The relevance of studying ophthalmic injuries with the presence of foreign bodies is due not only to the high risks to the patient's health, but also to the need to develop new, more effective treatment methods, as well as to strengthen preventive measures to prevent injuries.

Thus, taking into account the above, conducting a comprehensive analysis of the frequency of occurrence, localization and nature of foreign bodies in eye injuries is a pressing issue that requires a solution. And stratification of data by types of injuries, anatomical localization and expected composition of foreign bodies will improve early treatment tactics.

The purpose of the study was to assess the frequency of occurrence and nature of foreign intraocular bodies among patients with eye injuries hospitalized in the National Ophthalmology Center named after Academician Zarifa Aliyeva.

Materials and methods. A retrospective analysis of records of inpatients with various eye injuries hospitalized in 2019–2023 at the National Ophthalmology Center named after Academician Zarifa Aliyeva (NOC named after Academician Z. Aliyeva) was conducted. Only patients with eye injuries involving foreign bodies were included in this study. The inclusion criterion for this study was the presence of any type of eye injury and its adnexa. The diagnosis of “ocular trauma” was established according to clinical manifestations based on the BETTS classification used at the NOC named after Academician Z. Aliyeva and the International Statistical Classification of Diseases and Related Health Problems 10th revision (ICD–10), class VII: Eye injuries [6].

According to the recommendations of the international BETTS classification, in this work the main object of analysis as a unit of observation of ocular trauma was the eye. This approach allows for a more accurate reflection of the incidence, structure and nature of injuries, as well as their complication rates and outcomes. This, in turn, allows for comparability with world literature data [5, 11].

A total of 2225 cases with various ocular traumas were studied, including 394 with the presence of superficial and intraocular foreign bodies. All information about the time, place, conditions of injury and the time of medical help were carefully collected from all patients. The average age of patients was 34.5 ± 1.2 years. The largest proportion of ocular trauma occurred in men of working age in the age group 30–44 years (32.9 % of all patients).

Statistical analysis was performed using Microsoft Office Excel 2007 software, using descriptive statistics methods. For statistical analysis of the relationship between the location of the eye injury and the nature of the foreign body, Pearson's χ^2 test was used.

Results of the study and their discussion. The largest proportion of all ocular trauma studied were open globe injuries (n=1389). Among them, penetrating eye injuries have occupied a dominant position throughout all years of the study. The average value of this category for the specified period was 81.9 ± 2.7 %. However, there is a clear downward trend in their share: from 83.6 % in 2019 to 76.4 % in 2023. Statistical data processing using the Student's t-test revealed the reliability of this decrease ($t=2.87$; $p<0.05$). The observed increase in the proportion of open globe injuries with the presence of intraocular foreign bodies over the years may be due to changes in traumatic factors, including an increase in the use of household and industrial tools without eye protection.

Closed globe injuries were 2.1 times less common (n=662). Among non-penetrating eye injuries, lamellar ruptures account for the largest proportion of all those studied, averaging 82.3 ± 5.4 % over the study period. Adnexal injuries accounted for only 7.8 % (n=174).

In 29.3 % of closed globe injuries (n=194), superficial foreign bodies were found. The most common location of foreign bodies not accompanied by signs of tissue perforation was the cornea (57.7 % of all cases). (Fig. 1). Of these, three cases involved eyes with combined eye trauma, the presence of a foreign body on both the cornea and the eyelids. The second most common localization is in the eyelid area – 29.4 %.

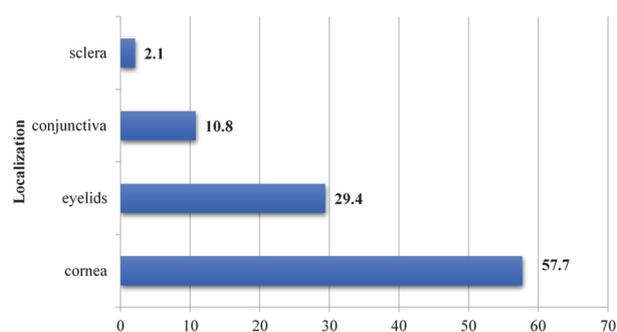


Fig. 1. Results of the study of the localization of foreign bodies in closed and combined globe injuries among patients hospitalized in the National Ophthalmology Center named after Zarifa Aliyeva.

Intraocular foreign bodies with conjunctival localization accounted for 10.8 % of all cases of closed globe injuries with the presence of a foreign body. The smallest proportion was made up of scleral foreign bodies – 2.1 %, which is probably associated both with the anatomical density of the sclera and with the fact that penetration to this level is less common in closed globe injuries and is more typical for penetrating injuries of a combined nature.

In all cases, dynamic observation and preventive treatment were carried out to avoid secondary complications such as endophthalmitis and other inflammatory reactions.

The composition of foreign bodies in the eye in non-penetrating wounds varies depending on the location of the injury (Table 1).

Table 1

Nature of foreign bodies of the eye in non-penetrating wounds depending on the location of the injury, in patients hospitalized in the National Ophthalmology Center named after Acad.Zarifa Aliyeva

Place of closed globe injury with a foreign body	Character of an intraocular foreign body	Abs. number (N=194)	Percentage of all cases with foreign bodies in closed globe injury
Yard, or in nature (forest, garden, beach, etc.) (n=110)	Organic	63	57.2
	Metallic	29	26.4
	Glass	7	6.4
	Unknown	7	6.4
	Plastic	4	3.6
Street injuries (n=27)	Organic	15	55.6
	Glass	4	14.8
	Metallic	3	11.1
	Plastic	3	11.1
	Unknown	2	7.4
Industrial injuries (n=26)	Metallic	17	65.4
	Organic	5	19.3
	Plastic	3	11.5
	Glass	1	3.8
Household injuries (n=12)	Organic	9	75.1
	Metallic	2	16.7
	Glass	1	4.1
	Unknown	1	4.1
Transport injuries (n=7)	Organic	2	28.6
	Metallic	2	28.6
	Plastic	2	28.6
	Unknown	1	14.2
Agricultural injuries (n=5)	Organic	4	80.0
	Metallic	1	20.0
Unknown (n=3)	Organic	3	100
Criminal injuries (n=2)	Glass	2	100
School injuries (n=1)	Plastic	1	100
Sports-related eye injuries (n=1)	Glass	1	100

The analysis performed using Pearson's χ^2 test showed the presence of statistically significant differences in the distribution of the nature of the foreign body depending on the location of the injury ($\chi^2 = 56.83$, $p < 0.001$).

Thus, among the extracted foreign bodies of the eye obtained in an open space, organic elements such as wood, grass, seeds, insects (bee sting), etc. accounted for a predominantly high percentage.

In cases of industrial injuries (n=26, 13.4 %), the majority of foreign bodies in closed eye injuries were metallic in nature (65.4 %), which is explained by the characteristics of the man-made environment. In household conditions, organic foreign bodies also predominate (75.1 %), which can be associated with injuries when working with household items, food products or plants. Such as transport, school, sports-related and criminal injuries, is characterized by a narrow range of foreign bodies, and in most cases is either glass or plastic. It should also be noted that in eye injuries resulting from road traffic accidents, plastic, metal and organic materials are found in equal proportions (28.6 % of all studied).

Thus, summarizing the obtained results, it should be noted that the presence of non-penetrating foreign bodies was recorded in 29.3 % of patients, with the largest proportion of them localized on the eyelids and cornea. The spread of organic foreign bodies is of significant epidemiological significance, especially in open areas, due to their high infectious potential.

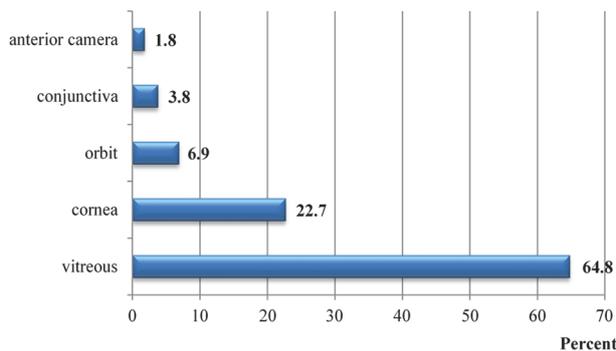


Fig 2. Results of the study of the localization of foreign bodies in open globe injuries among patients hospitalized in the National Ophthalmology Center named after Acad.Zarifa Aliyeva

complications such as ulcer, abscess, hypopyon, which in turn may lead to the development of endophthalmitis.

The composition of foreign bodies of the eye in penetrating wounds varies depending on the place of injury (Table 2).

Table 2

Nature of foreign bodies of the eye in penetrating wounds, depending on the place of injury in patients hospitalized in National Ophthalmology Center named after Academician Zarifa Aliyeva

Place of open globe injury with foreign body	Character of a foreign body in the eye	Abs. number (N=188)	Percentage of all cases with foreign bodies in open globe injury
Yard, or in nature (forest, garden, beach, etc.) (n=114)	Metal	78	68.4
	Organic	25	21.9
	Unknown	9	7.9
	Plastic	1	0.9
	Glass	1	0.9
Industrial injuries (n=45)	Metal	45	100
Household injuries (n=11)	Metal	7	63.6
	Glass	2	18.2
	Unknown	1	9.1
	Plastic	1	9.1
Street injuries (n=10)	Organic	7	70.0
	Metal	2	20.0
	Unknown	1	10.0
Agricultural injuries (n=3)	Organic	3	100
Transport injuries (n=3)	Metal	1	33.3
	Unknown	1	33.3
	Glass	1	33.3
Criminal injuries (n=1)	Metal	1	100
School injuries (n=1)	Organic	1	100

The analysis revealed the presence of a statistically significant association between these variables ($\chi^2 = 0.87$ at $p < 0.001$). The nature of the distribution of foreign bodies by origin deserves special attention. Thus, as can be seen from Table 2, in 68.4 % of cases of injuries received in open space conditions, the presence of a foreign body of metal origin in the eye predominated.

In cases of industrial injuries of the organ of vision, all foreign bodies in the eye were of metal origin (100 %). This fully corresponds to the nature of mechanical damage typical for industrial areas and workshops, where the main source of injury is working tools, equipment or metal fragments.

In penetrating eye injuries received in household conditions, on the contrary, along with metallic foreign bodies of the eye (63.6 %), fragments of both glass (18.2 %) and plastic (9.1 %) were also detected. This picture reflects a wider range of traumatic factors, which is associated with a heterogeneous household environment.

In street eye injuries, a statistically significant predominant proportion of intraocular foreign bodies were of organic origin (75.0 % of cases, $p < 0.05$). In agricultural injuries, all intraocular foreign bodies

detected were of natural (organic) origin (100 %). In road traffic eye injuries, the intraocular foreign bodies were metallic, organic, and of unknown origin (1 cases each). Intraocular foreign bodies in school eye trauma were of organic origin.

Thus, the conducted analysis showed that the nature of the foreign body in penetrating eye wounds is closely related to the conditions and mechanism of injury, which can be taken into account when forming diagnostic hypotheses and choosing treatment tactics.

With regard to adnexal injuries, of all the cases studied, 12 (6.9 %) patients (12 eyes) had a foreign body in the eyelid area. In five cases (2.9 %), the introduction of foreign bodies into the orbital region was detected. Foreign bodies removed from the adnexa of the eye were of organic and metallic origin (66.7 % and 33.3 %, respectively).

Thus, obtained results demonstrate the predominance of open globe injuries, which accounted for 62.6 % of all hospitalized cases. Penetrating injuries were the most frequent type among them throughout the entire observation period, despite a statistically significant trend toward a decrease in their proportion. As some authors suggest, this trend may be associated with improved preventive measures, increased availability of protective equipment (such as safety glasses), and greater awareness of eye injury risks both in household and occupational settings [2, 7].

An interesting observation, in our opinion, is the increase by years in open globe injuries' proportion involving intraocular foreign bodies. Conjunctival form of localization is typical for the penetration of small particles, often not accompanied by pronounced clinical symptoms, but having a risk of inflammatory complications when present in tissues for a long time [10]. According to several studies, this may reflect changes in the nature of traumatic factors encountered in both household and industrial environments [3, 9]. As many authors point out, the presence of organic foreign bodies can increase the risk of infection (bacteria, fungi) and the development of inflammatory eye diseases, including endophthalmitis [8, 12].

Among closed globe injuries, lamellar lacerations accounted for the largest proportion – what corresponds with data from other studies' data – indicating the predominance of partial-thickness injuries of the eye globe as a result of blunt trauma [5].

Of particular interest is the localization of superficial foreign bodies in closed globe injuries. Among one-third of such cases, foreign bodies were identified in the cornea. This finding aligns with the literature emphasizing the vulnerability of the anterior segment of the eye traumas [14]. Several authors have also noted that the presence of a foreign body in the cornea, even in the perforation's absence, requires close monitoring due to the risk of appearance of infectious complications such as corneal ulcer, abscess, or endophthalmitis [4, 8].

The distribution of foreign bodies by composition also revealed statistically significant differences depending on the injury setting. For example, in outdoor and agricultural injuries, organic materials predominated, whereas in industrial injuries, metallic foreign bodies were found in nearly all cases, which fully corresponds with current epidemiological data [10].

In the moist intraocular environment, the metal undergoes oxidation with the subsequent release of ions that have a cytotoxic effect, which can ultimately lead to dystrophic changes in the retina, secondary glaucoma and cataracts [10].

Injuries to the ocular adnexa with foreign bodies located in the eyelid and orbital areas were relatively rare. However, as noted by Yaşa D. and colleagues, such cases can also present both diagnostic and therapeutic challenges, especially when associated with organic materials and a high risk of infection [13].

Conclusion

Analysis of the presence of foreign bodies in various forms of ocular trauma allows us to make a number of important clinical conclusions. In closed globe injuries, the presence of superficial foreign bodies, predominantly localized in the cornea, indicates a high probability of injuries sustained during grinding, drilling, and other types of industrial or household activities without the use of protective equipment. Despite the external "insignificance" of such injuries, they require mandatory examination with a slit lamp, removal of the foreign body and antiseptic treatment to avoid the development of keratitis and secondary infectious complications.

In open penetrating eye injuries, the detection of foreign bodies, especially inside the vitreous body, indicates high energy of the traumatic agent and significantly increases the risk of endophthalmitis, retinal detachment and loss of anatomical integrity of the eye. These cases require emergency surgical tactics, in which the timing of patient admission and the accuracy of preoperative imaging are particularly important.

Foreign bodies in adnexal injuries, such as the eyelids and conjunctiva, usually pose less of a threat to vision, but fragments that are not diagnosed in a timely manner can lead to local inflammation, the formation of abscesses and chronic blepharitis. Such injuries require careful examination and dynamic monitoring.

Thus, the presence of foreign bodies in any type of ophthalmic trauma is an important diagnostic and prognostic factor that determines treatment tactics and the risks of possible complications. Their timely detection, classification and elimination are key steps in preventing vision loss and maintaining organ function. And the predominantly organic nature of superficial and intraocular foreign bodies indicates the need to study the timeliness of patient treatment and the choice of the necessary treatment tactics aimed at preventing bacterial complications in injured eyes.

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