

45(3):314-317,2004

OPHTHALMOLOGY

Cost of Treating Preventable Minor Ocular Injuries in Rijeka, Croatia

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Aim. To determine the cost of medical services for the treatment of preventable minor ocular injuries in Rijeka, Croatia.

Methods. We analyzed data on 3,755 outpatients (3,363 men and 392 women) treated for eye injuries at the Department of Ophthalmology, Rijeka University Hospital, from April 2002 to March 2003. Median age of patients was 37 years (range, 26-47 years). Data were collected with a questionnaire designed for the study, which included sociodemographic data, type of injury, time and place of injury, and preventability. We carried out cost analysis of the procedures and determined the length of hospital stay.

Results. Out of 5,143 emergencies, minor eye injuries comprised 3,755 cases (73%). Minor injuries were potentially preventable in 90% of cases, as they resulted from nonuse or misuse of obligatory protection devices. Total one-year cost of preventable eye injuries was €135,529.55.

Conclusion. Preventable minor eye injuries in Rijeka, Croatia, cause a serious medical and economic burden. Stricter adherence to the use of protection devices should be promoted.

Key words: cost and cost-analysis; eye foreign bodies; eye injuries; eye protective devices; occupational safety; primary prevention

Eye injury is a common but preventable disease, and presents a serious economic burden (1-3). About one in five adults reports a history of ocular trauma in his or her lifetime, although less than 2% have trauma severe enough to warrant hospitalization (2). Several authors reported that approximately 90% of all eye injuries were preventable (3). Eye trauma costs include medical and hospital bills, worker's compensation, and lost production time. Eye injuries are highly preventable by the correct use of safety eye-wear, which may result in great cost savings for health insurance.

Our aim was to determine the cost of medical services for preventable minor ocular injuries in Rijeka, Croatia and to establish the framework for cost reduction in future, especially for a health care system with chronic financial problems such as Croatian (5).

Patients and Methods

Patients

A cross-sectional survey included all patients seen at the Ophthalmological Emergency Service of the Department of Ophthalmology, Rijeka University Hospital, between April 2002 and March 2003. There were a total of 5,143 outpatients, and eye injury was confirmed in 3,755 cases. There were 3,363 men and 392 women with eye injuries; men to women ratio was 8.6 to 1.

Methods

Data on patients' age, sex, clinical presentation, type of injury, mechanism of injury (work-related or not), place of injury (work, home or other) and use of eye protective devices (yes-no) were collected during interview and ophthalmological examination (Table 1).

Minor ocular injury was defined as ocular injury not requiring hospitalization (2,4). Preventable injury was determined as injury, either work-related or not, preventable with eye protective devices.

Costs of medical services were based on prices determined and paid by the Croatian Institute for Health Insurance (6). Cost per case included reimbursement for the first visit, diagnostic services, intervention (if done), and a checkup in the Ophthalmological Emergency Service (7). It was not possible to calculate the reimbursement for visit to primary care physician to get the prescription and referral slip for the ophthalmological checkup, as primary care receives annual fees per capita and not per visit.

Statistical Analysis

Descriptive statistics and chi-square test were performed by using Statistica 6.0 software package (StatSoft, Inc., Tulsa, OK, USA). When a median was calculated, the variability was expressed with the 25th and 75th percentiles. The level of statistical significance was set at p < 0.05.

Results

Minor eye injury was confirmed in 3,755 cases (73% of 5,143 outpatients) in the study period. Nontraumatic ocular conditions were found in 1,330 cases (26%), and major eye injury requiring hospitalisation occurred in 40 cases (<1%). Eighteen cases (<1%) were inadequately documented (unknown mechanism of injury) and were excluded from further analysis.

Type of eye injury	Median age (years; range)	No. of eye injuries				
		men	women	total	ratio*	
Corneal foreign body	36 (26-46)	1,971	38	2,009	51.9	
Corneal erosion	41 (27-50)	581	157	738	3.7	
Traumatic conjunctivitis	37 (26-48)	234	19	253	12.3	
Conjunctival foreign body	30 (17-48)	134	79	213	1.7	
Photoelectric keratoconjunctivitis	29 (24-42)	94	0	94	-	
Corneal corrosion	47 (35-63)	73	15	88	4.9	
Blunt trauma of eyeball	25 (16-61)	55	14	69	3.9	
Traumatic hyposphagma	36 (26-49)	44	22	66	2.0	
Palpebral wound	42 (29-56)	56	6	62	11.4	
Conjunctival laceration	49 (42-54)	40	7	47	5.7	
Palpebral hematoma	19 (29-48)	15	10	25	1.5	
Corneal laceration	29 (23-35)	15	7	22	2.1	
Corneal combustion	40 (27-49)	12	10	22	1.2	
Orbital contusion	26 (18-52)	8	8	16	1.0	
Conjunctival corrosion	40 (35-51)	12	1	13	12.0	
Orbital fracture	41 (18-59)	7	2	9	3.5	
Hyphaema	39 (29-58)	3	3	6	1.0	
Tick bite	11 (2-63)	3	0	3	_	
Total	37 (26-47)	3,363	392	3,755	8.6	

Minor eye injuries occurred in 528 (14%) women and 3,227 (86%) men (Table 1). The median age of all cases with minor eye injury was 37 years (range, 26-47 years), with 1,202 cases (32%) aged \leq 30 years.

A total of 18 types of eye injuries were recorded. Corneal foreign body was the most frequent injury, found in more than half of examined patients, followed by corneal erosion (20%), traumatic conjunctivitis (7%), and conjunctival foreign body (6%). All other causes of injuries occurred in one-seventh of cases (Table 1). According to age and sex, we observed male predominance, ranging from 1.2 (for corneal combustion) to 12.0 (for conjunctival corrosion). Women were prone mostly to corneal erosion and conjunctival foreign body injury, which comprised almost two-thirds of total number of injuries among women. Other types of ocular injuries were rare among women.

The number of injuries examined monthly ranged from 214 (63% of all eye injuries) in June 2002 to 399 (80% of all injuries) in April 2002. The incidence of ocular emergencies was the highest in the months of March 2003, July 2002, and October 2002 (Fig. 1). These differences in injury distribution were statistically significant (chi-square = 60.772; p < 0.001). Seasonal distribution of number of ocular injuries showed a biphasic curve, and was also statistically significant (chi-square = 85.532; p < 0.001). Monthly proportion of minor injuries in total number of eye emergencies was constant over the year (chi-square = 0.052; p > 0.95).

The majority of ocular injuries occurred between 8 a.m. and 4 p.m., during working hours for most people in Croatia (Table 2). Statistically significant difference regarding time of occurrence was the most prominent for corneal foreign body, corneal erosion, and traumatic conjunctivitis, which were the most frequent ocular injuries recorded overall. After 4 p.m. the most frequent injuries were corneal foreign body and corneal erosions. There was no statistically significant difference regarding time of injuries that occurred in small number of cases, ie, tick bite, hyphaema, conjuctival corrosion, and orbital contusion.



Figure 1. Monthly distribution of eye emergency pathology at the Ophthalmological Emergency Service in Rijeka, Croatia, from April 2002 to March 2003. Open bars – minor injuries; gray bars – other causes (non-traumatic pathology, major injuries requiring hospitalization, and unknown pathology).

Table 2. Injury occurrence respective to the time of day							
	Time of injury occurrence (hours of the day)						
Type of eye injury	0-8	9-16	17-24	p*			
Corneal foreign body	11	1,199	761	< 0.001			
Corneal erosion	19	343	219	< 0.001			
Traumatic conjunctivitis	8	147	79	< 0.001			
Conjunctival foreign body	0	89	45	< 0.001			
Photoelectric keratoconjunctivitis	2	54	38	< 0.001			
Corneal corrosion	6	39	28	< 0.001			
Blunt trauma of eyeball	0	29	26	< 0.001			
Traumatic hyposphagm	0	22	22	< 0.001			
Palpebral wound	6	32	18	< 0.001			
Conjunctival laceration	2	25	13	< 0.001			
Palpebral haematoma	0	7	8	< 0.001			
Corneal laceration	0	15	0	< 0.001			
Corneal combustion	0	6	6	0.004			
Orbital contusion	0	5	3	0.015			
Conjunctival corrosion	0	7	5	0.023			
Orbital fracture	0	7	0	0.013			
Hyphaema	0	3	0	0.002			
Tick bite	0	1	2	0.368			
Total	54	2,030	1,273	< 0.001			
*Chi-square test.							

Table 3. Incidence and cost of all minor ocular injuries, work-related injuries, and preventable injuries expressed in absolute numbers and percentages over one-year study period (2002-2003)

	No. (%) of eye injuries			Cost of eye injuries (€)			
Type of eye injury	total	work-related	preventable	total	work-related	preventable	
Corneal foreign body	2,009	1,980 (99)	1,792 (91)	107,095.56	105,549.63	95,527.75	
Corneal erosion	738	497 (67)	442 (89)	29,500.58	19,866.92	17,668.37	
Traumatic conjunctivitis	253	191 (75)	175 (92)	10,113.34	7,634.97	6,995.39	
Conjunctival foreign body	213	165 (77)	152 (92)	11,354.58	8,795.80	8,102.80	
Photoelectric keratoconjunctivitis	94	94 (100)	94 (100)	3,757.53	3,757.53	3,757.53	
Corneal corrosion	88	82 (93)	78 (95)	3,517.68	3,277.84	3,117.95	
Blunt trauma of eyeball	69	14 (20)	0	2,758.18	559.63	0.00	
Traumatic hyposphagma	66	5 (8)	0	2,638.26	199.87	0.00	
Palpebral wound	62	4 (6)	0	4,827.92	311.48	0.00	
Conjunctival laceration	47	12 (26)	0	26,593.54	6,789.84	0.00	
Palpebral haematoma	25	0	0	999.34	0.00	0.00	
Corneal laceration	22	3 (14)	0	879.42	119.92	0.00	
Corneal combustion	22	1 (5)	0	879.42	39.97	0.00	
Orbital contusion	16	1 (6)	0	4,690.88	293.18	0.00	
Corrosio conjunctivae	13	11 (85)	9 (82)	519.66	439.71	359.76	
Orbital fracture	9	0	0	347.19	0.00	0.00	
Hyphaema	6	0	0	239.84	0.00	0.00	
Tick bite	3	0	0	159.92	0.00	0.00	
Total	3.755	3,060 (81)	2,742 (90)	210.872.86	157,636,30	135,529,55	

Potentially preventable eye injuries comprised 3,499 cases (93% of all injuries). Out of these, 3,151 cases (90%) admitted non-using of eye protective devices, and 348 cases (10%) claimed the use of eye protection devices. Truthfulness of the latter statements could not be proven because reports from inspections of safety on work were not available. Most injuries occurred at workplace (46%) and home (33%).

Corneal foreign body and corneal erosion were the most frequent eye injuries, 99% of them were work-related, with even 91% of them being preventable and producing very high medical cost (Table 3). Total one-year cost of preventable eye injuries was €135,529.55, comprising 64% of total cost of all injuries during the study period. Corneal foreign body injuries comprised 86% of the yearly cost of all work-related injuries, and 70% of yearly cost of all preventable ocular injuries. The rest of ocular injuries were also mostly work-related and preventable, comprising the total yearly cost of €74,276.72, with preventable injuries accounting for almost 33% (€22,333.43) of this sum.

Discussion

Our study showed that minor eye injuries comprised a substantial part of cases seen in Ophthalmological Emergency Service. The most frequent injury was corneal foreign body and almost half of eye injuries occurred at the workplace. Injuries occurred mostly in men and 90% of injuries were preventable.

As the study was carried out during the routine work in Ophthalmological Emergency Service, amount of data collected had to be limited. Truthfulness of patient's statements about the use of eye protective devices was not checked and it was possible that the use of eye protective devices was over-reported.

Our study showed that occupational injury was a major source of ocular trauma and is often preventable, as corroborated by many authors (8-11).

The source of injury depends on the type of economy in particular area. For instance, about 20%

of occupational eye injuries in USA occur in construction (1). The high rate of grinding/welding as a source of injury in our study could be attributed to the developed metal industry and ship-building in Rijeka (12). Unfortunately, our literature search on these topics revealed no data from European transitional countries.

The low prevalence of eye protective devices use reinforces the need for a review of the design and implementation of occupational eye safety programs in region of Rijeka. Results from our report illustrate that the minor eye injuries are preventable. It is well known that prevention benefits tend to be more cost effective than interventions with a single source of health benefit (7). The toll of injury in loss of productivity, economic impact, and patient suffering, can at present only be imagined and would be further researched. Nevertheless, the consequences of eye injuries are considerable, both for patients and healthcare services. The total direct costs on our region are very high even without counting the days lost from work.

The first step toward these goals would be to establish a register of eye injuries and consequent obligatory reporting of eye injuries. It would be of special interest to differentiate between eye injuries that occurred for the first time and repeated injuries. Unfortunately, relying on patient self-report of recidivism would not give accurate data. Again, a database of eye injuries would greatly improve the epidemiological and occupational interventions in this respect.

Our study also showed that the Croatian workplace eye injury burden was significant, as 46% of minor eye injuries occurred at workplace. Increased risk of injury is associated with increased alcohol consumption (13). It would be interesting to investigate the relationship between alcohol intake and eye injury, particularly at workplace. Also, little research exists on the relationship between working overtime and possible adverse health and safety outcomes.

Measuring public health impact of injuries is of great importance today. If number, severity or cost of injuries is not controlled, the financial outcomes are negative. Also, stricter adherence to the use of protection devices should be promoted. Public and health prevention services should be sensitized to the importance of eye protective devices and the identification of risk factors (alcohol on workplaces, working overtime, comorbidity). Further systematic and nationwide research is warranted for deeper insight into this problem.

Acknowledgment

We thank Dr Zoran Vatavuk and Ms Lidija Bilić-Zulle for their valuable help with the preparation of this manuscript.

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Received: December 17, 2003 Accepted: April 11, 2004

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