

# Ocular injuries secondary to motor vehicle accidents

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**PURPOSE.** *Ocular trauma is one of the main causes of visual reduction or loss, particularly in the younger population.*

**METHODS.** *In this prospective study the authors included 67 consecutive patients with ocular trauma secondary to motor vehicle accidents who were hospitalized in the Athens University Eye Clinic from September 1993 to December 1996. The mean follow-up time was 31 months, the mean age was 31.7 years, and the ratio between men and women was 2.7:1.*

**RESULTS.** *Thirty-two of the accidents (47.76%) took place in populated areas. Among the 67 injured persons, 58 (86.56%) were car passengers, 8 (11.95%) were on motorcycles, and 1 (1.49%) was a pedestrian. Only 3 (5.2%) of the 58 persons injured inside automobiles used safety belts and none of the motorcyclists used crash helmets during the accidents. Fifty-three (79.1%) ocular traumas were penetrating in nature, with glass fragments being the main cause in 36 of them (67.9%). Among the 53 injured persons experiencing penetrating ocular trauma, 49 had a follow-up time of more than 6 months. Twenty of them (40.8%) underwent one surgical procedure, 22 (44.9%) were submitted to two surgical procedures, and the remaining 7 persons (14.3%) needed three or more operations. Eighteen (36.7%) of the 49 patients with penetrating ocular trauma and with 6 months follow-up had a final visual acuity of less than 1/20, 21 (42.9%) had a visual acuity of more than 5/10, and 3 (6.1%) underwent enucleation. Among the 67 patients, 61 had a follow-up time of more than 6 months, regardless of their history of penetrating ocular trauma. Eighteen of them (29.5%) had a final visual acuity of less than 1/20, 8 (13.1%) had a visual acuity between 2/10 and 4/10, and 22 (52.5%) had a visual acuity of more than 5/10.*

**CONCLUSIONS.** *Because motor vehicle accidents can cause severe ocular trauma, it would be helpful for drivers to be more careful and aware of motor vehicle regulations. There seems to be a great need of enforcement of seatbelt laws in Greece. (Eur J Ophthalmol 2004; 14: 144-8)*

**KEY WORDS.** *Motor vehicle accidents, Ocular trauma, Windshield, Seatbelt, Surgical procedure*

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## INTRODUCTION

Ocular injuries are among the most common causes of visual impairment and vision loss in the general population and the most common cause of visual loss in young people. Ophthalmic trauma related to motor vehicle accidents (MVA) accounts for a significant percentage of ocular injuries, being the second most significant cause after occupational accidents (1, 2). In this study we evaluated eye injuries due to MVA in patients admitted to a major eye hospital in Athens, Greece, over a 3-year period. We were interested in how demographic and other factors might influence the frequency and nature of the ocular injury. Upon interview with the patient and family, including a questionnaire, followed by a clinical examination, we documented age, sex, kind and circumstances of injury, the use or not of a seat belt (in case of car accidents) or helmet (in case of motorcycle accidents), the use of alcohol prior to the accident, the time of day of the accident, and the extent of the ocular injury. The required surgical interventions and the final visual outcome were also documented.

## METHODS

This is a prospective study of 67 consecutive patients admitted to the Athens University Eye Clinic from September 1993 until December 1996 with an ocular injury due to MVA. All patients with an eye injury are first examined and recorded upon admission in the emergency ward, and after the first evaluation they are sent to the anterior or the posterior segment unit for further examination and treatment. This study provides a complete assessment of all the patients with ocular injury due to MVA.

All patients who needed surgical repair of the injury were operated under general anesthesia with the use of a surgical microscope. In all cases we examined the eye preoperatively and during surgical exploration, determining the extent of the trauma. As an initial operation, vitrectomy was not performed in any patient. All patients with a penetrating ocular injury received i.v. antibiotics (a combination of vancomycin and amikacin) as prophylaxis. Regarding the final visual acuity, we included patients with a follow-up of at least 6 months (61 of 67), those whose injuries were so severe that

enucleation was required, and those who underwent exenteration. One patient with reduced visual acuity prior to the injury was not included. Follow-up time varied from 6 months to 5.5 years, with a mean duration of 31 months.

## RESULTS

During the study period, 13,315 patients were admitted and treated at the Athens University Eye Clinic. A total of 312 patients (2.34%) had sustained an eye injury, and in 67 cases (21.47%) the injury was related to a MVA.

The age of the patients varied between 14 and 72 years, with a mean age of 31.7 years; 46.2% of patients were in their 20s. Forty-nine of the patients (73.1%) were male and 18 (26.9%) were female (a 2.7/1 ratio). Thirty-one of the patients had a right eye injury (46.3%) and 36 (53.7%) a left eye injury. None was injured in both eyes. There seemed to be a higher incidence of accidents between midnight and 6:00 am, when 41.8% of the total number of accidents occurred. Most accidents took place in December (12/67), October (11/67), and June (10/67), and only one accident happened during May and September. Twelve (17.9%) patients admitted that, at the time of the accident, they were under the influence of alcohol. Thirty-two (47.76%) of the accidents occurred within a populated area, 25 (37.3%) on rural roads, and 10 (15%) on a highway.

Thirty of the 67 injured persons were car drivers (44.7%), 28 (41.8%) were sitting in the passenger seat, 6 (9%) were motorcycle drivers, 2 (3%) were sitting in the passenger seat of a motorcycle, and 1 (1.5%) was a pedestrian. No patients with ocular injury were passengers sitting in the back seat of a car.

Of the 58 car drivers and passengers only 3 (5.2%) were wearing a seat belt, and none of the motorcycle drivers or passengers was wearing a crash helmet.

The mechanism of injury of our patients was as follows: 41 of the 58 car passengers (70.7%) were injured by the windshield or the side windows of the car. In 11 cases (19%) the eye hit an immobile object (wheel, mirror) or the ground, in cases where patients were expelled from the car. Two patients were injured by their own spectacles. Four patients were injured both by the windshield and an immobile object. Of

the eight motorcycle passengers, one was injured by the windshield of the car involved in the accident, six hit an immobile object (tree, ground, wall), and one was injured by his own spectacles. The pedestrian was injured by the fall on the ground. Details concerning the type of injury and the main findings in the ocular injuries can be seen in Table I.

The number of required operations in the 53 patients with penetrating injury was as follows. In all 53 cases the wound was sutured immediately after the admittance to the hospital (only two patients had enucleation performed at this time). In 20 cases (40.8%), no further surgical treatment was required; in 22 cases (44.9%), two operations were needed; and 5 patients (10.2%) were operated three times. Only two patients (4.1%) were operated more than three times.

Best-corrected visual acuity at the last examination of 61 of the 67 patients included in our study was as follows. Eight patients (13.1%) had no light perception (NLP) (in three cases enucleation had to be performed). In six patients (9.8%) there was LP. Four patients had visual acuity of hand motion (HM) or counting fingers (CF). Three (4.9%) patients had a final visual acuity of 1/20 to 1/10, 8 (13.5%) had a best-cor-

rected visual acuity of 2/10 to 4/10, 12 (19.7%) had 5/10 to 7/10, and 20 patients (32.8%) had a final visual acuity of 8/10 to 10/10. Of the 53 patients with penetrating eye trauma, in 49 cases, with a follow-up of 6 months, best-corrected visual acuity was as follows: NLP in 8 (16.3%), LP in 6 (12.2%), CF-HM in 4 (8.2%), 1/20 to 1/10 in 3 (6.1%), 2/10 to 4/10 in 7 (14.3%), 5/10 to 7/10 in 12 (24.5%), and 8/10 to 10/10 in 9 (18.4%). No patient developed endophthalmitis or sympathetic ophthalmia.

## DISCUSSION

MVA-related ocular injuries consist of 21.47% of hospitalized ocular injuries. That percentage is much higher than those in the 1950s and 1960s, when it varied from 2% to 3% (3-5), but is comparable to those in the 1970s to 1990s, when it ranged between 3.5% and 32% (1, 6-13). The increase of that rate is likely related to the higher number of vehicles on the roadway. The male to female ratio in our study (2.7:1) agrees with the reported ratios in other studies, ranging from 2.7:1 to 6.7:1 (1, 8, 12, 14, 15).

**TABLE I - DESCRIPTION OF THE MAIN FINDINGS IN OCULAR INJURIES**

Prolapse of uveal tissue 25 (37.3%)	hyphema 7 (10.4%)	Vitreous hemorrhage 6 (9%)	Lens subluxation 7 (10.4%)		
0	2	1	0	<b>Non penetrating injuries</b> 14 (21%)	Blunt injury 8 (57.1%)
					Lacrimal system and eyelids injury 6 (42.9%)
25	5	5	7	<b>Penetrating injuries</b> 53 (79%)	Cornea 21 (39.62%)
					Sclera 4 (7.5%)
					Cornea+sclera 26 (49.1%)
					Limbus 2 (3.78%)

Almost half (47.76%) of the accidents occurred in a populated area. It is notable that none of the motorcycle passengers who got injured was wearing a helmet and that only three car passengers out of the 58 injured were wearing a seat belt. The role of the seat belt in preventing severe injury is supported by our data and was noted in previous studies as well. A 58% to 73% reduction of penetrating ocular injuries occurred when use of a car seat belt became obligatory (10, 11, 16). In the same period there was no reduction in the number of vehicle-related accidents. In fact, according to one study (11), they increased by 13.9%, while there was a reduction of 60% in eye injuries. Additionally, according to another study (17), after compulsory seatbelt legislation was introduced in Germany and Great Britain, a 60% to 75% reduction in ocular injuries was observed. The seat belt protects the eye from injury as it prevents the forward movement of the body and consequently the possible hit of the head against the windshield of the car. Driver and passenger compliance with use of seat belts continues to be low in Greece, although it has been mandatory to wear a seat belt since 1992.

The windshield and the side windows of the car are the major cause of ocular injuries. In our study 68.7% of the injuries were attributed to the windshield and the side windows of the car. Previous studies had shown the windshield and the side windows as the cause of injuries in 45.4% to 76% of the accidents (13, 16, 18-20). Laminated windshield glass consists of two sheets of glass bonded to a plastic layer, which prevents penetration of the striking object and produces multiple small fragments on impact, which are often retained on the plastic film. Toughened or tempered windshields on the contrary consist of a 5 mm glass, and when an object strikes against them, they are shattered in thousands of small pieces.

The value of laminated windshields was also shown in a previous study (21), which illustrated that ocular injury rates were 17% when the head hit against a laminated windshield, compared to 35% when a toughened windshield was involved. In addition, as toughened windshields break into small pieces, they are more likely to cause multiple and deeper wounds in the lids, the cheeks, and the forehead, which tend to cause more severe scars.

Although airbags have been proven effective in saving lives and preventing injuries, a growing number

of reports indicate that the airbag is also a potential source of ocular trauma (22-27). Improvements in airbag safety will include increased consumer awareness and manufacturer design modification (27, 28). During the study period, the use of airbags was not mandatory.

In our study, 29.5% of the injured people had a final visual acuity of less than 1/20; that percentage increased to 36.7% in those who sustained a penetrating ocular injury. In previous studies and in cases of penetrating ocular injuries the number of patients with final visual acuity less than 1/20 ranged between 10% and 50%.

In the present study, 6.1% of the patients with a penetrating ocular injury required enucleation. Previous studies showed that 5% to 23% of the patients required such surgery, due to the nature of the eye injury and the options for surgical repair that were available (7, 8, 11, 18, 29-31). Finally, 52.5% of the hospitalized patients and 42.9% of those with penetrating ocular injury had a final visual acuity of 5/10 or more. In previous studies, concerning only penetrating ocular injuries, that same percentage varied between 29% and 68% of the patients (1, 11, 13, 18, 31-34).

Although a number of studies have been published concerning ocular trauma due to MVA (13, 18, 19, 31), we conducted this study knowing that many Greek drivers are not vigilant in complying with traffic regulations, and wanted to emphasize the severe peril to the globe during a MVA.

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