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CLOSED HEAD INJURY AND ITS OCULAR MANIFESTATIONS: A CLINICAL STUDY

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Abstract:

Introduction: The visual system is one of the systems involved in traumatic brain injury. The eye is frequently involved in head trauma due to proximity of the eye to the head as well as due to the neural connections between the eye and the brain.

Aim: To assess the simultaneous involvement of ocular structures in cases of closed head injury and describe the spectrum of ocular involvement.

Meterial and Method: A hospital based cross sectional study was carried out for duration of 1 year concerning ocular trauma in closed head injury patients. Adult patients with closed head injury diagnosed by surgical team on basis of history, neurological findings, admission Glasgow Coma Scale (GCS) score and brain computerized tomography (CT) scan findings, admitted within a week of injury were included in the study. Apart from the detailed surgical evaluation ophthalmic examination was carried out. Abnormalities of the visual system were classified as soft tissue injuries to the globe and adnexa, neuro-ophthalmic abnormalities, and injuries to the bony orbit. All the ocular injuries were managed as per standard protocol.

Result: A total of 65 consecutive adult cases of closed head injury were recruited in the study. There were 54 (83%) male and the mean age of patients was 38.7 ± 8.2 years. The main cause of head injury was road traffic accidents 35 (53.8%) followed by physical assault 20 (30.7%). Ocular involvement was found in 36 (55.4%) cases.Soft tissue injuries to the globe and adnexa included ecchymosis (43%), subconjuctivalhaemorrhage (26%), corneal epithelial defects (15.4%), commotion retinae (15.4%). Neuro-ophthalmic abnormalities recorded werepapilloedema (9.2%), traumatic optic neuropathy (15.4%). Injuries to the bony orbit were in form of orbital fractures in 23 (35.4%) patients. Floor and lateral wall were most commonly involved. There was no significant association of GCS score with the ocular involvement in this series

Conclusion: In cases of head injury spectrum of ocular involvement ranges to non significant findings like edema, ecchymosis to loss of vision and motility as in traumatic optic neuropathy and extraocular muscle palsy. In all the cases of head injury ophthalmic examination is essential for early diagnosis and timely management of these cases.

Keywords: Closed head injury, Occular manifestations, trauma

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Introduction

Head injury is a common cause of death and major disabilities in trauma patients especially in developing country like ours. In head injury patientsdisability is frequently characterized by a combination of physical and cognitive defects.[1] The visual system is one of the systems involved in traumatic brain injury. The eye is frequently involved in head trauma due to proximity of the eye to the head as well as due to the neural connections between the eye and the brain.[2] Despite the protection extended to the eyes due to its placement in the orbit, the injuries to eyes are very common in association with head injury. The ocular involvement in head injury can be due to direct injury or indirect impact. Many theories have been proposed of how the eye is injured in traumatic brain injury. In penetrating brain injury, there may be physical damage to the visual pathway, visual cortex, and/or other vision-related structures of the brain. In non-penetrating or closed-head injury, displacement, stretching, and shearing forces may damage areas of the brain, including those associated with vision.[3] Direct ocular trauma also contributes to the visual dysfunction in patients with head injury.[2] Head injury patients may be difficult to examinebecause of cognitive and communication disorders.A complete assessment may include evaluationof the eye, refraction, and examination of ocular motility, accommodation, vergence, stereopsis, visual perception, and visual fields.[4] Rehabilitation of the head injury patient is muchmore difficult if the visual system is not efficient.There has not been enough documentation regarding the ophthalmic manifestations of head injury in many trauma centers. Early diagnosis of visual problems following traumatic brain injury is essential to maximize the overall rehabilitation potential.[5] This close association warrants the careful ocular examination in all cases of head injury. This study was done to evaluate the simultaneous involvement of ocular structures in cases of closed head injury and to describe the spectrum of ocular involvement.

Material & Methods

Present study was a hospital basedcross sectional studycarried out for duration of 1 year January 17 to December 17 concerning ocular trauma in closed head injury patients. Adult patients with closed head injury attending casualty and outpatient or inpatient Department, in the Department of surgery were included in the study. Patients with a diagnosis of head injury by the surgical team on basis of history, neurological findings, admission Glasgow Coma Scale (GCS) scoreand brain computerized tomography (CT) scan findings, admitted within a week of injury were included in the study. Those less than 18 years or with injury of more than a week were excluded. Patient's sociodemographic data, mode of head trauma along with the GCS score and neurological findings were recorded. Ophthalmic assessment was carried out in all patients within one week of admission into the hospital by the ophthalmologist. Visual Acuity was assessed in conscious and oriented cases.Detailed ophthalmic examination was also carried out in all patients. Patients were managed according to their respective diagnoses by the surgical and ophthalmologic units. Diagnostic investigationswere carried out whenever indicated and included CT brain and orbit, gonioscopy, visual fields, diplopia charting, visual evoked potential and measurement of intraocularpressure. Ocular and visual complications were grouped into threemain classes of abnormalities of the visual system: softtissue injuries to the globe and adnexa, neuro−ophthalmicabnormalities, and injuries to the bony orbit.All the ocular injuries were managed as per standard protocol.

The study was conducted after approval from Institutional Ethics Committee and adheres to the tenets of Declaration of Helsinki. Data were collected after written informed consent from the case or legal guardian. Statistical analyses were performed using StatisticalPackage for the Social Sciences software (Version SPSS 22.0/ IBM, Chicago,USA). Data were analyzed with appropriate statistical indices. Ocular findings were associated with neurological findings of the patients using Chi square test of association.

Results

A total of 65 consecutive adult patients of closed head injury were recruited in the study. There were 54 (83%) male and 11(13%) female. The mean age of patients was 38.7 ± 8.2 years. Majority of patients46 (71%) were in age group of 18-40 years. Table 1 shows the age and gender wise distribution of study population.

Age (Yrs)	Male	Female
18- 30	21	2
31-40	18	5
41-50	12	3

51-60	2	1
>60	1	0
Total	54	11

Table 1: Age and Gender-wise distribution of patients

The main cause of head injury was road traffic accidents 35 (53.8%) followed by physical assault20 (30.7%). Other causes were fall from height 6 (9.3%), gunshot 1 (1.5%) and 3 (4.7%) occupational injuries [Table2].

S. No.	Causes	No. of cases
1.	Road traffic accident	35
2.	Physical assault	20
3.	Fall from height	6
4.	Others	4

Table 2 Mode of head injury

Out of all the patients18 (27.7%) were unconscious and thus their complaints, visual acuity and ocular movements could not be recorded. Ocular complaints were reported in 22 (33.8%) with lid swelling as most common complaint 16 (24.6%) patients, diminution of vision 9 (13.8%)and pain in 7(10.7 %) patients. Visual acuity was normal in 38(58.5%) cases. Ocular involvement was found in 36 (55.4%) patients.Soft tissue injuries to the globe and adnexa included lid laceration (20%), ecchymosis (43%), subconjunctivalhaemorrhage (26%), corneal epithelial defects (15.4%), open globe injury corneal / sclera laceration (1.5%), traumatic cataract (1.5%). Posterior segment was involved in (29%) cases with vitreous haemorrhage (4.6%), retinal hemorrhages (9.2%), commotion retinae (15.4%).Neuro-ophthalmic abnormalities recorded werepapilloedema(9.2), traumatic optic neuropathy(15.4%) and extraocularmuscle palsy (7.6%).Injuries to the bony orbit were in form of orbital fractures in 23 (35.4%) patients. Floor and lateral wall of orbit were most commonly involved.

SOFT TISSUE INJURIES	No of cases	Percentage (%)
Lids:		
Edema & Ecchymosis	28	43
Lid laceration	13	20
Lagophthalmos	6	9.2
Conjunctiva:		
Chemosis	4	6.2
laceration	2	3.1
Sub conjunctival hemorrhage	17	26.1
Cornea:		
Epithelial defect	10	15.4
Stromal edema	***1***	1.5
Laceration	***1***	1.5
Exposure keratitis	***4***	6.2
Anterior chamber:		
Hyphema	2	3.1
Iris:		
Dialysis	1	1.5
Prolapsed	1	1.5
Lens:		
Traumatic cataract	1	1.5
Subluxation	1	1.5
Posterior segment		
Vitreous hemorrhage	3	4.6
Commotio retinae	10	15.4
Retinal hemorrhages	6	9.2
NEURO-OPHTHALMIC ABNORMALITIES:		
Traumatic optic neuropathy	11	16.9
Papilledema	6	9.2
Extra ocular muscle palsy	5	7.7
Papillary involvement	13	20
INJURIES TO THE BONY ORBIT.		
Fracture orbital floor	10	15.4
Fracture orbital roof	0	0
Fracture orbital medial wall	2	3.1
Fracture orbital lateral wall	7	10.8
Multiple wall fracture	4	6.2

Table 3: Spectrum of Ocular Involvement in Head Injury Cases

GCS score	Ocular involvement		
	Present	**Absent**	**P value**
13-15 (Mild)	22 (33.8%)	17 (26.2%)	0.431
9-12 (Moderate)	5 (7.7%)	6 (9.2.%)	0.336
<8 (Severe)	8 (12.3%)	7 (10.8%)	0.061

Table4: GCS and Ocular Involvement Correlation

Discussion

Young adultmales (18–30 years) were the major group who sustainedhead injury. In the present study the mean age was 29.4 years (±7.8 years). Kulkarni *et al*. in their study showed the similar outcome.[6] Odebode *et al*. in their studyshowed a peak during third decades (21–30 years) of life.[7] Sharma *et al*. showed a peak in road traffic accidents during21–40 years.[8] This can be explained by the fact that ours is a male dominated society and they bear the burden of earning hence expose themselves more to such accidents because of outdoor activities.Road traffic accidents were the most common cause of head injury. Other studies also showedalmost similar observations.[6-9] Few authors have reported the higher incidence of road traffic accidents as a cause of head injury.[10,11] However Emem et al reported a very low incidence of ocular involvement 4.06%.[10] In present series ocular involvement was seen in 55.4% cases. This difference can be attributed to the difference in the inclusion criteria and high impact of collision in present study.Kulkarni *et al.*also found a higher incidence of ocularinvolvement of 83.5% in closed head injury patients.[6] Previous studies also showed higher incidences of ocular findingswhen ophthalmologists participate in theexamination of head injury patients.[12] In the present series the most common involvement was in form of soft tissue eyelid edema ecchymosis (43%) laceration (20%) sub conjunctival hemorrhage (26.1%) corneal epithelial defect (15.4%) and commotio retinae (15.4%). We compared our study to other studies by Madavi *et al* Kulkarni *et al* andOdebode*et al*. the results were comparable.[6,7,13] In cases of head injury the soft tissue involvement is often resulting of direct impact, however commotio retinae are due to concussion effect. Neurophthalmic evaluation is difficult in cases with reduced consciousness orcoexisting injuries.In eye the second cranial nerve transmits the visual signals and forms the anterior visual pathway. Third to seventh cranial nerves innervate the different structures of eye and are responsible for various ocular movements and functions. Thus neurophthalmic manifestations are frequently associated with head injury.[14] Pupillary signs (size, reaction tolight) are of grave importance in indicating the siteand severity of injury and in the prognosis of headinjury.In the current study 20% cases showed pupillary involvement. Pupillary abnormalities were found in 7.95%as in study by kulkarni et al.[6] This difference can be attributed to higher incidence of traumatic optic neuropathy and other anomalies of pupil like traumatic mydriasis which were also taken into account in the present series. Accurate ocular motilityassessment in unconscious cases was not possible, 7.7% cases were having extraocular muscle palsy 6th and 3rd.Sixth nerve palsy was seen in cases of severe head trauma with associated cerebral edema, bleed and raised intracranial pressure apart from direct involvement of muscle in orbital fracture. Traumatic optic neuropathy in conscious cases were diagnosed as those having low visual acuity with relative afferent papillary defect and changes in visual evoked potential, however in unconscious cases relative afferent pupillary defect along with coexisting fracture of optic canal.Orbital fracture was present in 29% cases with head injury. According to Duke Elder injury to skull is common cause of orbital fractures.[15] Orbital floor (15.4%) and lateral wall fracture (10.8%) on CT scan were the most common injuries of the bony orbit. Kulkarni*etal*observed 12% cases of orbital fractures in their series.[6] Although medial wall is the thinnest but in head injury cases due to high impact velocity, as the lateral part of face is more exposed floor and lateral wall fractures are more commonly encountered.The GCS (includes eye opening response, bestverbal response, and best motor response) is commonly used for grading of the severity of head injury. There was no significant association of GCS score with the ocular involvement in this series. This signifies the importance of ocular examination of all cases of head injury by the ophthalmologist. As the case with trivial head injury may have significant ocular morbidity and those with poor GCS score may not have any ocular findings.

There were few limitations in the present study like problem in ocular assessment of unconscious cases, few patients could not speak due to facial trauma and also poor eye opening because of lid edema and ecchymosis hindered ocular examination.This study emphasizes the importance of a detailed earlyOphthalmological assessment in patients with head injury irrespective of GCS score. This may further aid in the subsequent management of any ocular affections to decrease the ocular morbidity in head injury survivors.

Conclusion

Ocular structures and visual pathway can be involved in patients with head injury due to its proximity to head and connections to the brain. In cases of head injury spectrum of ocular involvement ranges to non significant findings like edema, ecchymosis to loss of vision and motility as in

traumatic optic neuropathy and extraocular muscle palsy. In all the cases of head injury early ophthalmic evaluation is essential for further management ofneurologic deficits, thus reducing the incidence of late/missed diagnosis.

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