



Mechanical injuries of the eye: incidence, structure and possibilities for prevention

Mehaničke povrede oka: učestalost, struktura i mogućnost prevencije

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Abstract

Background/Aim. Despite technological advances used in everyday clinical practice, injuries of the eye caused by various agents still produce blindness and poor vision in a significant number of people. The aim of this study was to analyze factors leading to occurrence of mechanical injuries of the eye. **Methods.** Mechanic injuries of the eye in patients treated at the Institute for Eye Diseases of the Clinical Center of Serbia in Belgrade, in an eight-year period were analyzed. Investigated parameters were: sex and age of patients, their profession, time of injury (months, days and hours), place and way of injury and a visual acuity on admission and dismiss, as well as further follow-up. Type of injury (closed or opened injuries of the eyeball), with all the complications that followed were carefully noted and monitored. The time of primary surgical repair was noted and analyzed, whenever necessary. **Results.** In the period of eight years, 2 701 patients (2 257 males and 444 females) were treated in the hospital due to mechanical injury of the eye. Almost equally, both the right (50.5%) and the left eye (49.5%) were injured, while in 39 (1.4%) patients both eyes were injured at the same time. The injuries occurred in all age groups, but mostly in adults, employed persons, aged from 16 to 65 (70%). Among injured children, 18.8% were beyond the age of 15. Most frequent injuries occurred in workers (39%), and then in pupils (16.3%). Wood was the mean of injury in 23.7% of cases, sharp and pointed objects in 16.1%, hammering and metal particles in 14.4%, glass in 10.1%, and other different objects in the rest of 35.7% of all injured persons. There were other very serious means or mechanisms of eye injuries, like hair band, dog bite, rooster's beak,

rubber bullet, etc. Considering months in the year and days in the week, the injuries were almost equally distributed, and related to the time of day even 75% occurred between 10 a.m. and 10 p.m. Most injuries (38.2%) occurred while doing some work out of professional working place, while only 25.4% injuries occurred at the working place. Most of the patients (30.3%) had visual acuity L+P+ (light perception with correct projection) only, on attendance, but it varied from complete blindness to 1.0. There were 1 282 blunt injuries (contusion) (47.5%) and 1 373 penetrating eyeball injuries (50.8%), while the rest (1.7%) were injuries of ocular adnexa. Most of the primary surgical treatments (63.7%) were done in the first 24 hours from the moment of the injury. At dismiss, visual acuity was normal in 53.2%, the eye was blind in 19.1% injured patients. **Conclusion.** The results of this study showed that the injuries occurred most frequently in actively working people and pupils, that men were injured five times more often than women; that wood, sharp objects and glass were the most common means, that there was an equal number of blunt injuries and penetrating wounds, and that it was very important to treat injury promptly, preferably within the first 24 hours. By further analysis, it might be concluded that many injuries could have been prevented, avoiding long medical treatment and accompanying costs, and what is most important - permanent invalidity caused by reduced visual function or blindness of the injured eye is avoidable.

Key words:

eye injuries; eye injuries, penetrating; incidence; diagnosis; treatment outcome; risk factors; risk management.

Apstrakt

Uvod/Cilj. Uprkos tehničkim dostignućima koja se koriste u svakodnevnoj kliničkoj praksi, mehaničke povrede oka izazvane različitim uzrocima još uvek dovode do slepila i smanjene sposobnosti vida kod značajnog broja ljudi. Cilj ovog rada bio je analiza faktora koji dovode do mehaničke povrede oka. **Metode.** Analizirane su mehaničke povrede oka kod bolesnika koji su bolnički lečeni u Institutu za oč-

ne bolesti Kliničkog centra Srbije u Beogradu u periodu od osam godina. Od parametara analizirani su pol i starost bolesnika, njihovo zanimanje, vreme kada se povreda desila (po mesecima, danima i satima), mesto i način gde su se povrede desile, kao i oština vida pri prijemu i pri otpustu ili kasnijim kontrolama. Analizirana je i vrsta povrede (zatvorena ili otvorena povreda očne jabučice) sa svim komplikacijama. Na kraju je dato i vreme kada je izvršena primarna hirurška obrada rane na oku, ukoliko je ona bila neop-

hodna. **Rezultati.** U toku osam godina, zbog mehaničke povrede oka, bolnički je lečeno 2 701 bolesnik (2 257 osoba muškog i 444 osoba ženskog pola). Skoro podjednako bilo je povređivano i desno (50,5%) i levo oko (49,5%), dok su kod 39 (1,4%) bolesnika bila povređena oba oka istovremeno. Povrede su se dešavale u svim starosnim kategorijama, ali najčešće kod odraslih radno aktivnih osoba starosti od 16 do 65 godina (70,0%). Među decom uzrasta do 15 godina bilo je 18,8% povređenih. Najčešće su se povređivali radnici (39,0%), a zatim učenici (16,3%). Drvo je bilo uzrok povrede kod 23,7%, oštri i šiljati predmeti kod 16,1% ispitanika, čekić i metal kod 14,4%, staklo kod 10,1%, a drugi uzročnici kod preostalih 35,7% povređenih ispitanika. Bilo je i vrlo retkih uzročnika povrda oka, kao što su rajf, ujed psa, kljun petla, gumeni metak itd. Prema mesecima i danima, povrede su bile skoro podjednako raspoređene, a prema dobu dana, čak 75,0% povreda desilo se od 10 sati pre podne do 10 sati uveče. Najviše povreda (38,2%) desilo se pri obavljanju posla van profesionalnog radnog mesta, dok je na poslu zadobijeno 25,4% povreda. Najveći broj bolesnika (30,3%) pri prijemu imao je vidnu oštrinu L+P+ (osećaj svetla sa tačnom projekcijom), ali je

vidna oštrina na prijemu bila od amauroze do 1,0. Zabeležene su 1 282 kontuzione povrede (47,5%) i 1 373 penetrantne povrede očne jabučice (50,8%), dok su ostale (1,7%) bile povrede pomoćnih organa oka. Najveći broj primarnih obrada rane (63,7%) izvršen je u prva 24 časa od momenta povrede. Pri otpustu vidna oštrina je bila normalna kod 53,2%, dok je amauroza postojala kod 19,1% povređenih bolesnika. **Zaključak.** Rezultati ove studije pokazuju da se najčešće povređuje radno aktivno stanovništvo i učenici, (muškarci pet puta češće od žena), da su drvo, oštri predmeti i staklo najčešći uzročnici povreda, da je podjednak broj kontuzionih i penetrantnih povreda i da se neophodna primarna obrada rane preduzima najčešće u prva 24 časa od povrede. Daljom analizom ovih faktora može se zaključiti da su se mnoge povrede mogle prevenirati, čime bi se sprečilo dugotrajno lečenje i troškovi lečenja, a ono što je najvažnije, mogla se izbeći trajna invalidnost zbog smanjenja sposobnosti vida ili slepila na povređenom oku.

Ključne reči:

oko, povrede; oko, penetrantne povrede; incidenca; dijagnoza; lečenje, ishod; faktori rizika; rizik, kontrola.

Introduction

Eye injuries are an important cause of blindness and poor vision^{1,2}. They are more common in young people, causing permanent invalidity, as well as a reduced working and everyday life capability.

In children, injuries are one of the most common causes of blindness³.

Eye injuries can be caused by various agents. In underdeveloped countries, as well as in rural areas, they are most frequently caused by wood⁴, by branch or thorn, while in industrially developed countries they most frequently occur at place of work, sport grounds, or during recreation⁵⁻⁷. Children are more frequently injured at home or while playing, with blunt or sharp objects^{8,9}.

Although nowadays we do have powerful drugs and microsurgery reached unimagined limits, prognosis for serious eye injuries is still poor, in general^{10,11}. Eye injuries request long-lasting care, including hospital treatment, a long period of conservative medication, with a possibility of one or repeated surgeries^{12,13}. This has a big social and economic effects¹¹. That is why in many studies, particularly in those dealing with epidemiology of eye injuries, the full attention has been given to preventive measures^{6,14-17}.

In our previous paper¹⁸ we dealt with similar problems of mechanical eye injuries, only for some shorter period of time - five years.

The aim of this study was to analyze factors leading to occurrence of mechanical eye injuries as well as to reveal the possibilities for prevention and, consequently, to reduce the number of eye injuries.

Methods

This prospective study included patients with mechanical injuries of the eye that had been treated at the Institute for

Eye Diseases of the Clinical Center of Serbia in Belgrade during a period of eight years (January 1st 2000 - December 31st 2007). Only the patients with major traumas were hospitalized, and both contusions and penetrating injuries were analyzed.

The following factors were noted: sex and ages of patients, their occupation, place of injury, way of injury, time (concerning months, days and the time of the day), visual acuity in the moment of the first contact with the doctor, and visual acuity at dismiss, too. Types of injuries (blunt or penetrating) were noted, with all possible complications. In blunt eyeball injuries, damage to the structures in the eye were examined, as well as the eyeball rupture if present; in penetrating injuries, we studied the place of eyeball penetration, whether a scleral wound was in question, or both cornea and sclera were injured at the same time. Also, it was emphasized whether the injury was accompanied with a traumatic cataract or not. The number of penetrating injuries with a retained intrabulbar foreign body was shown. At the very end, we noted the time of primary surgical repair.

Results

As a result of mechanic injuries, in the period of eight years, 2 701 patients were hospitably treated. That means that an average of one patient a day was kept for treatment in the hospital. Of all hospitalized, there were in total 2 257 men (83.6%) and 444 women (16.4%), the male/female ratio being 5.1:1. Out of 2 701 patients, 39 (1.4%) had injuries to both eyes, while 2 662 (98.6%) had one eye injured. Of those, 1 364 (50.5%) had the right eye injured, 1 337 (49.5%) the left one. Injured patients aged from 2 to 88 years, with an average of 35.5 years of age (Figure 1).

Considering patient's occupation, there were 1 053 (39.0%) workers, 439 (16.3%) pupils, 309 (11.4%) unem-

ployed people, 240 (8.9%) farmers, 187 (6.9%) employees, 183 (6.8%) preschool children, 164 (6.1%) housewives, 60 (2.2%) students and 66 (2.4%) retired people injured (Figure 2).

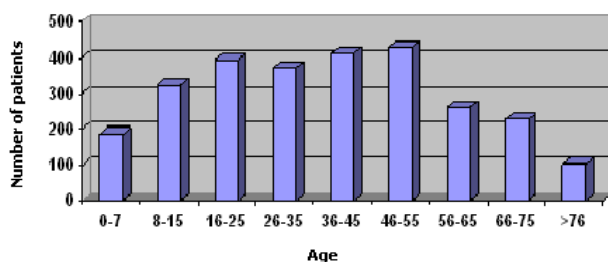


Fig. 1 – Age distribution of injured patients

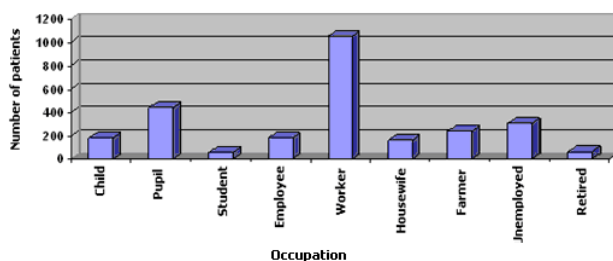


Fig. 2 – Distribution of injured patients according to their occupation

The causes and mechanisms of injuries were: wood in 639 (23.7%) studied persons, pointed and sharp objects in 435 (16.1%), hammering and metal particles in 389 (14.4%), glass in 274 (10.1%), cork of beer or any other bottle in 82 (3.0%), plastics in 119 (4.4%), electric battery explosion in 31 (1.1%), injuries due to falls in 150 (5.5%), eye injuries in fighting in 149 (5.5%), puck suspenders and elastic rubber bands in 64 (2.4%). The rest of the patients, 203 (7.5%), got injured in different, often bizarre manners as violations of the rule or an explosive object, for example (Figure 3).

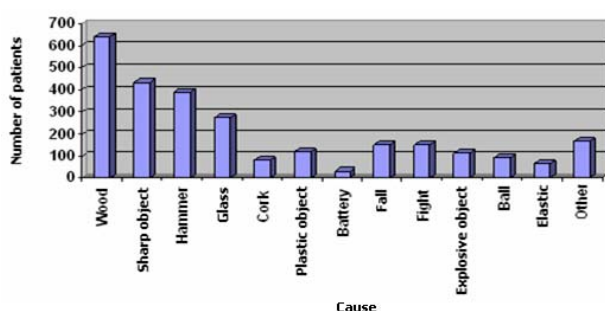


Fig. 3 – Distribution of injured patients according to cause and mechanism of injury

Injuries to both eyes occurred mainly in traffic accidents or were caused by explosive equipments. One psychotic patient was self-injured: with his hand, he pulled out his own right eyeball and destroyed the left one leading it to traumatic rupture and semievisceration.

Month distribution was unremarkable (Figure 4). For the days in a week, the number of patients with eye injuries was also similar – varying from 299 on Tuesdays to 430 on Sundays (Figure 5).

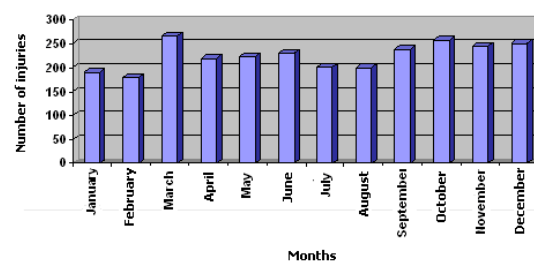


Fig. 4 – Number of injuries by months

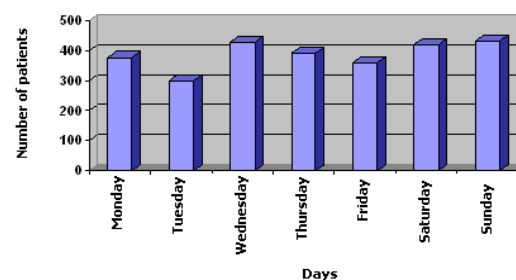


Fig. 5 – Number of patients with eye injuries by days in week

Taking a look at distribution of injuries depending on the part of a day, the day is divided into four-hour periods. Between 6 h a.m. and 10 h a.m. - 461 (17.1%) patients were injured, from 10 h to 14 h - 749 (27.7%), from 14 h to 18 h - 836 (31.0%), from 18 h to 22 h - 440 (16.3%), from 22 h to 02 h - 136 (5.0%), from 2 h to 6 h a.m. - 79 (2.9%) patients were injured (Figure 6).

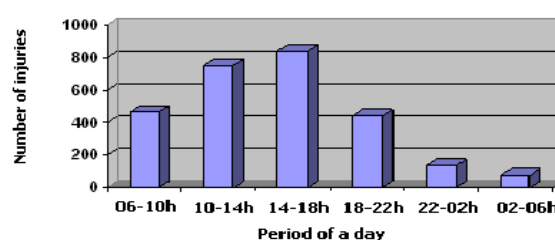


Fig. 6 – Number of injuries in different periods of a day

Injuries occurred in different places: at the professional working place in 686 (25.4%) patients, at work but not at the professional working place in 1031 (38.2%), at home in 336 (12.4%) patients, in traffic accident in 134 (5.0%), while playing in 217 (8.0%), during recreation in 130 (4.8%), at school in 106 (3.9%) patients (Figure 7).

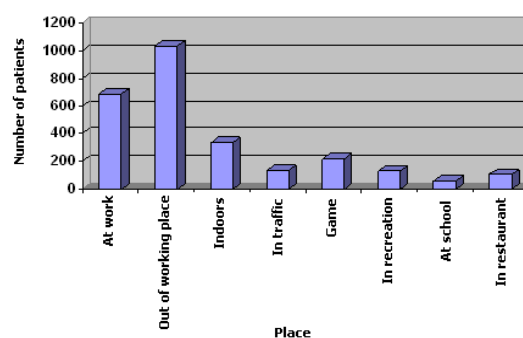


Fig. 7 – Distribution of injured patients depending on place of infliction of injuries

On admission, visual acuity in injured eye was: no light perception in 170 (6.2%), light perception without correct projection in 269 (9.8%), light perception with correct projection in 832 (30.3%), 1/60-0.1 in 466 (17.0%), 0.2-0.5 in 339 (12.4%), 0.6-0.8 in 254 (9.3%), and 0.9-1.0 in 410 (15%) (Figure 8).

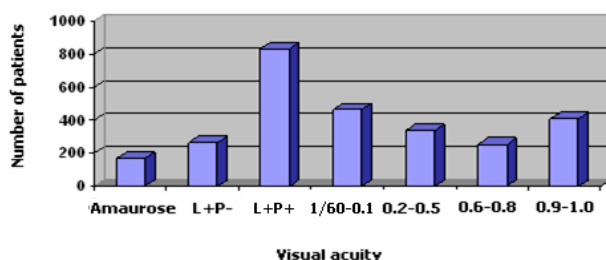


Fig. 8 – Distribution of injured patients according to visual acuity of the injured eye on admission
L - light perception, P – correct projection

Hospitalization of the patients with injuries of the eye lasted in average 6.7 days. Visual acuity upon dismiss had following values: no light perception in 441 (16.1%), light perception without correct projection in 112 (4.1%), light perception with correct projection in 151 (5.5%), from 1/60-0.1 in 103 (3.8%), from 0.2-0.5 in 140 (5.1%), 0.6-0.8 in 240 (8.8%), and 0.9-1.0 in 1 514 (55.2%) patients (Figure 9).

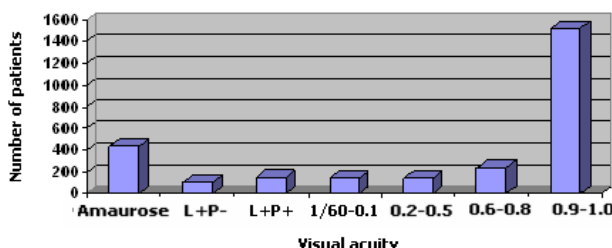


Fig. 9 – Distribution of injured patients according to visual acuity of the injured eye on dismiss
L - light perception, P – correct projection

This was not a definite visual acuity.

Blunt eyeball injuries occurred in 1 282 (47.5%), penetrating ones in 1 373 (50.8%) patients, while 85 (1.7%) were hospitalized due to an adnexal injury.

HypHEMA was the most frequent cause of hospitalization in patients with blunt injuries. It was found in 1 123 (87.6%) cases, and in all of them it was the direct reason for hospitalization. Also we saw: iridodialysis in 62 (4.8%), iridodhesis in 33 (2.6%), subluxation of the lens in 146 (11.4%), lens luxation in 127 (9.9%), hemophthalmos in 74 (5.0%), edema and hemorrhage of retina in 89 (6.9%), and the eyeball rupture in as much as 248 (19.30%) patients.

Total percentage of complications was more than 100%, as one injured eye sometimes harbored several complications. In 1 373 patients suffering a penetrating eyeball injury, the place of penetration was: cornea in 809 (58.9%), sclera in 265 (19.3%), and both cornea and sclera in 299 (21.8%) patients. The penetration through cornea was followed by traumatic cataract in 365 or 45.1% patients of all

cases with perforated cornea, there was no cataract in the rest of 444 (54.9%) patients. Scleral perforation was accompanied with traumatic cataract in only 15 patients (5.7%). Perforation of both cornea and sclera with traumatic cataract was registered in 117 (39.1%), and without cataract in 182 (60.9%). Among patients with a penetrating injury of the eyeball, in 433 (31.5%) there was an intrabulbar foreign body of different nature.

Primary surgical repair was done in 1 522 patients. Operations were performed at different times after injury: within the first eight hours in 274 (18.0%) patients, in the period of 8 to 24 hours in 695 (45.7%), at the period of 24-48 hours in 260 (17.1%) and in more than 48 hours from the moment of injury in 293 (19.2%) patients (Figure 10).

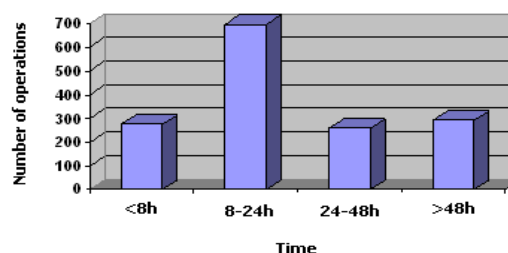


Fig. 10 – Number of operations according to the period between time of injury and primary surgical repair

Discussion

In one of our previous papers¹⁸ we analyzed mechanical injuries of the eye with the same parameters for a period of five years. Now we carry out the same analysis again, but for a period of eight years with much more patients. Although the purpose of the study is the same as the previous one, our additional intention was to find out if anything changed in the meantime. This time, 2 701 patients with a total of 2 740 mechanical eye injuries were analyzed. This is a respectable group, so that the results and conclusions should be valid. We had an average of one serious hospital-treated injury each day in those 8 years. As the Institute for Eye Diseases of the Clinical Center of Serbia in Belgrade is a referent center for the treatment of eye injuries in Serbia, the majority of patients with serious eye injuries were treated there. Considering that Serbia has a population of approximately 8 million, then we see that the incidence of mechanical eye injuries is 4 out of 100 000 inhabitants per year. This number is somewhat bigger in fact, because a number of injured persons had been hospitalized and treated elsewhere: other university clinics or provincial eye departments. In various studies, the incidence of eye injuries per 100 000 inhabitants/year varies very much^{19, 20}.

Incidence of injury of the right and the left eye was almost equal. What particularly worries us, are the simultaneous injuries of both eyes, seen in 39 (1.4%) patients. Those were very serious cases, resulting in poor vision in both eyes, blindness in one and poor vision in other, or even blindness in both eyes.

In literature, there is a statement that eye injuries are more common in men than in women²¹⁻²⁴. In our study,

there were 5.1 times more men than women. We discovered that the same was true in children and young, as well as in grown up persons, while in elderly - the number of injured males and females is almost equal. Such gender distribution is understandable when you know that boys play more dangerous games, also using toys that can injure the eye, while grown up men more frequently are exposed to eye injuries at work, in traffic, during recreation, in fight. Old persons, both men and women, are somewhat protected being generally less active. They are more frequently injured at home, moving around without enough care, or fall at home or in the street.

Anyhow, all age categories suffered injuries: small children, pupils, adults, working populations, but also retired and very old people. As it could be expected, among the injured were mostly working people, aged between 26 and 65 (54.4%). There has been a disturbing high percentage (6.8%) of injured children younger than 7 - preschool children. Among them, there were also children just one year old or slightly older, that were "accidentally" injured with a knife, glass or other sharp object which normally should not be found in the hands of such a small children. Dangerous objects or tools must not be kept in places reachable by children. Small children are not able to recognize the threat - the difference between dangerous and not dangerous objects - but parents or grandparents should always think about it. That is why we think that "by accident" should not exist: there is only our carelessness, our negligence and our incapability to foresee possible consequences of such a carelessness. If we look upon this problem seriously, almost all eye injuries could be avoided.

There was also found a considerable percentage of injuries in school children (12.0%), aged 8-15. They were injured in school (pencil, pair of compasses, chalk, glass), in the school yard (various games), at sport hours (ball, finger or elbow of a schoolmate), at home or outside. Again, in the majority of cases this was due to carelessness. Negligence is the primary cause of injuries. On the bases of a more complete analysis of causes and ways of getting injured, it was seen that such injuries could have been avoided, too, at least in 70% of the tested patients.

Also, in the biggest group of injured patients (actively working population) which we already mentioned, injuries are avoidable. Injuries at the working premises, in the first place, the injured person not using protective means prescribed by law. We also met a quite number of injured (38.2%) among those who were doing some other work, out of their professional place of work, for which they had not been prepared enough. There are two basic reasons for injuries. The first, not being trained enough for such kind of work, the second - work without any protection at all, although it was obligatory.

The retired were injured in different ways, most often at homes (fall in the bathtub, hitting the shower-battery, falling and hitting furniture edges), particularly at night. In the same group there were also elderly farmers, injured in stable, while working in field, cutting wood etc. - which only confirms what we already know that in villages old people still

work hard. The prevention for those people is very much to be discussed, as injuries are always unexpected and do occur all of a sudden.

Analyzing occupational distribution of eye injuries, we see that the workers are most frequently injured (39.0% of all), industrial workers in particular, as well as car drivers. Many of them did not have any protection at all. They were also injured when not paying enough attention, not taking enough care. The same was true for drivers not using safety belts. A very high percentage of injured pupils had been registered, too. This group covers both the primary school and the high school pupils, to the age of 18, that is why the participation of the pupils among the tested injured persons is high (16.3%). This is really a very high percentage in the group of very serious injuries, which most frequently caused permanent disability, predetermining further life destiny of those young people. Keeping in mind all those parameters and already described ways of injury of younger school children, we must also be worried about the frequency of the injuries in older school children group (children attending high school), in fights, traffic, drinking. The importance of proper education of young people and their bringing up should be stressed, the family being always at the first place, followed by school and the whole society. That could contribute to prevention of a considerable number of injuries. University students were seldom injured (2.2%), for many reasons. It is true that they represent the smallest group of all, spending most of their time studying in the libraries, not having so much possibilities to be injured.

The employed, with one eye injury (6.9%), represent a surprisingly high percentage if we take into consideration their occupations. However, they were not injured at work, but working at some other places instead, during recreation, in car accidents, etc. The prevention measures taken during all these activities could certainly decrease the number of injuries in persons working in offices. The injured housewives (6.1% of all), usually get injured at home, in the garden, or in the field. This is the least protected group among injured persons, hardly having been protected at. Farmers were injured while working in the field, or any other place. For this group of injured, endophthalmitis following penetrating eyeball injury was characteristic, being more common than in other groups. We can hardly talk about prevention at work, but the fact is that they contact the doctor much later, sometimes even several days after the injury, when serious complications already occurred. They usually believe that the injury is not serious, that it will be healed all by itself, sometimes claiming that visiting a general practitioner in order to be referred to an ophthalmologist is a loss of time.

Only a small number of unemployed persons (2.4%) had an eye injury. They had been injured either dealing with something themselves, or by standing close to other persons watching them working or helping them.

The injuries occurred in various ways and were provoked by various causes. The most frequent cause (23.7%) was piecing wood (cutting wood with an axe). Those were usually serious blunt injuries followed by hyphema, lens luxation into the vitreous or anterior chamber, iridodialysis, but still more often by rupture of the eyeball and prolapse of

the interior eye structures. Such injuries, in most instances, ended in amaurosis. It is interesting that both men and women were equally injured by a piece of wood in that way. We are dealing with wood also in those injuries caused by a branch of a tree when cutting it, walking or running in the woods, or processing wood in a circle-cutter.

Although as a rarity, this kind of injury was also seen in a pilot of agricultural aircraft, flying low with an open clam and consequently hitting a branch of tree and resulting in a scleral injury. Injury caused by tree branch is most frequently seen in farmers or women who cultivate flowers. Injury by a rod, or a wooden stick we usually met in children playing outside; such injuries used to be very serious, regardless whether it was only a contusion or an eyeball penetration.

The second group classified by frequency (16.1%) represented injuries caused by pointed or sharp objects: knife, fork, wire, armature, a piece of grinding panel, and similar. Those were always penetrating injuries of the eyeball with no retained intraocular foreign body. Both children and adults were injured in that way.

Hammering of various objects or polishing metal, were the third common cause of eye injuries (14.4%). When hammering, a piece of metal could penetrate into the eyeball (penetrating injuries of the eyeball with the retained foreign body). According to the patient's explanations, it was not rare that such an injury was caused by hammering a stone, sawing a tree, etc. Most of the patients were aware of having got a piece of stone or wood into the eye. However, such injuries were almost always caused by a piece of metal from a hammer or an axe. Seldom, a perforation of the eyeball occurred with a foreign body retained in the orbit.

Broken glass was also the frequent cause of eye injuries (10.1%). In car accidents, broken windshields caused irregular, star-shaped corneal or scleral wounds. In other causes wound edges were more regular and good for surgery. Much to our surprise, there was quite a number of injuries caused by glass of a bottle broken out or in the refrigerator. All the patients stated that the bottles exploded spontaneously, without any physical effort or damage. It is possible that the sudden change of temperature was the cause, or may be an improper pressure of the contents, because it was always a full bottle that exploded. In such cases, the producer's responsibility should be always questioned.

Injuries caused by beer or mineral water bottle cork were classified in a special group (3.0%). In a short time period, we had numerous eye injuries caused by bullets from a children plastic gun toy. Those were always blunt injuries with hyphema, usually with subluxation or luxation of the lens, with iris damage and retinal edema. Children were injured, not those holding a gun, but those standing next to them, most frequently - girls. Those injuries could have been avoided if the parents have been warned in time about the possibility of such accidents, before buying such a dangerous toy.

Injuries obtained in fight were found in 5.5% of all injured persons. They were usually caused by the fist, or any object that the attacker had in the hand (boxer, broken bottle, stick, gun handle). Depending on this, the injuries were contusions or penetrating, accompanied by adnexal damage.

Injuries that occurred when falling (5.5%) were seen both in children and adults, particularly in elderly persons. The most common place of accident in children was school. The adults were usually injured outside, when in a hurry they stumbled and fell, hitting the eye against any extended object. Injuries often occurred at home. In the bathtub, when the patient slept and hit the shower battery. Usually, such injuries caused rupture of the eyeball and visual loss, but frequently loss of integrity of the eye, too. The later was also due to fall in the flat, hitting the edge of the furniture. This most often happened to elderly people, when walking in the night with no light on. Certainly, some of those injuries could have been prevented - slip in the bathtub is avoidable if a special plastic rag had been placed, and the light should always be on while walking at night.

Injuries caused by explosive devices most frequently occurred due to explosion of firecrackers and other similar pyrotechnical objects. We have seen bomb detonators, bombs and fire weapons in that group of explosion injuries, too. Injuries caused by firecrackers and other pyrotechnical objects usually occur at time of mass celebrations, particularly the New Year's Eve. They are usually very serious, with a lot of foreign body particles in the cornea inside the eye itself, in the case of penetrating injuries of the eyeball, always with serious loss of function. Children are the usual victims, but the adults, too. Those injuries could have been prevented if legal prohibition of sale of dangerous and potentially harmful toys was followed. Parents should have a special task: not to buy or not to permit their children to buy such toys, in order to avoid serious self-injuries in their children or doing harm to other people.

Injuries by ball occurred in young boys, mostly during recreation, but in professional sportsmen, too. Usually such injuries occurred while playing football, basketball and handball and there were always eyeball contusion with hyphema.

Injuries caused by electric battery explosion were not common (1.1%), but they usually were very serious and, beside the mechanic effect, there were all signs of a caustic burn caused by sulfuric acid.

Injuries caused by various elastic rubber bands occurred in 2.2% of all cases, but they were extremely serious, too.

Some patients experienced injuries by cow horn, stone or other object coming out of a mower. There were also some bizarre, but serious injuries, like self-injury, injuries caused by bee bite, cock pickling, piece of a disk (for disk record), rubber bullet from a police fire-weapon, etc.

We also analyzed the time of injury, in order to check whether there were some months in a year, or days in a week, or particular moments of a day, when injuries occurred more often, in order to suggest special measures of prevention to be taken at that specific period, if any. We found that injuries were generally almost equally distributed by months in a year (the differences not being statistically significant) (Figure 4). Similar distribution was found when days in a week were checked: injuries equally occurred both on working days and during weekends (Figure 5). However, incidence of injuries varied depending on the part of day. Be-

tween 6 h and 10 h a.m., the incidence was low (17.1%). Usually, those were workers injured at work, or farmers or housewives who started with their work early. In the period between 10 h and 14 h, the number of injuries was much higher (27.7%). At that period of time all sorts of injuries occurred. The highest incidence (31%) was in the afternoon (14 h–18 h), when all sorts of already mentioned injuries occurred. People are tired by the end of a working day and there are more children in the streets, playing. When we know all this, it becomes clear that we should be particularly careful at this period of the day. In the evening (18 h–22 h), the number of injuries somewhat decreases, while incidence in the night (22 h–06 h) was considerably lower compared to other periods of the day (Figure 6), which is understandable, as the most of people sleep in the night. Patients, who had been injured then, were either fighting in restaurants, were drunk, or had car accidents. We also met injuries at work during the night shifts, but they were few.

Analysis of the places where injuries had occurred is very interesting (Figure 7). One should expect most injuries to occur at work, which some investigators stated in their studies. However, we found a lower percentage of injuries at work (25.4%), compared to those that happened somewhere else (38.2%). One of the reasons could be that this study was carried on at the time of economic crisis in our country, with many unemployed people, who, in order to survive, had to work very often wherever possible. Consequently, many jobs had been done by unqualified persons or without normal protection, injuries therefore being more frequent. Injuries that occurred at home or in yards were seen in 12.4%. At home, children were injured while playing with sharp and pointed objects, but the same was true for the adults, particularly housewives injured at home. Home injuries were caused by knife or broken glass, were due to falls in the bathtub, falls in the room hitting the edges of furniture, etc., while yard injuries were caused by wood, branch of a tree or a thorn. We should think of those possibilities in time, as many of them are avoidable. Some people were injured by a soccer ball, tennis ball or a racket, some other had a contact with a branch of tree while walking or jogging in parks or woods. Children were injured playing. Those injuries were caused by stick, rubber band or a hand. At school, 3.9% of all injuries occurred. Another 5% were those that occurred in car accidents. They perhaps do not look very high, but two things are very remarkable: firstly, almost always a very young or a younger person was injured, secondly: both eyes were injured too often simultaneously. Restaurants are typically the place where injuries do occur in fights. It is usually at night, and in most instances people are drunk. Those injuries are caused by fists, glass or broken bottles, or any other object that was at hand. Drunk people were often injured upon fall.

Out of a total of 2 701 patients that were hospitalized for an eye injury, in 1 282 of them (47.5%) there was a contusion of the eye. In many of those patients (87.6%), there was a hyphema, which was the main reason for hospitalization. Hyphema ranged from the first degree to a total one. Beside hyphema, some patients had also damages to other structures of the eyeball: iridodialysis, iridorrhexis, subluxation or luxation

of the lens, hemophthalmos, retinal edema or hemorrhages, rupture of the choroids. A considerable number of complete eyeball ruptures (248 or 19.3% of the total number of blunt injuries) worried us particularly. Those contusions followed by rupture of the eyeball, were usually caused by a hit with a piece of wood and a cow horn, or occurred upon fall, hitting an exposed object. Usually there was a prolapse of eyeball contents, usually ending in amaurosis. The second half of the mechanic traumas treated in the hospital (1 373 cases or 50.1%) were penetrating eye injuries. Penetration through the cornea was the most common (58.9%), more than half of those patients had also a traumatic cataract. Patients with corneal perforation without cataract were treated with less difficulties. In one fifth of the patients (19.3%) we met a scleral wound. The next one, fifth of the patients (21.8%) had a perforation of both cornea and sclera simultaneously, the wound spreading across the limbus. Those were serious injuries. In most of the cases with corneal perforation there was a vitreous prolapse, too, and with both corneal and scleral perforation – a prolapse of uveal tissues and the vitreous. Of all penetrating injuries of the eyeball, in 433 (31.5%), there was an intraocular foreign body retained. The nature of foreign bodies was different: most frequently that was iron, but also copper, bronze, wood, plastics, glass.

Beside those two groups of patients, with blunt and with penetrating eyeball injuries, there was a small group of 46 (1.7%) patients without injuries of the eyeball itself. Serious injuries of the ocular adnexa (eyelids and lacrimal drainage system, in most of the cases) was the reason for hospitalization of those people.

The visual acuity on admission ranged from amaurosis to normal vision. It was not measured in small children or in adults when it was not possible due to objective reasons. In 6.2% of patients, injured eye was blind on admission, in another 9.8% there was a perception of light without correct projection, in 30.3% on admission there was a light perception with correct projection. Such a visual acuity had not discouraged us, but we tried to preserve the integrity of the eyeball at the moment of the primary treatment, while with further reconstruction later on we did our best to improve the visual function. In 53.7% of patients the visual acuity was between 1/60 and 1.0 on admission (Figure 8).

Conservative treatment and surgery resulted in a much better visual function on dismissal. It ranged from amaurosis to normal vision (Figure 8). Time of the primary treatment of the wound is essential. The best would be if it was done within the first eight hours after injury, but we did our best to have it done in the first 24 hours. Our opinion is that surgical repair of a seriously injured should not be performed by a doctor on duty – at night. We preferred to treat such injuries with the help of experienced surgeons or a team of ophthalmologists, first thing next morning. We had 18.0% of patients operated in the first eight hours, which is unsatisfactory and that percent should be higher. We had 45.7% patients operated between 8 h and 24 h after injury, which is acceptable, but we must try to improve that which could be done by better organization. In 17.1% of patients, the period from injury and the operation was between 24 h and 48 h,

which is not satisfactory, as well as the percentage of 19.2% patients who were operated even later, several days after the accident. Such late surgery was usually done in patients from the country province, that reached the clinic later. The result of late surgical repairs were much worse.

Conclusion

The results of this study showed that the injuries occurred most frequently in actively working people and pupils, that men were injured five times more often than

women; that wood, sharp objects and glass were the most common means, that there was an equal number of blunt injuries and penetrating wounds, and that it was very important to treat injury promptly, preferably within the first 24 hours.

It might be concluded also that prevention is necessary and that it should be our major task in future. By prevention, many of typical injuries could be avoided, as well as the consequences resulting in poor vision or blindness, the same being true for economic costs for treatment, rehabilitation and absence from work. Prevention is possible at any age, any place and in all activities mentioned.

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