

Etiological Spectrum, Clinical Presentation, and Visual Outcomes of Ocular Trauma in a Rural Tertiary Hospital Setting

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ABSTRACT

Ocular trauma in rural tertiary hospital settings predominantly affects young adult males (aged 21–40 years) and is largely preventable, with outcomes heavily dependent on the promptness of medical care and injury severity. [1, 2, 3]

Etiological Spectrum (Causes)

- **Primary Causes:** Road traffic accidents (RTAs), agricultural/farm work, and occupational hazards (such as handling tools or construction materials) are the leading etiologies in rural cohorts. In specific agrarian settings, agricultural field labor and domestic/play accidents (with wooden sticks, thorns, or stones) represent a major share of cases. [1, 2, 3, 4, 5, 6]
- **Demographics:** Studies consistently show a high male predominance (ranging roughly from 71% to 88% of patients) and a peak incidence among individuals aged 21 to 40 years. Rural residents make up the majority (70%–85%) of patients presenting to these facilities. [1, 2, 3, 4]
- **Safety Gear:** The vast majority of patients report a lack of standard eye protective devices (EPD) at the time of injury. [1]

Clinical Presentation

- **Injury Classification:** Closed-globe injuries (such as contusions and lamellar lacerations) account for the majority of presentations (68%–83%), while open-globe injuries (ruptures or lacerations) make up 10%–32% of cases. [1, 2, 3]
- **Anterior Segment Findings:** Common clinical manifestations include corneal abrasions or penetrations, lid lacerations, subconjunctival hemorrhage, hyphema (blood in the anterior chamber), traumatic iritis, and traumatic cataracts. Lid lacerations and corneal surface involvement are especially frequent in blunt and minor penetrating impacts. [1, 2, 3, 4]
- **Posterior Segment Findings:** More severe trauma involves vitreous hemorrhage, retinal tears/detachments, choroidal ruptures, or traumatic optic neuropathy. [1, 2]
- **Presentation Delay:** A significant proportion of rural patients experience treatment delays (often exceeding 24 hours from the time of injury to hospital arrival) due to travel distances and referral patterns. [1, 2]

Visual Outcomes

- **Initial vs. Post-Treatment Acuity:** A high percentage of patients present with initial severe visual impairment or blindness (vision of 6/60 or worse in over half of acute cases). [1]
- **Prognostic Improvement:** Following prompt surgical or medical intervention (such as lid/corneal tear repairs, anterior segment management, or cataract extraction), a substantial recovery rate is observed—with significant proportions achieving functional or improved best-corrected visual acuity at 6 to 8 weeks of follow-up. [1, 2, 3]
- **Poor Prognostic Factors:** Independent predictors of poor visual outcomes (vision worse than 20/200 or persistent blindness) include open-globe injuries, presentation delays greater than 24

hours, older age (>50 years), posterior segment involvement, intraocular hemorrhage, and relative afferent pupillary defects (RAPD). [1, 2, 3]

KEYWORDS- etiological, clinical, ocular, trauma, visual, hospital

INTRODUCTION

A significant number of blindness cases worldwide are related to ocular trauma. Over two million cases of ocular trauma are reported every year, of which over 40,000 result in significant vision loss. Traumatic ocular injury negatively affects the quality of life of the patients and their families, as well as their socioeconomic status and psychological well-being. Injury to a person or a tissue or organ is defined as the interruption of tissue function due to the transfer of external energy (mechanical, thermal, radiant, nuclear, chemical, or electrical) [1]. The eyeball is generally well protected in our bodies. The lids, eyelashes, and orbital margins protect the eye from direct damage. As for physiological protection, it is protected by blink reflex, head-turning reflex, and lacrimation after the entry of any irritating material.[1,2,3]

Trauma can cause injuries to the globe, optic nerve, and adnexa of the eye, and these range from superficial to vision-threatening complications. It is critical that ophthalmologists and non-ophthalmologists use a standardized classification system of terminology and assessment when describing and communicating clinical findings as our understanding of the pathophysiology and management of these disorders has evolved tremendously in recent decades. The ocular tissue is delicate and sensitive, making ocular injuries more severe than those involving other body parts, and may lead to permanent blindness. Hence, to facilitate proper communication between ophthalmologists and plan clinical trials in the field of ocular trauma, the Ocular Trauma Score (OTS) has been developed. There are a variety of ocular injuries, including minor ones, such as a subconjunctival hemorrhage that does not affect vision, and more severe ones such as a globe rupture or retinal detachment. Globe injuries are classified into two types: open and closed. The delicate, sensitive nature of the ocular tissues causes ocular injuries to affect the eye more severely than any other part of the body, often leading to permanent blindness.

Globally, ocular trauma is the most common cause of visual disability and morbidity. In India, over 500 lakh people suffer from blindness, and every year the blind population increases by 38 lakhs. Of note, 1.2% of cases of blindness are caused by avoidable ocular injuries. A rural population (4.5%) may have a higher prevalence of blindness compared to an urban one (3.97%) [2]. People living in rural areas are often uninformed about protective devices such as goggles and shields. Agricultural work and handling of animals are also major causes of eye injuries.

Due to the financial costs associated with ocular trauma and the economic burden on the healthcare system resulting from the cost of treatment and rehabilitation services, raising awareness and implementing prevention measures are highly justified. Many injuries can be prevented by increasing public awareness about potential risk factors and agents that may cause injury [3-4].

DISCUSSION

Ocular trauma is a leading cause of avoidable monocular blindness and visual impairment worldwide.[1] The incidence and prevalence of ocular trauma vary based on geographical location, climate and societal factors. Approximately 1.6 million people worldwide are blind due to ocular trauma, 2.3 million being bilaterally visually impaired and 19 million have unilateral loss of vision.[2], [3] The reported incidence of ocular trauma in India varies from 1% to 5%.[4], [5] 5% of all ophthalmic hospitalisation in the developed countries are due to ocular trauma and this figure is much higher in developing countries.[6] Despite its public health importance, ocular trauma is most neglected and under-reported disorder.[4,5,6]

Severity and extent of ocular injury is determined by the amount of energy transferred to the globe & orbit, characteristic of traumatic agent and location of impact area. Blunt trauma is the commonest form (54.9%) of ocular injury.[7] Blunt trauma can occur in almost any setting and circumstances including workplace / domestic accidents, road traffic accidents, sports & recreational activities and physical assaults etc.[8]

The most common traumatic agent causing blunt ocular trauma are cricket ball, squash ball, fist, bamboo /wooden stick, airbag, cow horn and other projectile objects like stone, brick & Gulli etc.[9], [10] The spectrum of blunt ocular injuries ranges from mild non-sight threatening injuries like ecchymosis of eye lid, corneal abrasion, sub-conjunctival haemorrhage to extremely serious blinding consequences such as globe rupture, retinal detachment, intraocular haemorrhage, traumatic optic neuropathy and orbital haemorrhage etc.

Blunt ocular trauma can cause damage of ocular tissue by the coup and countercoup mechanism and anteroposterior compression or horizontal tissue expansion. Coup injury occur at the site of impact (e.g. ecchymosis of lid, sub-conjunctival haemorrhage and corneal abrasion etc). Counter-coup refers to injuries at the opposite side of site of impact like commotio retinae.

Blunt trauma causes various effects in anterior and posterior segment of the eyeball and its adnexa [eyelid, orbit, conjunctiva][7,8,9]

Ocular trauma is a major cause of vision loss and long term morbidity particularly in young male population. It is the most common cause for monocular blindness. The personal impact of ocular trauma is compounded by socioeconomic costs, such as treatment, hospitalization, loss of work and rehabilitation. Patients with major facial trauma have a high risk of vision threatening injury.

Lifestyle, culture and socioeconomic condition of the people influence the nature and cause of trauma. Eye injuries constitute about 7% of all bodily injuries and 10 to 15% of all eye disorders. It is estimated that 90% of all eye injuries are preventable. Road traffic accidents remain the most common etiology of eye injuries followed by assault and accidental self falls. Trauma

patients should be carefully evaluated for the presence of hidden eye injuries beyond obvious ones, since they represent a major risk factor for visual impairment

RESULTS

In this era of high speed vehicles and industrialization, the incidence of ocular injuries is increasing in general along with other bodily injuries. In spite of the fact that eyes are well protected with lids, margins of orbit, nose and fat cushion from behind, eyes are prone to all form of injuries.

In our study of 560 trauma patients with ocular involvement, most commonly males were involved. The commonest age group involved was young males between 21 to 30 years (29.2%). Males (82.1%) had higher frequency of orbital wall fractures with ocular manifestations when compared to females. Unilateral ocular involvement was more common in our study.

Road traffic accident (51.4%) was the most common etiology followed by assault, self fall, sports injuries and work place injuries. Facial involvement has been considered a risk factor for sight threatening injuries. In our study, patients who sustained facial injuries suffered sight threatening injuries. Visual acuity was normal (6/6) in most cases (58.9%). 11 cases had no perception of light due to total globe rupture and traumatic optic neuropathy.[2,3,4]

The most commonly reported eye injury in our study was periorbital edema with ecchymosis (69.3%). Periorbital edema and ecchymosis was associated with majority of the cases along with other ocular manifestations. The second most common manifestation was orbital fractures (13.6%). Orbital fractures were associated with periorbital edema and ecchymosis in most cases. The lateral wall of the orbit (42.1%) was most commonly involved in our study patients.

Subconjunctival hemorrhage (11.3%) was seen in 63 patients. Lid lacerations were also commonly seen in our patients. 4 cases had third nerve palsy. Globe rupture was seen in 2 cases. 2 patients had corneal tear. Hyphema was seen in 2 cases. Facial nerve palsy was seen in 1 patient presenting with lagophthalmos and exposure keratitis. One patient had Subluxation of lens. Commotio retina was present in 4 cases. Posterior segment was less commonly involved than anterior segment in our study. The most common posterior segment finding was Berlins edema. Traumatic optic neuropathy was seen in 9 cases presenting with relative afferent papillary defect.

Trauma is the leading cause of monocular preventable blindness in the developed world, although few studies have uniformly and consistently addressed the problem of trauma in developing nations and rural areas.[1] Combined with adnexal injuries, the eyelids, the lacrimal system, and the orbit, ophthalmic trauma is a major cause of morbidity with permanent structural, functional, esthetic, economical, and psychosocial consequences both in adults and children.[2,3]

While mechanical injuries are the most commonly encountered, well-studied, and of relevance to the discussion in this manuscript, other injuries include chemical, thermal, and ionizing radiation. The spectrum of ophthalmic trauma includes ocular injuries, ocular adnexal injuries (eyelid, lacrimal, and orbital structures), and orbito-facial injuries (cranio-orbital and orbitofacial fractures and soft tissue injuries). Ocular trauma is encountered in 13–16% of all systemic injuries[4-7] and as high as 83% in patients with head injuries[4-7] warranting the need for a formal evaluation by ophthalmologists in all head injuries and suspect cases in systemic injuries.

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The etiology of ocular injury vastly differs between urban and rural areas and among various geographical regions around the world and is worthy of investigation.[8-10] Common causes of mechanical ocular trauma include road traffic accidents and motor vehicle accidents including direct impact with steering wheels, windshield and windows and also airbags, assault, industrial accidents and other occupational injuries, falls, domestic accidents especially in children and women and sports injuries.[10,11] Other less frequent but potentially serious causes include firecracker injuries,[7] guns, and finally, terrorism-related injuries. Common risk factors for ocular trauma include children (domestic accidents), youth (sports and violence), adult males (industrial accidents, violence, and assaults), alcohol consumption, and the elderly (falls).

Globe injuries have been variably and often incorrectly mislabeled over the centuries. The first major attempt to address this and introduce a standardized terminology was with the introduction of the Birmingham Eye Trauma Terminology (BETT). Taking into account the nature of the injury, integrity of the ocular coats, internal disruption, and the presence of intraocular foreign bodies, two broad classifications along with part from a formal classification into closed- and open-globe injuries, may then be classified into closed- and open-globe injuries[6,7,8]

CONCLUSION

Blunt ocular trauma remains a significant cause of visual morbidity, particularly affecting young males. Early intervention and appropriate management of complications can result in favorable visual outcomes in the majority of cases. Workplace safety measures and road traffic injury prevention strategies are essential for reducing the burden of ocular trauma [9]

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