Ocular Manifestations in Head Injury Patients - A Prospective Study

Rashmi Kumari[1], Bhawesh Chandra Saha[2], Kalyan Kumar Saha[3], Bibhuti Prasanna Sinha[4]

ABSTRACT

Introduction: Ophthalmic findings are often ignored in patients of head injury leading to delay in their proper management resulting in permanent visual impairment. This prospective study aims to evaluate various ocular manifestations in cases of head injury patients ,correlate them with the patients neurological status and to analyse any association between them .

Material and methods: A detailed ophthalmological examination was carried out in 86 patients with closed head injury within 6 hours of admission in the Intensive care unit of our institute. Glasgow Coma Scale (GCS) was applied to grade the severity of head injury. Ocular neurological signs like abnormal pupillary reactions and abnormal extraocular muscle (EOM) movements and GCS were then correlated to prognosticate the visual outcome and survival rate of the. Patients were managed by a multidisciplinary approach.

Results: Out of 86 enrolled patients of head trauma,74 (86.04%) were males and 12 (13.91%) were females in the age range 5-74 years and mean of 28.68 years. Ocular complications occurred in 58 (67.44%) patients . Young adult males (21-30 years) were more vulnerable to head injury. Road traffic accident was the most common cause of head injury in 52 cases (60.46%) leading to soft-tissue injuries to the globe and adnexae in maximum no. of patients. The most frequently encountered neuro-ophthalmic manifestation was pupillary involvement as relative affarent pupillary defect (RAPD) in 27 (31.39%) cases, followed by extraocular muscle (EOM) affection in 21(24.41%) cases and disc edema in 14(16.27%)cases.

Conclusion; Pupillary involvement has a significant association with severity of head injury but there was an insignificant co-relation of the GCS, neurodeficit and the ocular signs with the outcome. RAPD being most common and best early indication to post-traumatic reduced vision does not has much bearing in determining the final visual outcome.

Keywords: Head Injury, Glasgow Coma Scale, Ocular Signs of Neurological Origin

INTRODUCTION

Head injuries are a cause of hospitalization of 200-300 persons per 100,000 population per year[1] and about 25% of these are associated with ocular and visual defects. Ocular trauma is the cause of blindness in more than half a million people worldwide and of partial loss of sight in many more and it is often the leading cause of unilateral loss of vision, particularly in developing countries.[2] Hence, the role of ocular injuries secondary to head trauma in the causation of blindness and overall prognosis of patients has become a subject of immense importance.[3] Head injuries are frequently associated with ophthalmicmanifestations and consequent visual morbidity, but many of the ophthalmic findings are often ignored and present much later to specialist neuro-ophthalmic clinics.[4] Hence, clinical correlation of the ophthalmic findings is important in early localization of the site of injury, better management, and improved visual prognosis of the patient with head injury.[5,6] The aim of this study was to evaluate various ocular manifestations in cases of head injury patients ,correlate them with the patients neurological status and to analyse any association between them.

MATERIAL AND METHODS

The study comprised a prospective analysis of 86 patients diagnosed as having closed head injury by the neurosurgical team. They were hospitalized for varying periods between June 2014 and July 2015 at the emergency services of a tertiary care hospital in eastern India. The details of demographic profile of the patient were noted. Detailed history regarding the injury was taken and the clinical details were entered into a standard clinical proforma. Consciousness status was assessed using Glasgow coma scale. Uncooperative patients were excluded from the study.

Ophthalmological examination was done at two stages. Bedside examination on admission and evaluation in outpatient department after patient was ambulatory. Bedside examination included extra orbital injury assessment, pupillary response by torchlight, vision by counting fingers at 2 mt distance bedside, extra ocular movement examination, visual field assessment by finger confrontation, fundus examination using direct ophthalmoscope, intraocular pressure by shiotz indentation tonometer was done whenever necessary.

Evaluation in out patient department included assessment of visual

acuity with pinhole using snellen's chart, anterior segment evaluation was done with slit lamp, Posterior segment assessment was done on dilated eye by direct and indirect ophthalmoscopy. Intraocular pressure by Goldmann applanation tonometer was done when needed. Neurological visual field defects were assessed using HFA SITA on

[1]Senior Resident , Department of Ophthalmology, [3]Senior Resident, Department of Medicine, [4]Professor and HOD, RIO, IGIMS, [2]Senior Resident, Department of ophthalmology, AIIMS, Patna

Corresponding author: Dr Bhawesh Chandra Saha, Senior Resident, Department of Ophthalmology, AIIMS, Patna, India

How to cite this article: Rashmi Kumari, Bhawesh Chandra Saha, Kalyan Kumar Saha, Bibhuti Prasanna Sinha. Ocular manifestations in head injury patients - a prospective study. International Journal of Contemporary Medical Research 2017;4(8):1648-1651.

patients with pupillary involvement and suspected field defect on confrontation. Diplopia charting was done whenever the patient complained of diplopia or restricted movement. Gonioscopy was done if necessary for the case studied. Computed tomography of brain, skull and spine, MRI and B-Scan was taken whenever appropriate. Any ocular manifestation requiring treatment-medical or surgical were treated as per standard medical and surgical practices.

STATISTICAL ANALYSIS

Statistical analysis and significance by p values were calculated using chi square test and fisher exact test with the help of SSPS software version 20.

RESULTS

Total of 86 patients of head trauma were included in the study. Out of these,74 (86.04%) were males and 12 (13.91%) were females in the age range 5-74 years with mean age of 28.68 (±8.78 years) [Table 1]. Young adult males (21-30 years) were most vulnerable to head injury. The incidence of head injury was less during childhood, peaked in the third decades of life, and thereafter declined Road traffic accident was the most common cause of head injury in 52 cases (60.46%) leading to soft-tissue injuries to the globe and adnexae followed by assaults in 19cases (22.09 %). In remaining 15 patients (17.44%), causes of head injury included falls, pedestrians hit by motor vehicles, or cattle [Table 1]. The right, left, and both eyes combined were injured in an approximate ratio of 1:1:2, respectively. Ocular and visual complications occurred in 58 of 86(67.44%) head injury patients [Table 2]. They included soft tissue injuries to the globe and adnexa in 42 patients (48.83%), neuro-ophthalmic abnormalities in 28 patients (32.55%), and fracture of the orbit with rupture of the eye in 11 patients (12.79 %). The most frequent soft tissue injuries were periorbital ecchymosis in39 patients (45.34%), subconjunctival hemorrhage in 20 patients (23.25%), lid laceration in 6 patients(6.97%), corneoscleral laceration requiring surgery in7patients (8.13%), and macular edema in 4 patients (4.65%). The most frequently encountered neuro-ophthalmic manifestation was pupillary involvement (in the form of abnormalities of pupillary size and reaction in one/both eyes) in 27 patients (31.39 %) followed byEOM restriction (24.41%) and disc edema(16.27%). A combination of two or more ocular findings such as ecchymosis , subconjunctival hemorrhage, orbital fracture, hyphema, and scleral tears was present in 74patients(86.04%). The more severe injury was taken as the main ocular finding for assessing prognosis in head injury. In 13 patients (15.11%), head and ocular injuries were associated with injuries to other organs such as chest, abdomen, and long bones. consideration. Among orbital wall fracture ,11 patients (12.79 %) had associated multiple facial bone fractures, most common fracture was lateral orbital wall fracture in 5 patients(5.81%), rest of the fractures included 3patients (3.48%)with medial wall, 2 patients(2.32%) orbital roof and 1patient (1.16%) with orbital roof fracture (Figure 2).

1. Sex ratio	n (%)
Male	74(86.04%)
Female	12(13.91%)
2. Age distribution	
Range	(5-74 yrs)
<10 yrs	2(2.32%)
11-20	5(5.81%)
21-30	31(36.04%)
31-40	22(25.58%)
41-50	14(16.27%)
51-60	11(12.79%)
>60yrs	1(1.16%)
3. Mode of injury	
-Road traffic accident	52(60.46%)
-Assault	19(22.09 %)
-Others	15(17.44%)
(Fall from height, pedestrians hit)	

Table-1: Clinical profile of the patients of head injury

Type of injury	n(%)
A. Soft tissue injury	42 (48.83%)
1. Periorbital ecchymosis	39(45.34%)
2. Lid laceration	6 (6.97%)
3. Sub conj.hemorrhage	20 (23.25%)
4. Proptosis	3(3.48%)
5. Ptosis	7(8.13%)
6. Corneoscleral rupture	7(8.13%)
7. Hyphema	5(5.81%)
8. Vitreous hemorrhage	2(2.32%)
9. Macular edema	4(4.65%)
10. Retinal detachment	1(1.13%)
B. Orbital fracture	11 (12.79%)
1. Lateral wall	5(5.81%)
2. Medial wall	3(3.48%)
3. Floor	2(2.32%)
4. Roof	1(1.16%)
C. Neuro ophthalmic complications	28(32.55%)
1. Abnormal pupil reaction, (RAPD)	27(31.39%)
2 EOM restriction.	21(24.41%)
3. Disc edema	14(16.27%)

Table-2: Profile of ocular trauma in head injury patients

Ocular and visual complications occurred in 58 of 86(67.44%) head injury patients [Table 2]. They included soft tissue injuries to the globe and adnexa in 42 patients (48.83%), neuro-ophthalmic abnormalities in 28 patients (32.55%), and fracture of the orbit with rupture of the eye in 11 patients (12.79 %). The most frequent soft tissue injuries were periorbital ecchymosis in39 patients (45.34%), subconjunctival hemorrhage in 20 patients (23.25%), lid laceration in 6 patients(6.97%), corneoscleral laceration requiring surgery in7patients (8.13%), and macular edema in 4 patients (4.65%). The most frequently encountered neuro-ophthalmic manifestation was pupillary involvement (in the form of abnormalities of pupillary size and reaction in one/both eyes) in 27 patients (31.39 %) followed byEOM restriction (24.41%) and disc edema(16.27%). A combination of two or more ocular findings such as ecchymosis , subconjunctival hemorrhage, orbital fracture, hyphema, and scleral tears was

present in 74patients(86.04%). The more severe injury was taken as the main ocular finding for assessing prognosis in head injury. In 13 patients (15.11%), head and ocular injuries were associated with injuries to other organs such as chest, abdomen, and long bones. consideration. Among orbital wall fracture ,11 patients (12.79 %) had associated multiple facial bone fractures, most common fracture was lateral orbital wall fracture in 5 patients(5.81%), rest of the fractures included 3patients (3.48%)with medial wall, 2 patients(2.32%) orbital roof and 1patient (1.16%) with orbital roof fracture (Figure 2).

Among 21cases with extra ocular movement restriction, only 9 cases had associated cranial nerve palsy ,sixth nerve palsy in 5 cases,fourth nerve palsy in 1 case,third nerve palsy in 3 cases. Rest of intraocular movement restriction was attributed to local mechanical restriction which resolved eventually. The association of cranial nerve palsy among patients with extra ocular movement restriction was found to be insignificant with p value 0.123 [Table 3].

Pupillary involvement was present in 28 cases of which 27 cases had RAPD and rest had traumatic anisocoria due to sphincter tears. Among the patients with RAPD 5 had vision of perception of light (PL+) and rest of the 22 patients had a bedside vision counting finger 2 meter.Of the all patients with RAPD (27 cases), only 2(7.40%) patients had a poor visual outcome of <6/60, five patients (18.51%) had vision 6/6 and rest 20(74.07 %) with vision ranging from 6/60 to 6/9, hence Association of incidence of RAPD in causing poor visual outcome (<6/60) was found to be insignificant with p-value 0.5 (Table 3). However, on visual field examination by HFA in patients with RAPD of vision better than 6/60, 17 patients (62.96%) had significant visual field defects, two patients of vision PL+ showed primary optic atrophy.

Among 15(17.44%) patients with GCS<10, 12(80%) patients had associated pupillary involvement indicating significant association between pupillary involvement and severity of head injury (Table 3).

DISCUSSION

In developing countries like India progressing towards more cosmopolitan standards, Road Traffic Accidents play major role in physical sufferings of young working generation. Head injury being one of the important cause and eyes being frequently involved in most of head injury patients, it has to be ensured that adequate ophthalmic assessment happens on time and treatment is to be delivered accordingly to prevent permanent visual deficit.India accounts for approximately 10% of RTA world wide.[4] As was found in our study, high velocity impact due to RTA is the commonest cause of head injury reported.[4] With young men most frequently involved. This study was done on 86 head injury patients admitted in neuro surgery wards with ophthalmic findings. Age of patients was ranging from 5 to 74 years, with highest in 3rd decade of life (Table 1). Males were affected more 74 (70%) out of 86 than females 12 (30%) out of 86 which corresponded with high number of head injury in male mainly because of more number of vehicular accidents and assault.

In our study Lateral orbital wall was found to be the most commonly fractured 5 (5.81%) among all fractures in spite of being strong boundary (table 2). it may be attributed to the mechanism of impact during RTA where lateral wall gets injured most of the time on verge of protecting the eyeball. unlike in other type of injury to orbit like blowout injury where direction of impact is from the front, orbital injury in RTA is commonly due to force of impact being on lateral aspect of the orbit. Though most common orbital fracture is blowout fracture, usually involving orbital floor with or without medial wall, Lateral orbital wall fracture associated with malar complex fracture is also common.[12] lateral orbital wall is strongest among other orbital walls however is commonly fractured in settings of severe facial traumas fracture usually occurs at spheno zygomatic suture line.[13] In general patient with lateral orbital wall fracture are usually young males who present with mid facial swelling and some

A. Association of EOM restriction and cranial nerve palsies				
	CN+	**CN-**	**Total**	**P value**
EOM+	9	12	21	0.123
EOM-	0	35	55	
Total	9	77	86	
B. Association of RAPD with vision				
	Vision<6/60	**Vision>6/60**	**Total**	**P value**
RAPD+	5	22	27	0.5
RAPD-	8	51	59	
Total	13	73	86	
C.Relation of RAPD with visiual outcome				
RAPD	**Vision<6/60**	**Vision>6/60**	**Total**	**P value**
<grade2	0	16	16	0.4
>grade 2	5	6	11	
	5	22	27	
D. Association of severity of head injury (GCS<10) and pupillary involvement				
	Positive		**Negative**	
Pupillary involvement	12		74	
GCS<10	15		71	

Table-3: Association of GCS scales, ocular signs and neurodeficit with outcome.

degree of deformity.

Articulation between the zygomatic bone and greater wing of sphenoid is broad. This articulation is the commonest site for lateral orbital wall fracture which is usually accompanied by disruption of zygomatic bone articulations with frontal bone temporal bone, maxillary bone.[13]

Our study also reported 7 (15%) lower cranial nerve palsy, out of 38 patients with extra ocular movement restriction .association between the two was insignificant with p value 0.12 (Table 1, Figure 3) , other retrospective studies 2,3 like by Moster et. al.[9], which reported III cranial nerve palsy in 30%, IV cranial nerve palsy in 26% and VI cranial nerve palsy in 22% cases. Mariak[8], after brain autopsy in 12 patients, found serious cranial nerve involvement in 75% of the fatal closed head injury cases. The initial restriction of extra ocular movement may be attributed to local entrapment of muscle with associated fracture of orbital wall and swelling of surrounding soft tissues.

Pupil size and reaction to light is very important in the initial assessment of head injury cases. Apart from pupillary signs of uncal herniation and associated primary injuries to the globe, the ocular findings are of secondary importance during emergency management of the patient.[1,2] Early signs of temporal herniation include-ipsilateral miosis due to oculomotor nerve irritation (Hutchison's stage I) followed by paresis causing ipsilateral pupillary dilatation and a sluggish response to light (Hutchison's stage II). Progressive dilatation of the ipsilateral pupil and miosis of the contra

lateral pupil (Hutchison's stage III), heralds progressive III rd nerve palsy due to temporal lobe herniation, followed by bilateral dilation of the pupil (Hutchinson's stage IV).[5] Bilateral dilated nonreactive pupils can also be due to inadequate brain perfusion.[1] In our study 80% of patient with GCS<10 had associated pupillary involvement in them, thereby showing significant association between severity of head injury and pupillary involvement.(Table 3). Out of 27 patients with RAPD, five (18.51%) recovred vision of 6/6, only 2 (7.40%) were left with vision <6/60 and the rest 20 (74.07 %) recovered vision ranging from 6/9-6/60 (Table 3). We considered vision of <6/60 as poor vision which 13(15.11%) of our patients had. Out of these poor vision cases only 5 patients had associated RAPD in them, thereby showing that RAPD does not play a major role in causing poor vision in head injury patients with insignificant p value 0.5 (Table 3). Further vision was assessed in different grades of RAPD (grade I, a weak initial constriction and redilatation, grade II, initial still and redilatation; grade III, immediate pupillary dilatation; grade IV, immediate pupillary dilatation following prolonged illumination of the good eye for 6 seconds; grade V, immediate pupillary dilatation with no secondary constriction).and was found that 22(81.48%) patients with RAPD recovered vision >6/60 showing that RAPD does not always have poor visual prognosis (Table 3). Similar studies like International optic nerve trauma study[15] also showed visual acuity improvement of >3 lines in 57% of untreated group, 52% of the group that received steroid alone, and 32%of the group that underwent surgery which was not a statistically significant result. Field defects in opticochiasmal injury like Monocular field defects (altitudinal, temporal) have been described.[14] Our study also had 17(62.96%) patients with RAPD who showed associated significant field loss which may be attributed to optic nerve injury.

CONCLUSION

Pupillary involvement has a significant association with severity of head injury. RAPD being most common and best early indication to post-traumatic reduced vision does not play a major role in causing final poor visual.

Immediate post traumatic extra ocular movement restriction may not always be associated with residual cranial nerve palsy. Lateral orbital wall in spite being the strongest boundary of orbit was most commonly fractured ,which can be attributed to mechanism of impact during RTA.

REFERENCES

1. McCann JD, Seiff S. Traumatic neuropathies of the optic nerve, optic chiasm, and ocular motor nerves. Curr Opin Ophthalmol. 1994;5:3–10.
2. Steinsapir KD, Goldberg RA. Traumatic optic neuropathy. Surv Ophthalmol. 1994;38:487–517.
3. Baker RS, Epstein AD. Ocular motor abnormalities from head trauma. Surv Ophthalmol. 1991;35:245–67.
4. Thurman DJ, Jeppson L, Burnett CL, et. al. Surveillance of traumatic brain injury in Utah. West J Med. 1996;165:192–6.
5. Hutchison J. Four lectures on compression of the brain. Clin Lect Rep Med SurgStaff Lond Hosp. 1867-1868;4:10–55.
6. Kowal L. Ophthalmic manifestations of head injury. Aust N Z J Ophthalmol. 1992;20:35–40.
7. Lepore F. Disorders of ocular motility following head trauma. Arch Neurol. 1995;52:924.
8. Mariak Z, Stankiewicz A. Cranial nerve II-VII injuries in fatal closed head trauma. Eur J Ophthalmol. 1997;7:68–72.
9. Moster M, Volpe NJ, Kresloff MS. Neuro-ophthalmic findings in head injury. Neurology. 1999;52:A23.
10. Cook MW, Levin LA, Joseph MP, et. al. Traumatic optic neuropathy: A metaanalysis.Arch Otolaryngol Head Neck Surg. 1996;122:389–92.
11. Levin LA, Beck RW, Joseph MP, et. al. The treatment of traumatic optic neuropathy: The International Optic Nerve Trauma Study. Ophthalmology. 1999;106:1268–77.
12. Becelli, R., Renzi, G., Perugini, M., Iannetti, G. Craniofacial traumas: immediate and delayed treatment. J. Craniofac. Surg. 2000;11:265–9.
13. Bell, R.B., Kindsfater, C.S., The use of biodegradable plates and screws to stabilize facial fractures. J. Oral. Maxillofac. Surg. 2006;64:31–9.
14. Mahapatra AK, Tandon DA. A prospective study of 250 patients with optic nerve injury. In, Madjid Samii (Ed). Skull Base: Anatomy, Radiology and Management. S Karger Basel. 1994: pp 305-9.
15. Levin, L.A et. al.: The treatment of optic neuropathy. The International OpticNerve Trauma Study. Ophthalmology. 1999;106:1268-77.

Source of Support: Nil; **Conflict of Interest:** None

Submitted: 09-07-2017; **Accepted:** 16-08-2017; **Published:** 25-08-2017