Socioeconomic Status and Decreasing Incidence of Ocular Injuries in Bosnia and Herzegovina

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ABSTRACT

Purpose: To examine the epidemiologic and clinical characteristics of ocular injuries and their association with socioeconomic status (SES).

Material and Methods: All cases of ocular injuries hospitalized in Department of Ophthalmology of University Clinical Center Tuzla, Bosnia and Herzegovina, from January 2009 to December 2012 and January 2017 and December 2019 were prospectively followed. The injuries were classified according to Ocular Trauma Classification System (OTCS) and Birmingham Eye Trauma Terminology (BETT).

Results: This study included a total of 420 eyes from 396 patients. There were 162 (38.57%; 95%CI: 32.86–44.99) open globe injuries (OGI) and 258 (61.43%; 95%CI: 54.16–69.4) closed globe injuries (CGI). The decrease in incidence of ocular trauma requiring hospitalization was noted from 16.7 per 100 000 (95%CI: 13.11–20.97) in 2009 to 9.25 per 100 000 (95%CI: 6.64–12.55) in 2019 (p=0.006). Most injuries occurred in males 341 (81.19%; 95%CI: 72.8–90.28), active working patients 258 (61.43%, 95%CI: 54.16–69.4), and patients with rural residence 285 (67.86%; 95%CI: 60.21–76.21). Almost all ocular injuries 418 (99.52%; 95%CI: 90.21–109.54) occurred in patients with middle and lower SES categories, and home was the most prevalent place of injury in 258 (61.43%, 95%CI: 54.16–69.4) patients. The total of 289 (70.49%; 95%CI: 62.59–79.1) patients had good final best corrected visual acuity (BCVA). Poor final BCVA was associated with lower ocular trauma score (OTS) (p=0.000), poor initial BCVA (p=0.000), penetrating injuries of cornea (p=0.004) and sclera (p=0.001), Zone III injuries (p=0.000), intraocular foreign body presence (p=0.000), cataract (p=0.002), retinal detachment (p=0.001), endophthalmitis (p=0.000) and vitreous hemorrhage (p=0.010).

Conclusion: This study provides a detailed insight into epidemiology and socio-economic characteristics of patients hospitalized for ocular injuries.

INTRODUCTION

Vision impairment is associated with a diminished quality of life and represents a major global health concern. Ocular trauma has been highlighted as one of the most important causes of monocular visual impairment and blindness in all parts of the world. The economic burden of blindness, due to both direct and indirect costs, makes it extremely important to allocate adequate resources and invest in prevention, treatment, and rehabilitation programs. Because injuries are highly preventable, evidence-based prevention measures are promoted in a variety of policy documents targeting either specific groups or specific major injury causes.

In recent decades remarkable downward trends in injury mortality and morbidity have been observed globally. Although the patterns vary widely by population, age, sex, region or time, there is still a plenty of space for significant improvements. Despite the downward trends in risk levels, there is a higher incidence of ocular injury, especially serious ocular injuries, among a socioeconomically deprived population. There are a small number of hospital-based studies investigating temporal changes in epidemiology of ocular injuries requiring hospitalization. Ocular injuries are still a neglected area of research and prevention, with a small amount of data on the epidemiology of ocular trauma from Bosnia and Herzegovina. Therefore, understanding the nature of ocular injuries in Bosnia and Herzegovina could provide essential information for development of future prevention programs.

The aim of this study was to perform an epidemiological analysis of demographic and clinical characteristics of individuals hospitalized for ocular injuries in tertiary health care institution, and investigate the association of socioeconomic status (SES) with ocular trauma incidence and severity.

MATERIAL AND METHODS

This prospective epidemiological study included all consecutive patients with ocular injuries hospitalized in Department of Ophthalmology, University Clinical Center Tuzla, Bosnia and Herzegovina. The study covered two time periods, the first from 1 January 2009 to 31 December 2012 and the second from 1 January 2017 to 31 December 2019. The current study was approved by the University Clinical Center Tuzla Ethics Committee on 1 September 2008 (Approval number: 32-
The initial best corrected visual acuity (BCVA) was measured upon the hospital admission, while the final BCVA was taken on the hospital discharge. Initial and final BCVA were classified as no light perception (NLP), light perception (LP)/hand motion (HM), 1/200–19/200, 20/200–20/50, and ≥20/40. The final BCVA ≥ 20/200 was defined as good and final BCVA of less than 20/200 as poor visual outcome.19,20

Differences between means were analysed by Student t test. The Chi-square or Fisher exact test was used to assess the differences between categorical variables, and for continuous variables the analysis of variance (ANOVA) was used. A multivariate regression model was used to assess the risk factors for final BCVA. Statistically significant p values were considered those <0.05. The data were analysed using Stata Statistical Software, version 14.0 (StataCorp LP, College Station, Texas, USA).

RESULTS

This study included a total of 420 eyes from 396 patients. Overall, 184 (43.81%; 95% CI: 37.71–50.62) of the injured eyes were on the right side, 188 on the left side (44.76%; 95% CI: 38.59–51.64), and 24 were bilateral (5.71%; 95% CI: 3.66–8.5). During both study periods, 2009–2012 and 2017–2019, a total of 291 (69.29%) and 129 (30.71%) injuries were hospitalized, respectively. A significant decrease in incidence of ocular trauma requiring hospitalization was noted from 16.7 per 100 000 (95% CI: 13.11–20.97) in 2009 to 9.25 per 100 000 (95% CI: 6.64–12.55) in 2019 (p=0.006) (Figure 1). This trend was particularly pronounced in the working age population, with noted reduction from 16.0 per 100 000 (95% CI: 11.91–21.04) in 2009 to 6.27 per 100 000 (95% CI: 3.83–9.69) in 2019 (p=0.002). Tables 1 and 2 present the demographic and socioeconomic characteristics of ocular injuries in this study.

The average age of all included patients was 41.45 ± 21.9 (range 1–88) years, with no difference between the two study periods (p=0.625). In this study, the age was not associated with any socioeconomic determinant; however, older patients had a higher incidence of injuries occurring at home (p=0.001) and ocular injuries with blunt force objects (p=0.005). Furthermore, older patients had a higher frequency of OGI (p=0.007), injuries with low OTS (p=0.016), and were associated with poor visual outcome at hospital discharge (p=0.000). On the other side, younger patients were more likely to be admitted earlier (p=0.001) and had shorter hospital stay after the injury (p=0.000).

More than 81% of all ocular injuries were among males, where most of them were in active working age (p=0.000), living in rural areas (p=0.016) and were unemployed (p=0.035) at the time of the injury. Male patients were also found to be younger than females, 40.08 ± 25.91 compared to 47.34 ± 25.25 (p=0.004). Out of 52 injuries at workplace, 50 (96.15%, 95% CI: 71.37–126.77) occurred in male patients (p=0.001). Sport-related or eye injuries sustained in physical assault (p=0.000), and injuries with sharp force objects (p=0.028) were more prevalent in male patients. All bilateral ocular injuries in this study occurred in male patients (p=0.000), with an evident trend of decreasing frequency in the second study period (p=0.091). On the other side, injuries
in female patients were mostly a result of blunt force object (69.44%; 95%CI: 51.54–91.55) (p=0.038), resulting with lower OTS at admission (p=0.004), and poor final visual outcome at hospital discharge (p=0.038).

Almost all patients (99.52%; 95%CI: 90.21–109.54) with ocular injuries in this study were found to be of middle and lower SES category (Table 2). Working active patients accounted for nearly two-thirds (61.43%; 95%CI: 54.16–69.40) of all injuries, with the highest OGI incidence (p=0.007). Manual workers (56.17%; 95%CI: 47.0–66.61) as well as fire and hazard workers (33.62%; 95%CI: 26.61–41.9) were the most common occupations, and had the highest OGI incidence (p=0.003) (Table 3). Furthermore, patients with rural residence had higher OGI incidence (p=0.051), with lower OTS (p=0.042) which more often resulted in poor visual outcome (p=0.012).

Clinical characteristics of ocular trauma are presented in Table 4. Out of 258 (61.43%; 95%CI: 54.16–69.4) CGIs in this study, 189 (45.0%; 95%CI: 38.81–51.89) injuries were contusions and 69 (16.43%; 95%CI: 12.78–20.79) lamellar...
The nature and cause of trauma can be influenced by the climatic and geographical conditions, as well as population characteristics including the lifestyle, cultural and socioeconomic state. In this study, individuals at the highest risk of ocular injuries were young and middle-aged males injured at home while engaged in crafting activities. Furthermore, almost all injuries that occurred in the workplace were recorded in males which is also similar to other studies till date. A predominance of male individuals among those with ocular injuries is a universal finding, with reported female:male ratio up to 1:7.8, 2-8,10,12,14,19-27 This can be explained by male increased outdoor activities, as they are more involved in sport, violence, rash driving and are more employed in factories or manual jobs. However, female patients in this study were found with higher risk of potentially vision-threatening ocular injuries. This is in contrast with previous studies, 10,22 and is mostly a result of increasing incidence of blunt ocular trauma resulting with OGI in older female patients. 9,21,28,29

It has been previously reported that incidence of ocular injuries decline with older age. 23,24 Almost two-thirds of ocular injuries in this study have been recorded in active working populations, similar to previous research from different populations. 10,12,14,22,25 Although the mean age in both study periods stayed practically unchanged, there was a slight shift towards a larger number of older patients with ocular injuries. Studies analysing long-term temporal changes in ocular trauma requiring hospitalization showed two peaks in the age of injured patients, first in young and middle-aged adults and second peak in old age. 9-11,26 Falls among elderly individuals are responsible for 82% of the increase in hospitalizations related to ocular injuries. Furthermore, as reported earlier, elderly patients have more OGI occurring at home and poorer final visual outcome, and could present a possible target population for future prevention programs. 29

A major finding in this study is a significant decrease in incidence of both, CGI and OGI requiring hospitalization over an 11-year period. The rationale for this finding has complex socioeconomic implications, but nonetheless, one important event can be linked with this transition. In 2012, the European
Union started with the gradual and increasing mass employment of manpower from Bosnia and Herzegovina, mostly with no more than a high school education. Therefore, many unemployed working active individuals started looking for a possible employment and were probably engaged in occasional or seasonal jobs abroad. This coincides with the fact that Bosnia and Herzegovina still has a high unemployment rate, although it has reduced from 42.0% in 2009 to 32.17% in 2019. Thus, this population at risk of ocular trauma had no more need or time for manual crafting activities at home, which led to reduction of ocular injury incidence. This is consistent with the finding that the most significant reduction of trauma incidence in this study was noted in unemployed working active male patients with rural residence.

Another interesting finding is the rate of bilateral ocular injuries. Previous studies reported frequency between 1.1% and 5.1%. In our study, we have found the highest rate of bilateral ocular injuries of 5.71% with a relative downward trend in frequency. This decrease is mostly due to a reduced number of eye injuries that occurred at home involving firework and explosion, and could explain this relatively high percentage.

Previous reports have highlighted the shift from corporate to personal responsibility for risk awareness, and eye injury prevention. In Bosnia and Herzegovina it is a routine praxis for officially unemployed individuals to work at home in unregistered businesses for the purposes of tax evasion. Therefore, a significant number of injured patients in this study sustained a work-related ocular injury at home while simultaneously being characterized as unemployed. Consequently, black market employment could be a possible risk factor for ocular injury. The increased use of adequate personal protective equipment at workplace has decreased the incidence occupational ocular injuries. Nevertheless, more than half of these injuries occurred in individuals who did not use adequate protection at the workplace. We did not find that occupation was predictive for poor visual outcome, likely because any relation would be attenuated through the eye injury characteristics. This is in line with the results of studies reporting epidemiological characteristics of ocular injuries from Bosnia and Herzegovina and surrounding countries, which confirmed that most injuries occur in individuals while doing some work at home or out of professional workplace. Therefore, the prevention measures taken during all these activities could certainly decrease the number of ocular injuries in the future.

There is a higher frequency of injuries among a socioeconomically deprived population. Three-quarters of all patients in this study had less than a college education and more than half of all working active patients were unemployed at the time of the injury. Therefore, the majority (95.48%) of ocular injuries in this study occurred in individuals with low SES. This resulted in the severity of ocular trauma, expressed through OTS or OTCS, not being correlated with ISP, contrary to some other research. Final BCVA after eye injury has been correlated with several factors: initial BCVA, type and mechanism of injury, location of OGI, presence of lens damage, vitreous hemorrhage, retinal detachment, IOFB or endophthalmitis. These results re-emphasize the usefulness not only of the OTS, but of each individual variable within the OTS, too.

Treatment options for ocular injuries generally include observation, medical, and surgical treatment. In this study, more than half of the patients needed surgical treatment, where 11.19% of patients needed two or three surgical interventions. Continuous development of surgical techniques and appropriate use of antimicrobial agents have optimized visual outcomes in patients with ocular trauma and greatly reduced the rate of endophthalmitis and eyeball enucleation. However, in our study slightly worse visual results were recorded in the second period. This perhaps surprising result is mostly a consequence of a larger share of older and female patients included in the second study period. This practically means that by reducing the number of younger male patients, the population of older females becomes an increasingly important group at risk of eye injuries. Additionally, although more than 80% of individuals in this study recorded certain visual improvement at hospital discharge, final BCVA remained poor in almost one-third of patients during both study periods. This is similar to other studies published so far and suggest a high burden on society. These informations once again highlight the need for a systemic approach to the problem of eye injuries in Bosnia and Herzegovina.

The strengths of this study include the prospective design and the ability to record all details of injury and associated socioeconomic determinants. Limitations of this study include the possibility of under-reporting of trauma cases and an intermittent period of research. Despite the fact that many previous studies have used this same methodology, it is necessary to point out final BCVA determined on the hospital discharge as one of the study limitations. However, while some patients could worsen, other patients could also improve their final BCVA many months after the ocular trauma. Furthermore, University Clinical Center Tuzla is the only institution authorized and able to provide treatment for ocular injuries in Tuzla Canton. The group of working medical professionals and criteria for hospitalization remained unchanged over 11-year period. Even if there were certain ambiguities regarding the criteria for hospitalization of OGI, the number of OGI has also decreased significantly. The population of Tuzla Canton was stable and no public prevention or any other injury-related programs were implemented during the study period. Furthermore, the clinical profile of ocular injuries remained unchanged, but significant decreasing incidence of ocular injuries in this study has been associated with changes in demographic and socioeconomic determinants of injured individuals.

This study has provided a detailed insight into epidemiology and socioeconomic determinants of patients hospitalized for ocular injuries in Bosnia and Herzegovina. This study clearly identified the population at risk of ocular injuries and the need for implementation of strategic prevention programs.

**DATA AVAILABILITY STATEMENT**

The data set for this study has been uploaded to Dryad and is available via: https://doi.org/10.5061/dryad.rn8pk0p70
