

# Incidence of Ocular Injury in Visually Asymptomatic Orbital Fractures

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**Purpose:** To determine the incidence of severe ocular injury in visually asymptomatic patients with orbital fractures.

**Methods:** Retrospective review of 241 cases of orbital fracture, of which 126 cases had ophthalmic evaluation within 1 week of injury and were included in our analysis. Fracture type, associated symptoms, and injuries were evaluated. Injuries were categorized into severe (requiring immediate evaluation), moderate (requiring evaluation within the next several days), and mild (may not require evaluation). The presence of symptoms and associated visual acuity and severity of injury were analyzed for statistical significance.

**Results:** Forty-six of 126 patients with orbital fractures were visually asymptomatic. Of these patients, none had severe injuries, 15 had moderate injuries, 23 had mild injuries, and 8 had no injuries. Of those with symptoms, 15 had severe injuries, 27 had moderate injuries, 35 had mild injuries, and 3 had no injuries. Using Fisher exact test analysis, asymptomatic patients were unlikely to have severe ocular injury in the setting of orbital fracture ( $p = 0.0009$ ). In addition, visual acuity did not accurately predict the presence of severe ocular injury.

**Conclusion:** Visually asymptomatic patients with orbital fractures do not have ocular injury requiring emergent evaluation.

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Trauma resulting in orbital fractures is often associated with ocular and periocular injuries. These injuries, and their accompanying functional sequelae, range from eyelid abrasions and lacerations—resulting in no visual loss—to traumatic optic neuropathy and globe rupture causing blindness.<sup>1</sup>

Several studies have attempted to determine the frequency and severity of ocular injury in cases of orbital fractures with widely varying results. Kreidl et al.<sup>2</sup> found that “significant intraocular sequelae,” defined via select ICD-9 codes, were found in 40% of patients who were followed by an ophthalmologist.

Cook<sup>3</sup> noted a 26% ocular injury rate, and al-Qurainy et al.<sup>4</sup> found a 27% rate of moderate-to-severe ocular injury. Additionally, correlations between fracture type, visual acuity, mechanism of injury, and even intraocular pressure<sup>4</sup> have been made to help predict ocular injuries.

In some cases, the most important question is the timing of an ophthalmology referral. There is an argument that early treatment of fractures results in improved cosmesis<sup>5</sup>; however, if there is significant ocular injury, the eye must take precedence over the orbit. In addition, most oculoplastics specialists wait until orbital swelling is diminished to provide a better cosmetic result (with extraocular muscle entrapment being an urgent exception). There may also be a role for early surgery if there is potential for optic nerve compression.<sup>6</sup> Certainly, the easy solution is to refer every fracture patient; however, this is neither practical nor cost-effective.

Emergency room physicians and maxillofacial surgeons typically rely on patient symptoms to determine if an ophthalmic evaluation is necessary. al-Qurainy et al.<sup>3</sup> proposed a scoring sheet for maxillofacial surgeons to use in the initial evaluation of a patient to assist with determining when a referral to an ophthalmologist should be made. The scoring is based on the presence of 4 factors: visual acuity, fracture type, ocular motility dysfunction, and amnesia. This scoring sheet, however, is limited in that it does not account for subtle injuries that may lead to poor outcomes. They found that visual acuity was the best outcome predictor. They did not comment on whether visual acuity was changed or not. Many patients do not have 20/20 vision to begin with and are being evaluated at the bedside with a near card. Presbyopic patients and patients with media opacities will have lower visual acuities that may not be changed from baseline.

In this consecutive retrospective study, we attempt to correlate ophthalmic symptoms with ophthalmic findings in patients who have orbital fractures to assist nonophthalmologists in the decision-making process.

## METHODS

A consecutive retrospective chart review was conducted of all patients with orbital fractures between 1985 and 2006 at the University of Minnesota Medical Center. Of note, our center is not a major trauma hospital. A total of 241 charts were reviewed, and those patients who were evaluated by an ophthalmologist within 1 week of injury were included in the cohort. Our database comprises 126 patients with radiographically proven orbital wall fracture and seen either in consultation from trauma teams or the emergency department. All of the patients were evaluated by an ophthalmic plastic surgeon, and many were also previously evaluated by an ophthalmology resident. The written ophthalmology consultation reports, trauma service reports, and

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radiology reports, when available, were all reviewed. The age and gender of the patient, ophthalmic symptoms reported, visual acuity, associated injuries, mechanism of injury, fracture type, laterality of the fracture, and days elapsed between injury and consultation were documented.

Ocular injuries were placed in 1 of 3 categories. Severe injuries that do, or may, require immediate intervention include ruptured globe, retinal tear, vitreous hemorrhage, hyphema, traumatic optic neuropathy, extraocular muscle damage, orbital cellulitis, retrobulbar hemorrhage, and conjunctival lacerations. Moderate injuries that warrant evaluation and may require treatment within 2 days include traumatic iritis, choroidal rupture, microhyphema (or traumatic pigment dispersion), corneal abrasion, and eyelid laceration. Inconsequential injuries that may or may not warrant evaluation and do not require treatment include subconjunctival hemorrhage, conjunctival ecchymosis, periorbital ecchymosis, retinal hemorrhage, commotio retinae/Berlin edema, traumatic mydriasis, and V2 hypoesthesia.

Patients were separated into asymptomatic and symptomatic groups based on questioning about specific ophthalmic symptoms, including blurry vision, pain, photophobia, diplopia, nausea, floaters, photopsias, scotomata, dizziness, tearing, and a sensation of pressure. Those who exhibited any one of these symptoms were classified as symptomatic, and if none of these symptoms were present, a classification of asymptomatic was used. These groups were further evaluated for fracture type, mechanism, and visual acuity and their associations with the above-listed injuries. The Fisher exact test was used for statistical analysis.

## RESULTS

The median time from injury to ophthalmic evaluation was 4 days. Ophthalmic review of symptoms was obtained by the treating emergency room physician at the initial presentation. Most of the cohort comprised male patients (123 male vs. 23 female patients). Three patients were age 0 to 10 years (2%), 39 were 11 to 20 years (31%), 37 were 21 to 30 years (29%), 17 were 31 to 40 years (13%), 14 were 41 to 50 years (11%), 6 were 51 to 60 years (5%), 4 were 61 to 70 years (3%), and 4 were 71 years or older (3%). Most fractures were a result of assault (49%). There were 22 (17%) that resulted from sports collisions, 17 (13%) from falls, 9 (6%) from motor vehicle accidents (with 1 being bilateral), 7 (5%) from high-velocity balls, 4 (3%) from beer bottles, and the remainder from a variety of other methods, including horse kick, bull kick, and bungee cord.

Of the patients in the symptomatic groups, the percentages of patients and their symptoms were as follows: 31 with pain (39%), 30 with blurry vision (38%), 22 with diplopia (28%), 8 with photophobia (10%), 4 with nausea (5%), 3 with scotomata (4%), 2 with floaters (3%), 2 with dizziness (3%), 2 with tearing (3%), 1 with photopsias (1%), and 1 with a sensation of pressure (1%).

In the symptomatic group, there were 15 cases with severe injury including the following: 6 hyphema, 3 conjunctival lacerations, 2 retinal tears, 2 vitreous hemorrhages, 2 extraocular muscle damage, 1 case of orbital cellulitis resulting in central retinal artery occlusion, and 1 ruptured globe. There were 27 cases with moderate injury (a few patients had multiple injuries): 17 cases of iritis, 14 eyelid lacerations, 5 microhyphemas, all of which were not treated, and 6 corneal abrasions. The remainder of the injuries fell in the mild category.

In the asymptomatic group, there were no ocular injuries categorized as severe (Table 1). There were 15 (32%) injuries categorized as moderate: 9 eyelid lacerations, 3 cases of traumatic iritis that were untreated, and 3 cases of microhyphema, which also did not receive any treatment. The remaining injuries were classified as mild. Patients who were asymptomatic were unlikely to have severe injuries requiring prompt intervention ( $p = 0.0009$ ).

Further analysis was conducted to correlate visual acuity to severity of injury in each case of orbital fracture (Table 2). Most patients (79%) had 20/30 vision or better. Patients with poor vision (20/100 or worse) were more likely to have severe injury; however, no

**TABLE 1.** Number of patients with varying severity of ocular injury in both asymptomatic and symptomatic cohorts

Injury severity	Asymptomatic	Symptomatic	Total
No injury	8	3	11
Mild	23	35	58
Moderate	15	27	42
Severe	0	15	15
Total	46	80	126

statistical correlation was seen between visual acuity and severity of injury. In fact, a greater number of patients with severe injury had 20/30 vision (7) than 20/100 vision (6).

## DISCUSSION

There are 2 proposed theories of orbital fracture: the hydraulic theory and the buckling theory.<sup>8-10</sup> The hydraulic theory states that retropulsion of the globe causes a rise in intraorbital pressure. The increased pressure is transferred to the walls of the orbit, creating a force large enough to cause a fracture. The buckling theory proposes that direct force on the orbital rim causes a compression fracture of the wall as the energy is transmitted through the thinner orbital wall. Experimental models have been created to help validate both theories and many proponents of both exist. In reality, both mechanisms are plausible depending on the injury (i.e., a large blunt object that hits the rim vs. a smaller object that transmits most of the force to the globe).

It has been long maintained that the orbit is designed such that the walls will absorb energy and fracture to protect the globe in cases of trauma. Recent studies have concluded that the orbital floor, in particular, requires significantly less energy to fracture than does the globe to rupture.<sup>1,8</sup> However, the forces are still great enough to cause significant ocular injuries directly or indirectly (from bony fragments, etc.).

Many factors play in how extensive an evaluation is needed on initial presentation with an orbital fracture. For emergency room and trauma physicians, experience with a full ophthalmic evaluation is limited. A predictive scoring system has been proposed to attempt to help medical personnel determine a threshold for consultation,<sup>11</sup> and the most sensitive predictive factor has been reported as visual acuity.<sup>4</sup> This scheme seems helpful, but visual acuity is not perfectly sensitive for picking up severe injuries in al-Qurainy et al.'s data set, and even less so in our data set. This is true for several reasons. Many patients in a trauma setting have lost or broken their glasses, limiting the accuracy of visual acuity testing. Second, patients with pre-existing low vision will do poorly on visual acuity testing. Third, presbyopic patients evaluated at the bedside may do poorly on evaluation with a near card. Fourth, given the extent of their trauma, some patients may be intu-

**TABLE 2.** Number of patients with varying severity of injury and corresponding visual acuity

Vision	No injury	Mild injury	Moderate injury	Severe injury	Total
20/30 and better	11	47	34	7	99
20/40-20/80	0	9	6	2	17
20/100 and worse	0	2	2	6	10
Total	11	58	42	15	126

bated or sedated, rendering them incapable of providing a visual acuity. Finally, severe injuries may coincide with good visual acuity but have other symptoms such as pain, photopsias, floaters, diplopia, or scotomata.

Our data show that contrary to visual acuity, ophthalmic symptoms obtained at initial presentation in the emergency room are a very sensitive predictor of severe ocular injury. We found that all patients with severe injuries invariably presented with one of the above-mentioned symptoms. In addition, those patients without at least one of these symptoms had no ocular injuries requiring immediate intervention or evaluation. With few exceptions, it is relatively easy to determine a patient's ocular symptoms and, therefore, determine the urgency of ophthalmic consultation. We believe that the finding of an orbital fracture in most of these asymptomatic cases is incidental.

Most patients have injuries—mild to moderate—that ultimately require evaluation by an ophthalmologist. However, these injuries can be managed within a few days of the injury. In addition, if oculoplastic consultation is sought, most fractures will not be repaired in the acute time frame, and if available, combined evaluation with the orbital surgeon can be more convenient for the patient.

Our study does have a significant limitation in that the median time to evaluation was 4 days. Injuries such as hyphema, corneal abrasion, and traumatic iritis—which were all classified as moderate or worse injuries—could certainly resolve, or in the case of hyphema, become microhyphema, affecting our overall results. In reality, most patients with these types of injuries would be symptomatic—either photophobic, in pain, or have a foreign body sensation, which would likely result in sooner evaluation by the ophthalmologist. A prospective study comparing ophthalmic symptoms to eye injuries in orbital fracture patients will be needed to confirm our findings.

It is our recommendation that any patient with a change in visual acuity be promptly evaluated. In addition, those patients who are intubated or unable to provide information

about visual acuity or symptoms should be seen immediately. Those patients with no symptoms may not require immediate consultation.

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