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Ocular complications of head injury in children

Temitayo Shokunbi [1] **and Aderonke Agbeja** [2]

[1] Neurosurgery Unit, Department of Surgery, and [2] Department of Ophthalmology, University College Hospital, Ibadan, Nigeria

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Abstract. Ocular complications occurred in 28% of children with head injury. Neuro-ophthalmological lesions made up one-third of these complications, mostly involved the optic nerve, and were associated with other focal neurological signs more frequently than non-neural ocular complications. Lesions of the posterior visual pathways were rare but tended to be permanent.

Key words: Ocular – Complications – Head injuries – Children

The close proximity between the visual system and the skull base makes the former quite vulnerable to the effects of skull injury, brain swelling, and intracranial hypertension [11], all of which are well known side effects of head trauma. Ocular cranial nerve palsies may disrupt binocular stereoscopic vision and interfere with visual acuity [5]. Recently, studies have demonstrated the significance of visual field defect as a reliable index of the severity of brain damage and long-term neuropsychological performance after head injury [10, 11]. In children, in whom the prognosis for survival after head injury is good [10], functional recovery may be jeopardized by the morbidity resulting from the associated damage to the visual system. There are numerous accounts in the literature of ocular complications of head injury concerning patient populations from all age groups [3, 4, 6, 9, 12], but few of these focus on this problem in children. This is a report of a retrospective analysis of the ocular complications seen in a group of 99 children with head injuries, aged 16 years and below, recently evaluated at our institute. The causes, neurological complications, and outcome in the whole group is the subject of a separate communication.

Offprint requests to: T. Shokunbi

Patients and methods

The hospital records of 99 children aged 16 years and below, who suffered head injury and were treated by the neurosurgical unit between January 1988 and June 1989, were available for study. These constitute about 60% of the total number of head injuries in this age group seen during the period. The age and sex of the patients, the causes of the head injury, and the abnormalities in the visual system are described and analyzed.

Results

Ocular and visual complications occurred in 28 (28%) of the children studied. The mean age (±SD) of these patients was 84.5 (±57.3) months. The youngest patient was 7 months old. The age distribution of the patients is illustrated in Fig. 1. The mean age of the patients with ocular and visual complication was not significantly different from that of the entire group of children with head injuries (77.5 months; SD 53.1 month). The sex ratio was 1.8:1 (18 males, 10 females) and was identical to that of the whole group (63 males, 36 females). The causes of head injury in the 28 patients with ocular and visual complications are itemized in Table 1. The two principal causes of head injury in this age group were traffic accidents, in which the children were affected as pedestrians,

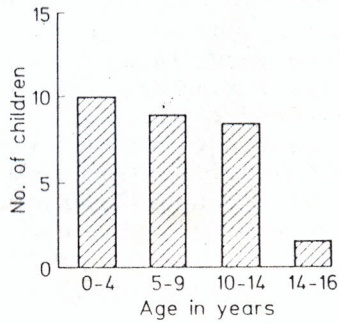

Fig. 1. Age distribution of children with ocular head injury complications

Table 1. Causes of head injury in 28 patients with ocular and visual complications

Causes	No. of patients
Traffic accidents	12
Falls from heights	12
Miscellaneous	4

Table 2. Ocular and visual complications in children with head injury in Ibadan

	No. of patients[a]
Soft tissue injuries to the globe and adnexa	
Periorbital ecchimoses	9
Laceration of the eyelids	2
Subconjuctival hemorrhage	1
Chemosis	6
Retinal hemorrhage	1
Commotio retinae	1
Neuro-ophthalmological signs	
Ocular cranial nerve injury	
Optic	6
Abducens	4
Oculomotor	3
Treachlear	1
Homonymous hemianopsia	1
Cortical blindness	1

[a] Some patients suffered multiple complications

Table 3. Mean age and percentage of patients with fractures and associated neurological deficit

	Neuro-ophthalmologic signs ($n=11$)	Soft tissue injuries ($n=17$)	P-valve
Mean age ± SD (months)	110.2 ± 53.1	82.3 ± 60.7	>0.5
Fractures	63.6 (7)[a]	52.9 (9)	>0.5
Associated neurological deficits	81.8 (9)	23.5 (4)	<0.001

[a] Figures in parentheses are actual numbers

and falls from heights. Ocular complications occurred equally frequently in head injury from these two causal factors (43% each). There were two main groups of abnormalities affecting the visual system. These were soft tissue injuries to the globe and surrounding tissues and neuro-ophthalmological signs (Table 2). They were present in 17 and 11 patients, respectively. The soft tissue injuries included periorbital ecchymoses (9 patients), chemosis (16 patients), and lid lacerations (2 patients). Subconjunctival and retinal hemorrhages were each seen in 1 patient; commotio retinae was seen in 1 patient. There were no cases of globe penetration, although hypotropia was seen in one case.

The neuro-ophthalmological abnormalities most frequently present were ocular cranial nerve palsies. Traumatic optic nerve damage, manifesting as an afferent pupillary defect; and papilledema with atrophy occurred in 6 patients. This was closely followed in order of diminishing frequency by abducens paresis (4 patients), oculomotor nerve paresis (3 patients), and trochlear nerve palsy (1 patient). Gaze palsy, homonymous hemianopsia, and cortical blindness were infrequent, each occurring in 1 patient. Abnormalities of the visual system were associated with additional focal neurological deficits in 46% (13/28) of patient's and with skull fractures in 57% (16/28) of patients. Eleven of the fractures were anterior in location.

None of the patients with neuro-ophthalmological signs had externally visible soft tissue injury to the globe and adnexa, and vice versa. The two groups were, however, similar with respect to age and frequency of associated fractures of the skull, although other neurological abnormalities, such as long tract signs, were present in a greater proportion of those with neuro-ophthalmological signs than of those with soft tissue globe injuries (81.8% vs 23.5%; $P<0.01$, Table 3).

There were 5 patients with paralysis of the facial nerve. Treatment of these patients was directed towards prevention of exposure keratopathy, and consisted of topical application of chloramphenicol eye ointment and, where necessary, lateral tarsorrhaphy. In the rest of the patients, treatment was largery conservative beyond suturing of lacerations and padding the eye. With the exception of the second cranial nerve, all the ocular cranial nerve palsies recovered completely during follow-up, which ranged from 1 week to 9 months. Blindness, either total or partial, occurred in 5 patients: the 3 patients with cortical blindness, homonymous hemianopsia, and commotio retinae, and the 2 patients with optic atrophy setting in after papilloedema.

Discussion

Several previous descriptions of ocular complications of head injury that involve the visual system have focused on specific aspects of the visual anatomy such as the optic nerve, chiasm, and posterior visual pathways, including the cortex and ocular cranial nerves [3, 4, 6, 7, 9, 11]. This approach does not provide an overview of the manner in which head injury affects the visual system. Because of the retrospective nature of our study, some cases were likely to have been missed, since visual complications were not specifically sought out. Furthermore, the affected child may not complain of a visual disability, so that the true incidence of this complication is unknown. Our figures are likely to underestimate the size of the problem. Nevertheless, they suggest that in children most of the injuries to the visual system (two-thirds) affect non-neural structures and are relatively minor in nature.

The manifestations of head injury and its numerous other systemic complications are so compelling that damage to the visual system is likely to be overlooked. Although the eye is examined as part of the neurological

assessment of the patient with a head injury, this is mainly for the purpose of gauging the severity of the head injury itself. This study has demonstrated that in children there is a great propensity for the eye and associated neural structures to be damaged in cases of head injury. Although the nature of the lesions is such that life is not threatened, early recognition and treatment will reduce morbidity among survivors.

After head injury, the survival rate is higher and persistence of cognitive deficits and long tract signs is less frequent in children than in adults. Despite prolonged coma, survivors achieve ambulation and self-care [2]. It is preferable that their recovery not be hampered by poor visual function. Partial or total blindness was observed in five of our patients during follow-up. The identification of these patients is important, so that appropriate recommendations for rehabilitation and schooling can be made as early as possible.

Of the ocular cranial nerves, in this study the second nerve was the most frequently involved (6 patients). The incidence in this series of children with head injuries (99 patients) is approximately 6%. The condition has been reported in the literature to occur with a frequency of 0.5–5.2% in head-injury patients [12]. The mechanisms include hemorrhage into the nerve, contusion, and ischemia [3]. The value of operative decompression has been debated, and it has been suggested that the best surgical result is obtained in patients with a visual acuity of 0.01 or more and who have a fracture of the optic canal with contusion of the nerve [12].

Injury to the abducens nerve is a well-known complication of head injury and is commonly blamed on its long intradural course, during which it is liable to be pressed against the petrosphenoid ligament, but unilateral dysfunction may be part of a herniation syndrome [9]. There is a tendency to misdirection of the regenerating nerve fibers, a sequel that may disrupt binocular vision [5]. Although direct impact may be the mechanism by which the III, IV and VI cranial nerves are commonly damaged, rootlet avulsion at their exits from the brain stem may occur as a result of differential mass movement between the latter and supratentorial structures [6]. Generally, nuclear and infranuclear lesions predominate over supranuclear lesions [1]. However, when supranuclear lesions exist, they tend to be overshadowed by the prominent manifestations of associated brain stem lesions [8]. Lesions of the posterior visual pathways were rare but tended to persist.

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