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A Study to Correlate Ocular Manifestations of Closed Head Injury with Glasgow Coma Scale and Vision and Neurological Outcome in A Rural Tertiary Care Center

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Abstract

Purpose: To evaluate and document various ocular manifestations in patients with closed head injury and to evaluate and document the neurological status by Glasgow Coma Scale (GSC) score at the time of presentation and to compare the association between them. *Materials and Methods:* A prospective study was undertaken which included a total of 85 patients of ocular trauma. Conscious status was assessed using Glasgow coma scale. Thorough examination of anterior segment, posterior segment, extraocular movements, visual acuity and investigations were carried out for all patients. *Results:* The highest incidence of head injuries was in the age group of 21 to 30 years. There were 60 males and 25 females. The mean age for males was 34.14 ± 14.4 and the mean age for females was 45.43±12.44. In this study, 4.70 % cases of severe head injury cases had posterior segment manifestations. And 3 patients with pupillary abnormalities, i.e 3.52%. And 1.17% patients had traumatic optic neuropathy manifestations. During follow up visits, there was improvement in ocular manifestations and GSC score. *Conclusion:* In severe head injury (GCS 3–8), it is important to look for posterior segment findings and neuro-ophthalmic manifestations. A detailed ocular assessment during the first presentation in all cases of head injury patients is mandatory as it helps in better management and the final outcome could be improved with better diagnosis and management.

Keywords: Closed head injury; Ocular manifestations; GCS score.

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Introduction

Traumatic head injury is increasingly recognised as a major cause of morbidity and mortality worldwide.[1] Industrialization and modern modes of transportation has amplified the frequency of accidents and consequently, trauma to the skull.[2] These injuries are responsible for 50% of trauma deaths and 60% of road traffic accident deaths.[3] The proximity of eyes to the brain, leads to the high frequency of association of skull injuries with ocular injuries and consequent morbidity.[4] Half a million or so people are blinded by ocular trauma, worldwide. Partial loss of sight is documented in many others. Mono-ocular blindness is also one of the consequence of trauma.[5] Therefore, ocular manifestations of traumatic head injuries play a major part in causation of blindness and as a prognostic factor for patients. Secondarily, due to head trauma, ocular manifestations and associated complications may have varied presentations and may change within a short period of time. Clinical evaluation of ocular manifestations is vital in early localization of the site of injury for better management, and improved visual outcome of the patient.[6,8] Despite of the significant problems associated with ocular manifestations of head trauma, literature does not have enough data which shows the whole picture of the problem. This study aims to evaluate and document various ocular manifestations in patients having closed head injury and correlate them with the patients' neurological status assessed by Glasgow Coma Scale (GCS) scoring and to compare any association between them.

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Method of Collection of Data

A prospective study was undertaken including 85 patients of closed head injury, reporting to the emergency department at R.L.J. Hospital And Research Centre, Tamaka, Kolar attached to Sri DevarajUrs Medical College between January 2018 and May 2019. Patients with prior history of any neurological disease and ocular trauma were excluded. Detailed history regarding injury was documented. Patients were examined at the time of presentation, at 1 week, 4 weeks and 6 weeks after the injury and the neurological and visual outcome was evaluated and documented and the association, if any, between the two was analysed. Consciousness status was assessed using Glasgow Coma Scale. Ophthalmic examination included assessment of external injury, anterior segment examination, pupillary reaction, visual acuity, assessment of extra-ocular movements, visual field assessment by finger confrontation, fundus examination by direct or indirect ophthalmoscopy. If necessary, assessment of visual acuity using Snellen's chart, assessment of intra ocular pressure using Goldmann applanation tonometer, and diplopia charting was done.

Results

Out of the total 85 patients examined, 60 subjects were males and 25 were females.

Table 1: Gender distribution.

Gender	Frequency	Percentage
Male	60	70.58
Female	25	29.41
Total	85	100

Table 2: Distribution of patients according to age and sex.

Age (Years)	Male	Female	Total
<20	3	–	3
21–30	23	11	34
31–40	13	4	17
41–50	10	8	18
51–60	4	2	6
61–70	5	–	5
>70	2	–	2

The age distribution of the patients ranged from 4 months to 76 years with mean age of 35.20 years. The age range of 21–30 years accounted for the maximum number of patients among males & females.

Table 3: Frequency of the ocular manifestations at the time of presentation as seen in casualty/sicu/picu.

Ocular Manifestations	Frequency	Percentage
Periorbitaloedema	46	54.11
Ecchymosis	18	21.17
Eyelid laceration	22	25.88
Abrasion	1	1.17
Subconjuctivalhaemorrhage (SCH)	13	15.29
Corneal tear	6	7.05
Pupillary abnormality	3	3.52
Fundus findings	4	4.70

Periorbital oedema was the most common presentation, seen in 46 patients out of 85, i.e 54.11%, followed by eyelid lacerations, which was seen in 22 patients, i.e 25.88 %. Ecchymosis was seen in 21.17%, SCH in 15.29% and corneal tear in 7.05% patients. Pupillary abnormalities and fundus findings were there in 3.52% and 4.70% patients respectively.

Table 4: Distribution of cases according to GCS at presentation.

GCS Score	Frequency	Percent
14, 15 (Mild)	76	89.4
9–13 (Moderate)	6	7.1
5–8 Severe	3	3.5
Total	85	100.0

Out of 85 patients, 76 had GCS score 14,15 that is 89.4% patients with closed head injury had normal GSC score.[6] 7.10% had GCS score in the range of 9–13, and 3.5% patients had GSC score in the range of 5–8.

Table 5: Visual acuity at the time of presentation.

Visual Acuity	Frequency	Percent
More than counting finger 3m	62	72.94
Less than counting finger 3m	13	15.29
Could not be assessed	10	11.76
Total	85	100

Visual acuity was greater than counting fingers 3m in 72.94% patients, and it was lesser than CF 3m in 15.29% patients. Vision could not be assessed in 11.76% patients.

Table 6: GSC category and trauma to the ocular adnexae.

GCS Category	Cases with Trauma to Ocular Adnexa	Percent
Mild	67	72.94
Moderate	2	2.35
Severe	0	–

Among 69 patients who had injury to ocular adnexa, 72.94% cases had mild head injury, whereas 2.35% cases had moderate head injury.

Table 7: GCS and Significant post trauma anterior segment findings.

GCS Category	Cases with Trauma to the Anterior Segment	Percent
Mild	16	18.82
Moderate	3	3.53
Severe	0	–

22.35% patients had injury to anterior segment. Among these, 18.82% patients had mild head injury and only 3.53% patients had moderate head injury.

Table 8: GCS category and post trauma posterior segment findings.

GCS Category	Cases with Trauma to the Posterior Segment	Percent
Mild	–	–
Moderate	1	1.17
Severe	3	4.70

Out of 85 patients, 4 had posterior segment manifestations, i.e 4.70%. 1 patient had moderate head injury and 3 patients had severe head injury.

Table 9: GCS score and VA correlation at the time of presentation.

Head injury severity As GCS score	VA(at presentation)			Total
	CF>3m	CF<3m	Could not be assessed	
Mild	61	11	4	76
Moderate	1	2	3	6
Severe	0	0	3	3
Total	62	13	10	85

71.76% patients with mild head injury patients had vision CF>3m and 12.94 % had vision CF <3m. For 4.70% patients it could not be assessed.Vision could not be assessed for 3.52% patients who had moderate head injury, 2.35% had vision CF<3m and 1.17% patients had vision CF>3m. And in all 3 patients of severe head injury, vision could not be assessed.

Table 10: Ocular manifestations at 1 week as seen during follow up in SICU/ophthalmology OPD.

Ocular Manifestations	Frequency	Percent
Periorbital oedema	10	17.85
Ecchymosis	10	17.85
SCH	9	16.09
Pupillary abnormality	1	1.78
fundus findings	2	3.57
Nil	26	46.42

At 1 week of follow up, out of 85 patients, follow up of 26 patients was lost, 3 patients died due to head trauma complications. The most common ocular findings were periorbital oedema and ecchymosis, both seen in 10 patients, out of 56 patients, with the frequency of 17.85% each.

Table 11: Distribution of cases in categories according to Glasgow Coma Scale(GCS) score at 1 week.

GCS score	Frequency	Percent
14,15 (Mild)	55	98.21
9–13 (Moderate)	1	1.79
5–8 (Severe)	–	–
Total	56	100.0

GCS score of 55 patients out of 56 was 15.One patient scored 12 on the GCS scale. All patients with lids and adnexa manifestations at 1 week follow up, had mild head injury Anterior segment manifestations patients had mild head injury at 1 week of follow up.

Table 12: Showing frequency of ocular manifestations at 4 weeks.

	Occurrence	Percent
No ocular findings	46	47.1
Ecchymosis	1	1.2
Death	4	4.7
Lost follow up	34	40.0
	85	100.0

At 4 weeks of follow up, only 47 patients were followed up, out of which, 1 had ecchymosis and other 46 had no ocular findings, either due to head injury or due to direct trauma.

Follow up was lost for another 7 patients and 1 more patient died since the last follow up. All patients examined at 4 weeks had GCS score of 15. At 6 weeks, 45 patients were followed up, none of them had any ocular finding, either due to primary head injury or due to direct ocular trauma, All patients had GCS score of 15.

Discussion

According to the undertaken study, patients who were in the age range of 21 to 30 years were the ones who got affected the most. There were 60 males and 25 females. For men, the age ranged from 4 months to 70 years with the mean age of 34.14 years. The age range for female patients was from 21 to 75 years, mean being the 45.43 years. The majority of males who were affected had age ranging from 21–30 years (23 cases) and the majority of affected females were also in the age group 21–30 years (11

cases). In the study by Odebode et al[6], showed the high frequency of affected male patients compared to female patients; i.e male–37 (64.9%) > 20 (35.1%) female subjects. In the study by Kulkarni et al[7], a total number of two hundred patients were examined of CHI, out of which 194 i.e 97% were males patients and 6 i.e 3% were females. The age ranged from 5 to 67 years, with a Mean of 28.08 years. 5–67 years was the age range of men with a Median of 27.85 years. And for female patients it was 14–47 years with mean age as 35.33 years. Male patients with the age range of (21–30 years) were more prone to head trauma, i.e 62%. In the study by Smitha et al[2], men formed the major portion of the study population which was 92% patients and 8% were the female patients. The demographic report of closed head injury cases of the undertaken study correlates with the conclusions of various other studies, showing that male population is more commonly involved, mainly because men more frequently go out and travel more for work and men have more probability to be involved in industrial activity. They are more likely to go through from alcohol abuse which can lead to motor traffic catastrophies and assaults. In this study, we saw that more commonly occuring ocular finding was periorbital oedema, in 54.11% patients, followed by eyelid lacerations, seen in 22 patients, i.e 25.88%. Ecchymosis was seen in 18 patients, 21.17%. Subconjuctival haemorrhage was present in 13 patients. Periorbital skin abrasions were present in 1 patient, 6 patients had corneal tear. Pupillary abnormalities were observed in 3 patients,posterior segment findings i.e 4.70%, as Papilloedema in 1 patient, macular edema 1, Purtscher's retinopathy in one case and Traumatic optic neuropathy in 1 patient. According to a study done by Kulkarni et al[7], the commonest ocular finding was observed as ecchymosis in 54 (27%) patients followed by subconjunctival haemorrhages in 38 (19%) patients. 24 patients (12%) were observed to have orbital wall fractures . Papilloedema was seen in 11/200 cases (5.5%), macular edema in 4/200 cases (2%), retinal haemorrhage in 1(0.5%) case, vitreous haemorrhage in 1(0.5%) case, corneal tear in 2(1%) cases, scleral tear in 2(1%) cases. According to Odebode et al[6] the soft-tissue injuries to the globe and adnexa were the most common finding, observed in 29(12.89%) patients, and orbital fracture with rupture of the eye was present in 2(0.89%) patients. Periorbital ecchymosis was the most frequent soft tissue injury, recorded in 17 patients (7.56%), chemosis in 20 patients (8.89%), subconjuctival haemorrhage in 21 patients (9.33%), ten cases had lid laceration, i.e (4.44%), corneoscleral laceration in five cases (2.22%), haemorrhages on the retina were observed in 2 patients (8.89%), and commotio retinae in 3(1.33%) patients. Various other neuro-ophthalmic complications observed were atypical pupil reaction in 12 (5.33%), partial or complete ptosis in 10 patients (4.44%), and lagophthalmos in 1 patient (0.44%). In a study by Ramachandran. S et al[9], 60 patients with ocular trauma were included, 31 out of sixty cases had head injury in association of the eye trauma , severity of the head injury was categorized by GCS score, and the observations made were, 25 had mild head injury, moderate head injury was seen in two cases and 4 patients had severe injury. The most common eye finding due to head trauma was ecchymosis of lids and periorbitaledema,i.e 58%, followed by subconjuctival haemorrhage.

Observations of the undertaken study, correlate with the findings of other studies.

Our study showed, 3 patients with pupillary abnormalities, i.e 3.52% and 1.17% patients had traumatic optic neuropathy.In the study by Masilaet al[5] 39 eyes had atypical pupil reaction. Two patients had third cranial nerve palsy. According to Kulkarni et al[7], involvement of pupil was present in 10/200 cases (5%) and it was the most frequently occurred neuro-ophthalmic sign. Sixth cranial nerve palsy was recorded in 2% of head injury cases. Traumatic optic neuropathy is seen in 0.5% of cases and third nerve palsy is seen in 1.5% of the cases.According to Odebode et al[6] involvement of the sixth cranial nerve was the most common ocular motor nerve palsy, which was present in 8 patients, followed by third and fourth cranial nerve palsies, which were obsereved and documented in six cases each. Various other neuro-ophthalmic complications recorded were atypical pupil reaction in 12, partial or complete ptosis in 10, and lagophthalmos in 1 case. According to this study, 72.94% cases with mild head injury had trauma to ocular adnexa, and 18.82% patients had anterior segment manifestations.

Severe head trauma and posterior segment findings had constant relation, without any exception. Severe head trauma was also positively correlated with the neuro-ophthalmic findings. According to Odebode et al[6], severe head injury patients had only soft tissue injury to the eye, adnexa and periorbital region, 50% of the times. 43.75% patients with severe head injury had neuro-ophthalmic manifestations in association with damage to ocular soft tissue, adnexa and periorbital region,as well. Patients with extreme severity of head injury had rupture of the globe and fracture orbit as well as neuro-ophthalmic

manifestations and soft tissue damage to eye, adnexa and periorbital region in 6.25 % cases. According to Kulkarni et al[7], 82.7% patients with less severe head injury had eye involvement of no neurological significance, including unilateral and bilateral ecchymosis 49 (32.67%), subconjunctival haemorrhages 38 (25.33%), orbital margin fractures in 12 (8%), proptosis in 6 (4%), blow out fractures of the orbit in four (2.67%), macular oedema in three (2%) cases, unilateral traumatic mydriasis, lacrimal gland prolapse and scleral and corneal tears in 2(1.33%) cases each, and hyphaema and haemorrhage in vitreous in one (0.7%) case each. 82.8% of patients of moderately injured head had ocular involvement. 9(31.03%) patients had pupillary signs. Papilloedema was observed in three (10.34%) cases, lateral rectus palsy in 4(13.79%) cases, ecchymosis and orbital margin fractures in 2(6.9%) cases each, retinal haemorrhage, macular oedema, ptosis, and traumatic optic neuropathy in 1(3.45%) case each. 90.48% patients of extremely severe head injury had involvement of eye. 2 (9.52%) patients had pupillary involvement. Papilloedema was seen in 8 (38.1%) cases, orbital fractures were observed in six (28.57%) cases and ecchymosis was seen in 3(14.29%) cases.The findings of these studies largely correlate with the findings of our study. In this study, visual acuity greater than CF 3m was present in 59 cases, less than CF 3m in 18 cases and vision was unrecordable in 8 cases at presentation. In the study done by Masila et al[5], 70.8% eyes had the normal visual acuity, 21.90% had visual impairment, and 2.4% had severe visual impairment.

These findings correlate with our study.

At 1 week, 26 patients were lost to follow up and 3 patients died. Among the 56 patients who were followed up, commonest ocular findings were periorbital oedema and ecchymosis, documented in 10 patients each (17.85%), followed by SCH (16.07%) and in 1 patient optic nerve atrophy secondary to trauma was seen. And the remaining twenty-six subjects had no ocular findings.

All cases with lids and adnexa manifestations at 1 week follow up had head injury categorized as mild. Anterior segment manifestations patients had mild head injury at 1 week of follow up. Severe head injury with posterior segment findings, were recorded in one patient.Visual acuity less than 6/60, was recorded in one patient at the first follow up visit. Others had visual acuity greater than 6/60 in both eyes. At 4 weeks of follow up, we lost the follow up for 8 more patients, and 1 more patient died. So the follow up was done for 47 patients and 1 patient had ecchymosis and all other patients had no ocular finding. All patients examined at 4 weeks had GCS score of 15. All patients at 4 weeks had vision better than 6/60. At 6 weeks, only 45 patients were followed up, and none of them had any ocular finding. All of them had GCS score of 15. All followed up cases at 6 weeks had their vision greater than 6/60.

So, the observation made was that at various follow up visits, patients had improvement in the ocular manifeatations of the head injury and of the direct trauma to the eye. There was an improvement in the GCS score as well.

Conclusion

With the inferences drawn from the study we conclude that, there can be various ocular manifestations in closed head injury patients. The correlation of the severity of head injury with the posterior segment and neuro-ophthalmic manifestations, showed that the more severe form of head injury is related with severe ocular findings and thus resulting in poorer neurological and visual outcomes.

Therefore, a detailed ocular assessment during the first presentation in all cases of head injury patients is mandatory as it helps in better management and the final outcome could be improved with better diagnosis and management.

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