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Research Article

Co-relation of CT scan findings with Glasgow coma scale scores in pediatric head injury

Ajay Kumar Jain*, Kailash Charokar, Prateesh Agrawal

Department of Surgery, PCMS & RC, Bhopal, M.P, India

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***Correspondence:**
Ajay Kumar Jain,
E-mail: 123ajayjain@gmail.com

ABSTRACT

Background: Head injury in pediatric age is a major cause of mortality and disability. Clinical selection of cases prior to ordering CT scan would be desirable to avoid unnecessary radiation exposure and risk of malignancy.
Methods: An observational study of 50 pediatric cases of head injury that underwent CT scan as part of routine diagnostic work up. Correlation of CT scan findings with GCS scores and clinical profile done.
Results: Contusion was the most frequent finding in cases with positive CT scan findings and majority (94%) of patients could be managed conservatively. Among the mild head injury cases only 1 (3.8%) had positive CT scan findings whereas 16 (80%) with moderate head injury and almost all (100%) subjects with severe head injury had positive CT scan findings.
Conclusions: Careful clinical selection based on GCS score before ordering CT scan can help reduce radiation exposure among pediatric patients and pressure on limited resources. Studies with larger sample size would be warranted.

Keywords: CT scan, head injury, pediatric, Glasgow Coma Scale Score

INTRODUCTION

Pediatric head injury admission in emergency rooms of hospitals is a common phenomenon. Head injury not only accounts for large number of emergency pediatric admissions but is also responsible for mortality and disability in children above one year of age in significant proportions. The reported figures in Indian studies vary and only represent the tip of iceberg as many cases go unnoticed and unreported.

Head injury can be defined as an aggression to the brain caused by an external physical force that may produce a state of altered consciousness and thereby affecting the cognitive or physical activities of the victim. Damage secondary to head injury can be primary or secondary and may result into partial or total impairment of the functions.[1] Head trauma in children form a distinct subset of patients as paediatric patients have more susceptible cranial vault secondary to thin bones, large head-to-torso ratio and late development of air sinuses, differences in the immune system and in their capability of maintaining body temperature. Also, severe head trauma in children is less frequent compared to adults and mortality secondary to head injury is also lower in pediatric age group.[2]

Besides the detailed history and thorough clinical examination, skull X-ray and CT scan form the mainstay of diagnostic work up in such cases. Where skull X-ray is usually limited to the identification of skull fractures, computed tomography (CT) forms an indispensable tool guiding patient's management.[3] Although routinely performed in almost all cases of head injury, still a dilemma exists as which group of patients need to be

subjected to CT avoiding unnecessary radiation exposure in low risk cases.

METHODS

This was a prospective observational study carried out on head injury cases in pediatric age group admitted in emergency room of medical college hospital of central India. All pediatric patients below 14 years of age admitted with head injury were offered voluntary participation after informed consent and were included in the study over a period of two years (2012 to 2014). After inclusion in study all pediatric subjects underwent management as per institutional policy which involved quick detailed history and thorough physical examination. The time of accident, mode of accident, clinical presentation along with various demographic data were recorded. Besides the general examination, the wound examination was done to note the site, size, number, shape and depth of the wound. The presence of bleeding, hematoma, swelling in any part of scalp was noted. Patient's attitude, orientation, level of responsiveness noted in all according to Glasgow coma scale including sensory and motor examination to the extent as far as possible. All the vital organs including Ear, nose, throat, eyes, limbs and body viscera were examined for evidence of associated injuries. The exclusion criteria were children with prior history of seizures, doubtful history, congenital hydrocephalus or CNS malformations. CT scan head (plain) was performed on all the subjects as a standard investigation. CT scans films for all were examined and were considered positive if there was evidence of any acute traumatic intracranial lesion. The study participants were subjected to either conservative management or surgical intervention as per institutional protocol. The study received institutional ethics committee approval. In the present study we studied co-relation between CT scan findings & Glasgow coma scale in pediatric age group with head injury in Peoples Hospital.

Table 1: Co-relation between CT scan findings & Glasgow coma scale.

No.	Responses	Glasgow coma scale	Score	Glasgow coma scale
		Age > 2 years		Age < 2 years
1	Eye Opening	Spontaneous	4	Spontaneous
		To voice	3	To Speech
		To Pain	2	To Pain
		None	1	None
2	Verbal Response	Oriented	5	Coos, Babble
		Confused	4	Irritable, Cries
		Inappropriate	3	Cries to pain
		Incomprehensible	2	Moans to pain
		None	1	None
3	Motor response	Obeys Command	6	Normal, Spontaneous
		Localizes Pain	5	Withdraws to touch
		Withdraws to pain	4	Withdraws to pain
		Flexion to pain	3	Abnormal Flexion
		Extension to pain	2	Abnormal Extension
		None	1	None

RESULTS

The present study was carried out on all pediatric head injury cases who got admitted at medical college hospital of central India over a period of two years (Nov 2012 to Oct 2014).

GCS was calculated for all the study participants as part of routine clinical management. We observed that majority (92%) of subjects had GCS score above 9 with mild to moderate head injury.

CT scan was ordered for all subjects as a diagnostic work up. As the severity of injury increased higher proportion of cases had positive CT scan findings. Almost all cases (100%) of GCS score < 9 had positive CT scan findings.

Traumatic brain injury can be primary or secondary. Primary injury is the one that is present due to initial traumatic insult while secondary brain injury results later. On CT scan, a spectrum of injury can be identified. In our study, contusion was the most common finding (38%) followed by extradural hemorrhage.

DISCUSSION

Traumatic brain injury has been variously reported as the leading cause of paediatric mortality and morbidity from

all over the world. The reported incidence varies from place to place and so are the management guidelines. The variable management practices could be attributable to availability of resources and neurosurgical care. CT examination has become a standard tool in the investigation of head injury owing to its better sensitivity over skull radiographs and lower cost compared to MRI. Although, CT has almost revolutionized the diagnostic work up of head injury, its applicability in all cases is now debatable. Careful patient selection based on clinical parameters and selective ordering of CT scan without jeopardising patient care would not only reduce the cost of hospital stay but also undue radiation exposure in many. Current study was undertaken to study the co-relation between CT scan findings & Glasgow coma scale in pediatric subjects with head injury. Although, CT is routinely performed in moderate and severe head injuries, there is still an uncertainty about which children with minor head trauma would require CT. Rice et al. reported that there may be as high as 1 case of lethal cancer for every 1000 CT scans performed in a young child.[4] As fewer than 10% of children with head injury suffer from a traumatic brain injury identification of children having low risk for brain injury after head trauma is of paramount importance.

Table 2: GCS Score of head injury cases (N = 50).

GC score	No. of cases	Percentage
<9	4	8%
9-12	20	40%
13-15	26	52%

Table 3: No. of positive CT cases in relation to GCS Score (N = 50).

GCS Score	No. of cases	Positive cases	Percentage of positive cases
<9	4	4	100%
9-12	20	16	80%
13-15	26	1	3.8%

In a series of 1000 paediatric patients with minor head trauma, 65 patients had a positive CT and only 6 required neurosurgical intervention.[5] A recent study suggested that high-risk patients that require CT scan are those with failure to reach GCS score of 15 within 2 hours, suspicion of open skull fracture, worsening headache and irritability; whereas large scalp hematoma, signs of skull base fracture and dangerous injury mechanism were identified as medium risk factors.[6] Kraus et al (1984) in their series reported a peak incidence of head injury among the very young age group predominantly resulting from fall from height while the middle age peak corresponded to the high incidence of head injury resulting road traffic accidents.[7]

Contusion was the most frequent finding in cases with positive CT scan findings present in 8/21 (%) cases followed by EDH (6/21), depressed fracture (6/21), acute SDH (5/21) and brain oedema (5/21). These Findings are similar to study conducted by Ng et al[8] where contusion 35% was most common CT finding followed by depressed skull fracture 26% and EDH 14%. According to Fundaro et al, EDH was found in 20% and depressed skull fracture and SDH in 14% of cases.[9] In the present study, majority (94%) of patients were managed conservatively. Injuries requiring neurosurgical intervention are very uncommon in children with GCS scores of 13–15.[10] Martin et al found that only 0.6% of children with TBI needed neurosurgical intervention while a similar percentage (1.5%) was found by Guzel et al.[6,11] The patients who underwent surgical intervention in our study were cerebral oedema with mass effects, SAH & multiple fractures with intra-ventricular bleed and SDH. In our study, two cases expired during the course of study while rest all were discharged home in good condition. The mortality were among the cases who had GCS below 9 and required operative intervention.

Table 4: Types of positive CT findings (N = 50).

Lesions	No. of cases	Percentage
Acute SDH	5	23.8%
EDH	6	28.57%
Contusion	8	38.09%
Brain edema	5	23.8%
Depressed fracture	6	28.57%
Subarachnoid Hemorrhage	1	4.7%
Intra Cranial Hemorrhage	1	4.7%

In our study, majority (92%) of subjects had mild to moderate head injury. We correlated the CT scan findings with the GCS Score. Among the 26 mild head injury cases only 1 (3.8%) had positive CT scan findings whereas 16 (80%) with moderate head injury and almost all (100%) subjects with severe head injury had positive CT scan findings. CT scan was considered to be positive if it revealed an acute traumatic intracranial lesion that required either intervention or observation.[12] Positive CT finding were reported as subdural, epidural or parenchymal hematoma, subarachnoid hemorrhage, cerebral contusion or depressed skull fracture. Similar findings of positive CT scan were observed by Gomez et al (3.82%) & Mohanty et al (3.5%) in cases of mild head injury.[13,14] Almost all cases with GCS below 12 (100% with GCS below 9 and 80% with GCS 9-12) had positive findings on CT scan whereas only 4% (1/26) of subjects with GCS above 13 had positive CT scan findings. In the study conducted on 311 children of head injury, SM Ng et al concluded that a GCS of less than 12 and presence of focal neurological deficits were the two strong predictors of abnormal CT scan.[8] They also concluded that 95% cases of abnormal CT scan and 100% cases of intracranial injury can be identified by presence or absence of nine clinical findings.

CONCLUSION

Careful clinical assessment and selective ordering of CT scan based on GCS score would minimize the radiation exposure among pediatric patients and pressure on resource limited settings. However, studies with larger sample size would be warranted to draw conclusive recommendations.

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