

Ocular Trauma Resulting in Enucleation: A 12-year Experience From a Large Regional Institution

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ABSTRACT

Purpose: To review the frequency and cause of traumatic enucleation at the University of Wisconsin.

Methods: A 12-year retrospective chart review (2000-2012) from the University of Wisconsin Hospital and Clinics of patients who underwent enucleation following ocular trauma with specimens submitted to the University of Wisconsin Eye Pathology Laboratory.

Results: A total of 188 eyes enucleated following ocular trauma were identified between 2000 and 2012. One hundred eleven (59%) cases had an identifiable mechanism of injury recorded in the medical record and were included in the final analysis. The overall median patient age was 41 years with 83.8% male. Assault was the most common reason for enucleation (n=30, 27.0%) of which 15 (13.5%) cases were related to gunshot wounds. Other causes included outdoor or recreational activities (n=20, 18.0%), fall (n=14, 12.6%), non-motor vehicle accidents (n=6, 5.5%), motor vehicle accidents (n=15, 13.5%), work-related injury (n=15, 13.5%), and sports-related injury (n=11, 10%).

Conclusion: Assault is the most common cause of traumatic ocular injury leading to enucleation. Gunshot and stab wounds were responsible for the majority of these cases. Men were much more likely to undergo enucleation due to ocular trauma with the exception being that caused by falls, where the rate was nearly equal between men and women.

INTRODUCTION

Trauma is a significant source of ocular injury in the United States, with approximately 2.4 million eye injuries and 40,000 patients suffering traumatic visual impairment annually.¹

Unfortunately, enucleation is an occasionally unavoidable outcome following traumatic ocular injury. Several studies have examined the epidemiology of severe ocular injury and have shown young males to be at high risk.²⁻⁶ Assault, motor vehicle accident (MVA), task-related (including workplace, travel), recreation, and falls have all been noted as significant causes of ocular

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injury.² Sharp objects (broken glass, knives, metal), blunt objects (fists, sports balls), and projectiles have all been implicated in severe ocular injury as well.^{2,3,6}

The economic impact of enucleation is enormous. The National Safety Council estimates that job-related eye trauma costs amount to \$300 million annually. This figure includes medical and hospital bills, worker's compensation, and lost production time.⁷

METHODS

After obtaining institutional review board (IRB) approval and ensuring HIPAA compliance, a review of all ocular pathology charts was conducted to identify which patients underwent enucleation with histopathologic analysis performed at the University of Wisconsin Eye Pathology Laboratory between July 2000 and

December 2012. One hundred eighty-eight patients were identified who underwent enucleation following ocular trauma. Analysis was completed in 111 patients who had information recorded in the electronic medical record as to the cause of ocular injury. Patients were excluded if there was no history of trauma reported or if the cause of traumatic ocular injury was unknown.

The variables included in our study were patient age, gender, and cause of ocular trauma. Enucleated eyes were separated into the following categories based on the nature of trauma and the surrounding circumstances: assault, outdoor/recreational activity, fall/accident, motor vehicle accident, work-related injury, and sports-related trauma. We examined traumatic enucleation related to guns and falls separately.

RESULTS

A total of 188 eyes that were enucleated following ocular trauma were evaluated at the University of Wisconsin Hospital Eye Pathology Laboratory in a 12-year period between July 2000 and December 2012. Approximately 90% of all specimens received

Table 1. Traumatic Ocular Injury: Mechanism and Object

Mechanism	N (%)	Mean Age	% Male	Object of injury	n (%)	% Male
Assault	30 (27.0)	34.2	96.7	Gunshot wound	15 (50)	93.3
				Knife/stab ^a	8 (26.7)	100
				Glass bottle (blunt)	1 (3.3)	100
				Fist	5 (16.7)	100
				Baseball bat to head	1 (3.3)	100
Outdoor/ Recreational Activity	20 (18.0)	40.6	90.0	BB gun/potato gun/ pellet gun	11 (55.0)	90.1
				Tree branch trauma	4 (20.0)	100
				Lawn mower rock	2 (10.0)	50
				All terrain vehicle accident	1 (5.0)	100
				Firework/bottle rocket	2 (10.0)	100
Fall/Accident	20 (18.0)	52.7	60	Fall	14 (70.0)	57.1
				Walker handle	1 (5.0)	0
				Cupboard door	1 (5.0)	0
				Bungee cord	4 (20.0)	100
Motor Vehicle Accident	15 (13.5)	44.0	86.7	Unknown	15 (100)	86.7
Work-related	15 (13.5)	42.6	86.7	Trauma with pipe/hose	5 (33.2)	100
				Nail injury	2 (13.2)	100
				Farming accident (unspecified)	1 (6.7)	100
				Crush injury	1 (6.7)	100
				Shovel	1 (6.7)	100
				Exposure	1 (6.7)	0
				Attacked by animal—pig	1 (6.7)	0
				Tractor jack	1 (6.7)	100
				Wood fragment	1 (6.7)	100
				Metal	1 (6.7)	100
Sports-related	11 (10.0)	39.5	72.7	Softball	2 (18.1)	100
				Hockey puck	1 (9.1)	100
				Paintball	1 (9.1)	0
				Arrow	1 (9.1)	100
				Fishing-related	5 (45.5)	60
				Ski pole	1 (9.1)	100

^aTrauma was induced with a knife in 6 cases, and in 2 cases with sharp glass from a broken bottle.

at the University of Wisconsin Eye Pathology Laboratory were submitted by Wisconsin ophthalmologists. Ten percent of all specimens were submitted by ophthalmologists in other states as the University of Wisconsin Eye Pathology Laboratory is a referral center for several other institutions throughout the country. Review of these 188 cases revealed 111 (59%) cases with an identifiable cause and object of injury. The median age for the cohort was 41 years (range 9-91 years) with 92 (83.8%) male. The median age of female patients was 62 years (range 12-91 years), and the median age of male patients was 37 years (range 9-73).

Overall, assault was the most common underlying reason for enucleation (n = 30, 27.0%). Males represented 96.7% of patients in this group. The majority of violence-associated injuries were gunshot (n = 15, 13.5%) and stab wounds (n = 8, 7.2%). Other cases included outdoor/recreational activities (n = 20, 18.0%) and falls/accidents (n = 20, 18.0%). Motor vehicle accidents (n = 15, 13.5%), work-related injuries (n = 15, 13.5%), and sports-related

injuries (n = 11, 10.0%) also were seen (Table 1). A separate analysis of gun-related injuries (including gunshot wounds, BB guns, pellet guns, and paintball guns) revealed a total of 26 cases representing 23.4% of all cases. Most (92.3%) gunshot wounds occurred in male patients. Falls represented 14 cases (12.6%), with nearly half (42.9%) occurring in females.

DISCUSSION

Assault was the most common cause of traumatic enucleation, with gunshot wounds and knife/stab wounds representing the majority of cases. This is consistent with the findings of Freitag, et al.⁸ Other studies have shown work-related³ and home-related⁶ injuries to be the most common activity leading to enucleation.

Assault-related enucleation was approximately 30 times more common in males than females (29 males, 1 female) in our study. This is consistent with several other published studies in which males were far more likely to suffer traumatic enucleation than females.^{2,3,5,6,9}

The only area where females nearly equaled that of males was in the fall category, in which 57.1% of patients were male and 42.9% were female. It is notable that females in this category were older than their male counterparts (62 years vs 37 years). Elderly patients are at high risk

for falls.¹⁰ The medical implications of falls including fractures, intracranial hemorrhages, and post fall anxiety are well known.¹¹⁻¹³ Smith, et al² also found older patients more likely to suffer severe ocular injury due to falls, but did not comment on whether or not there was a gender discrepancy. Our study demonstrates the risk of severe ocular injury resulting in enucleation in elderly patients after a fall. Ocular injury or loss of an eye may place them at an even greater risk for subsequent falls.

Many studies have found sports-related ocular injury to a common pediatric problem.¹⁴⁻¹⁶ Patients who underwent enucleation resulting from sports-related trauma were older in our study than in a study by Patel et al⁵ (39.5 vs <16 years). Interestingly, there were relatively few sports-related ocular injuries in our study when compared to other categories. It is possible that more people are wearing eye protection while engaging in sports activities. Our study did not establish the presence of eye protection at the time of injury.

This study is limited by its retrospective nature, relatively small size, and recording bias. Also, the University of Wisconsin Hospital is a tertiary referral center. It is possible that the injuries seen in our study are more severe than those typically seen in other areas.

CONCLUSION

Trauma is a significant source of severe ocular injury that may lead to enucleation. Assault was the overall leading cause of traumatic ocular injury in our study. Gunshot and stab wounds were responsible for the majority of these cases. Men were much more likely to undergo enucleation following ocular trauma and they were significantly younger than women. Females were more likely to undergo enucleation after a fall than any other trauma. Sports-related ocular injuries may occur at any age.

Additional work in public education regarding causes of ocular injury and the value of eye protection may be beneficial. A low threshold for emergent referral of patients to those experienced in treating these injuries should be instituted when ocular injury occurs.

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