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Ocular Manifestations in Head Injury at SSIMS & RC

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Abstract: ***To determine the prevalence and pattern of ophthalmic manifestations in patients with head injury and the outcome in patients with neuro-ophthalmic manifestations. Methods: This prospective study provides a complete assessment of all patients with head injury having associated ophthalmic manifestations. It includes the signs and symptoms following head injury, initial examination with torch light and bedside visual acuity then a detailed assessment with Snellens's acuity chart and slit lamp biomicroscope. Intraocular pressure and gonioscopy performed wherever necessary. Fundus examination done with direct, indirect ophthalmoscopy. CTscan was done. Patients were managed accordingly and wherever needed surgical intervention was considered. Results: In this study of 63 cases of head injury, 48 cases had ocular involvement. Young adult males were more vulnerable to head injury(21-30 years(44.4%)). Road traffic accident was the most common cause of head injury in 56cases(88.8%). The ocular manifestations observed in 63 cases included soft tissue injuries- periorbital ecchymosis in 25 cases(39.7%) and subconjunctival haemorrhage in 17cases(27%). Neuro-ophthalmic abnormalities in 22cases (34.9%), pupillary involvement in 12 cases(19%) being most common, fracture of orbit in 10 cases (15.9%), globe rupture in 1 case(1.5%). CT scan showed extradural hemorrhage and diffuse cerebral edema in 9 cases (14.3%) respectively. GCS was assessed of all patients and head injury was classified accordingly. Conclusion: Injury to the globe and adnexae and constitute the most common oculovisual complications following head injury in our centre. The GCS, Neurodeficit and ocular signs contribute significantly to the prediction of outcome***

Keywords: head injury, road traffic accident, ocular manifestations, neuro-ophthalmic abnormalities, GCS.

1. Introduction

Although the eyes represent only 0.1% of the total body surface and 0.27% of the anterior body surface, their significance to individuals and the society is disproportionally higher. The eye is the third most common organ affected by injuries after the hands and feet and most of the information reach the humans through vision. Head injury is a common occurrence among trauma victims. It leads to several disabilities including damage to the visual system. The role of ocular injuries secondary to head trauma in the causation of blindness continues to be an immense public health problem. The immediate impact of head injury threatening other vital organs is so compelling that damage to the visual system is most likely to be ignored. Consequently, the socioeconomic impact of ocular trauma can hardly be overestimated as those affected often have to face loss of career opportunities, major lifestyle changes and occasionally permanent physical disfigurement [1]. Ocular injuries are among the most common causes of visual impairment and vision loss in the general population and the most common cause of visual loss in young people. Ophthalmic trauma related to motor vehicle accidents (MVA) accounts for a significant percentage of ocular injuries, being the second most significant cause after occupational accidents[2].

This study was conducted to assess the clinical profile of ocular findings in head injury in our center and to attempt a correlation between the neurological signs, ocular signs, GCS and final outcome.

2. Material and Methods

A prospective analysis was done of all the patients with head injury attending or referred to Department of Ophthalmology, from December 2013 to February 2014. All patients with head injury were first examined and recorded upon admission in the Ophthalmology OPD or emergency ward or neurosurgery ward , and detailed ocular evaluation was done. It includes the signs and symptoms at presentation following head injury, initial examination with torch light and then with slit lamp biomicroscopy for detailed assessment, bedside visual acuity assessment and with snellens's acuity chart. Intraocular pressure and gonioscopy performed wherever necessary. Fundus examination done with direct, indirect ophthalmoscopy. The severity of head injury was assessed by Glascow Coma Scale.

Radiological investigations like Plain X-ray skull AP and Lateral view, CT head with orbital sections and MRI brain was done wherever necessary. Further references were given to ENT, Plastic surgeon or physician wherever necessary. Patients were managed accordingly and wherever needed surgical intervention was considered.

3. Results

In this study of 63 cases of head injury, 48 cases had ocular involvement. 52cases (82.5%) were male and 11 cases (17.4%) were female. The age ranged from 12to 75 years. The most common age group affected was in the range of 21-30 years (44.4%). Young adult males were more vulnerable to head injury.

Table 1: Age distribution of head injury in male/females

Age wise distribution(in years)	*Number*	*%*
1-10	0	0
11-20	12	19.04
21-30	28	44.4
31-40	9	30.2
41-50	11	17.5
51-60	1	1.6
>61	2	3.2

Table 2: Sex wise distribution

Sex	Number	%
Male	52	82.5
Female	11	17.4

Road traffic accident was the most common cause of head injury in 56 cases (88.8%) followed by accidental fall from height in 3 cases (4.8%)

Table 3: Causes of head injury

Mode of injury	Number	%
Road traffic accident	56	88.8
Assault	1	1.6
Self fall from height	3	4.8
Accidental fall from height	3	4.8

Ophthalmic examination was carried out in all the head injury cases. Ocular involvement was found in 48 cases (76.2%). The ocular manifestations observed in 63 cases of head injury are shown in Table IV.They included soft tissue injuries to the globe and adnexa in 52 cases (82.5%), Neuro-ophthalmic abnormalities in 22 cases (34.9%), fracture of orbit in 10 cases (15.9%) and rupture of eye in 1 case (1.5%). Most frequent soft tissue injuries were periorbital ecchymosis in 25 cases (39.7%) and subconjunctivalhaemorrhage in 17 cases (27%). The most frequently encountered neuroophthalmic manifestation was pupillary involvement in 12 cases (19%). The globe was ruptured in 1 case and it needed immediate evisceration. CT scan showed extradural hemorrhage and diffuse cerebral edema in 9 cases (14.3%) respectively.

Table 4: Ocular findings in 63 cases of head injury

A. Soft tissue injuries to globe and adnexa	Number	%
1) Periorbital edema and ecchymosis	25	39.7
2) Eyelid laceration	10	15.9
3) Subconjunctival hemorrhage and chemosis	17	27
4) Corneosclreal laceration	-	
5) Retinal hemorrhages	3	4.8
B. Neuro-ophthalmic manifestations		
1) Optic nerve trauma- RAPD	5	8
1. Pupillary involvement		
a. Traumatic mydriasis	2	3.2
b. Anisocoria	12	19
2) Papilledema	-	
3) Nerve palsy		
4) 3rd nerve palsy	3	4.8
5) Traumatic cataract	2	3.2
6) Globe rupture	1	1.6
Orbital fractures		
Roof	3	4.8
Floor	1	1.6
Lateral wall	1	1.6
Zygoma	4	6.4

The commonest eye finding was ecchymosis in 25/63 (39.7%) followed by subconjunctivalhaemorrhages in 17/63 (27%) patients . Orbital fractures were seen in 9 patients (14.3%)

Table 5: C T scan findings in patients with head injury

CT findings	Number	%
Hemorrhagic contusion	4	6.4
Intracerebral bleed	1	1.6
Extra dural hemorrhage	4	6.4
Sub dural hemorrhage	9	14.3
Subarachnoid hemorrhage	6	9.5
Diffuse cerebral edema	9	14.3

Ophthalmic eye signs of neurological significance were found in 22/63 patients (34.9%). Pupillary involvement in 19/63 cases (30.2%) was the commonest neuro-ophthalmic sign.

Table 6: Association of GCS scales, ocular signs and neurodeficit with outcome.

GCS	Expected outcome	Number	Ocular involvement	No of deaths
3	Very poor	3	3	2
4-8	Poor to fair	10	7	2
9-12	Fair to good	19	14	1
13-15	Good	32	25	-

A correlation of ocular findings with the GCS in the first few hours following head injury was attempted. 19 patients (30.2%) had a mild head injury (GCS of 14–15) of which 25 (39.7%) patients had eye involvement, including unilateral and bilateral ecchymosis (10),subconjunctivalhaemorrhages (8), and 3 had lacerated wound of brow and forehead and 1 had traumatic cataract.

A total of 29 patients (46%) were graded as having incurred moderate head injury (GCS 9–13) of which 24 patients (38.1%) had ocular involvement. 11 patients had pupillary signs of which 4 had RAPD. 6 patients had anisocoria, 1 had traumatic mydriasis. 4 had traumatic optic neuropathy, 2 had retinal hemorrhage, 1 case had ptosis with total 3rd nerve palsy. There were 13 cases (20.6%) of severe head injury, of which one patient had purtschner retinopathy in right eye and left eye had globe rupture for which evisceration was done, and 8 patients had pupillary involvement with extra and subdural hemorrhages on CT scan and 2 patient had traumatic optic neuropathy. The GCS, Neurodeficit and ocular signs contribute significantly to the prediction of outcome

4. Discussion

Head trauma is common. Indeed,MVA is the most frequent cause of head injury. Young men are most frequently affected as noted in our study.

Head injuries can be defined as those in which there is evidence of involvement of the brain including concussion, with loss of consciousness or post-traumatic amnesia, neurologic signs of brain injury or skull fractures.[4] The Glasgow coma score and the Revised trauma scores are commonly used in grading the severity of head injury. The eyes are often involved in head injury (directly and indirectly) with neuro-ophthalmic deficits[1-4,7-13].

Most ophthalmologists when faced with injured patients tend to focus on obvious ocular manifestations such as contusions and laceration. Subtle manifestations may be

equally important and may go unrecognized. Neuro-ophthalmic evaluation is challenging in head injury patients with reduced consciousness or coexisting injuries.

The incidence of head injury has been reported as 109 per 100 000 cases[4.] As was found in our study, high velocity impact due to RTA is the commonest cause of head injury reported,[9] with young men most frequently involved.[7] Trauma patients often have multiple injuries including ocular involvement. Several retrospective studies have reported neuro-ophthalmic findings a few months after head trauma[4, 7,8,9,10,11,12.]

This study has looked at the ocular findings in the acute stage of head injury. These included physical ocular trauma, orbital fractures and neuro-ophthalmic findings. Comprehensive ocular assessment can contribute significantly to the overall understanding of the acute injury and the prognosis of the patient as well as ocular motor involvement, profoundly affecting their rehabilitation [4.]

Patients with neuro-ophthalmic deficit following head trauma can be a diagnostic and therapeutic challenge partly due to the frequently vague nature of their visual complaints and their coexistent neurologic deficits. 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. Early signs of temporal herniation include ipsilateralmiosis 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 contralateral pupil (Hutchison's stage III), heralds progressive IIIrd nerve palsy due to temporal lobe herniation, followed by bilateral dilation of the pupil (Hutchinson's stage IV). Bilateral dilated nonreactive pupils can also be due to inadequate brain perfusion.[4,6] . The eye and its adnexa are innervated by one-half of the cranial nerves, and 38% of all fibres in the central nervous system are concerned with visual function, so clinical findings of neuro-ophthalmological interest are frequently noted with head injury.[4,8]

Accurate ocular motility assessment within the first few hours of head injury is not possible with patients in coma. Many signs and symptoms like third nerve misdirection arise a few months after trauma[8.]Our study reported lower ocular motor involvement (3rd nerve palsy in 4.8% of head injury cases), as compared to other retrospective studies which have included patients referred specifically for ophthalmic problems, even beyond 12 months after the initial head injury[4, 10,12.] Moster *et al* reported III cranial nerve palsy in 30%, IV cranial nerve palsy in 26% and VI cranial nerve palsy in 22% cases[13].

Panagiotidis DN et al in his prospective study which included 67 consecutive patients with ocular trauma found that 53 (79.1%) had penetrating ocular trauma in which 36 (67.9%) of them were due to glass fragments and 49 of them had a follow up for 6 months[2].

Odebode TO et al in their prospective study conducted at University of Ilorin teaching hospital, Nigeria which included 225 patients among whom 57(25.3%)patients had ocular and visual complications like soft tissue injury to the globe and adnexae included periorbital ecchymosis, subconjuctivalhaemorrhage, lid laceration, or rarely globe rupture in 29 patients. Neuro-ophthalmic ocular cranial nerve palsies occurred in 28 patients, while orbital fracture was encountered in two patients. Ocular injuries were multiple in 60% of cases[3].

Emem A, Uwemedimbuk E conducted a retrospective study between Jan 2008- Dec 2009 at University of Uyo Teaching Hospital, Uyo, Nigeria where 5416 patients were examined out of which 226 had ocular injury giving a prevalence of 4.06%[1].
Kulkarni AR et al in their prospective study aimed to clinically correlate the various ocular findings with the neurological status in cases of closed head injury. A total of 200 consecutive cases of closed head injury admitted to a major teaching hospital underwent a thorough ophthalmic assessment. The main causes of head injury were road traffic accidents 52.5% followed by assaults in 34%. Ocular involvement was found in 167(83.5%) cases. These included corneal and scleral tears in 2%, subconjunctivalhaemorrhage or ecchymosis in 46%, orbital fractures 12%, pupillary involvement 6.5%, papilloedema 5.5%, intraocular trauma 5.5%, proptosis 3%, lateral rectus palsy 2%, lacrimal gland prolapse 1%, and optic nerve trauma 0.5% [4].

Raju NSD in their study on ocular manifestations in head injury found the most common manifestation in the eye was ecchymosis of the lids and subconjunctivalhaemorrhages which was seen in 30% of the cases. Next in frequency was IIIrd nerve paralysis which accounted for 20% of the cases. The incidence of optic nerve injury was 12.5%. Hutchinson's pupil was seen in 4 out of the 40 cases with opthalmic manifestations (10%). 7.5% of cases showed lagophthalmos, but onlyone patient developed exposure keratitis. In about 55% of the cases studied, pupillary abnormalities were present.

As in this prospective study, several retrospective studies have reported a high incidence of neuro-ophthalmologic findings after severe head injury[13]. Commonly reported abnormalities by Moster *et al* were, traumatic optic neuropathy (18% as opposed to 0.5% in our study), homonymous hemianopia (15%) and Horner's syndrome (7%) and multiple abnormalities (42%)[4,10,13]. Optic nerve disorder will cause some disturbance of visual function which may have nonspecific symptoms. Specific tests of optic nerve function such as contrast sensitivity, colour vision and optic nerve head morphology, field testing, and visually evoked potential could not be carried out in the acute setting of this study, hence subtle optic neuropathy, especially in cases with normal or near normal Snellen acuity, could have been missed[4].

The mechanism of injury for optic neuropathy can be direct, indirect, or due to papilloedema[7] Contusion injuries to the optic nerve are not uncommon after a head injury. An amaurotic pupil is objective proof of an afferent lesion in the pupillary reflex (or a conduction defect in the optic nerve),

while at the same time the motor limb (or a the third cranial nerve) is intact. It implies that a total and irrecoverable loss of vision has occurred in the affected eye although the optic nerve head may appear normal on admission. Countercoup contusion to the optic nerve has been reported to be transmitted through the temporal bone[8].

Pupillary signs are of grave importance in indicating the site and severity of injury and in the prognosis of head injury. It aids in localizing the site of supratentorial injuries, extradural and subdural haemorrhages, and pontine lesions. Hutchison's pupillary signs indicate progressive coning and the need for emergent life-saving intervention. Identifying these early would logically reduce the incidence of consequent morbidity and mortality[4].
We faced some problems during patient assessment due to the fact that GCS is heavily weighted towards speech and eye opening. Some patients were unable to speak due to facial injury and eye opening was hindered by severe periorbital trauma/oedema.

Our present study has led us to make the following observations:

- Patients of 21-30 years were most commonly affected 28 cases (44.4%)
- Road traffic accident was the most common cause of head injury (88.8%)
- Injury to the soft tissues of globe and adnexa were seen in 52 cases (82.5%)and was the most prominent form of ocular injury.
- Patients with ocular signs and neurodeficit exhibited a progressively worse outcome as the GCS worsened.
- The GCS, neurodeficit and ocular signs contribute significantly to the prediction of outcome. This emphasizes the importance of integrating ophthalmic assessment into the routine head injury assessment. This aids in the follow-up, prognosis and further management of neurological deficits, thus reducing the incidence of late/missed diagnosis.

This study highlights the importance of a detailed early ophthalmological assessment in correlation with an overall clinical assessment of patients of head injury in prognosticating outcomes.

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