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**Original Research Article**

# Validity of clinical examination in screening pediatric minor head trauma with loss of consciousness

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## ABSTRACT

**Background:** Minor head injury is the most common presentation in the emergency room for pediatric cases. Though most of them present with intact consciousness, there is an increased risk of primary and secondary brain damage, owing to several mechanical and cellular pathophysiological changes following trauma. Computed Tomography (CT) is the gold standard diagnostic tool for trauma; however, it has been reported that 30% of CT examinations are unwarranted. This study was carried out to evaluate the diagnostic validity of clinical examination in pediatric minor head trauma.
**Methods:** This cross-sectional study was carried out among 355 patients between 1-15 years of age presenting to the ER, who had closed minor head trauma and loss of consciousness. Patients with GCS of 13-15 were included. A thorough clinical examination including head and neck was carried out. All the participants were subjected to CT examination. Data was entered and analyzed using Microsoft Excel spreadsheet.
**Results:** The prevalence of minor head trauma detected by CT examination was 21.4%. The sensitivity and specificity of clinical examination were 71% and 63.8% respectively. The negative predictive value of the screening test was 89%.
**Conclusions:** The value of clinical examination in detecting minor head trauma may be well complemented by the development of standardized clinical criteria which may be evaluated for its diagnostic capability. Following efficient clinical tool will minimize CT examinations and thereby prevent lethal complications due to radiation overdose in the pediatric population.

**Keywords:** Computed tomography, Glasgow Coma Scale, Loss of Consciousness, Minor head trauma, Pediatric age group

## INTRODUCTION

Head trauma is a common minor injury in the pediatric age group, accounting to 500,000 emergency room (ER) visits every year.[1] Although a majority of the injuries are trivial and insignificant, minor head trauma results in several intracranial injuries, and potentially results in permanent disabilities and increased health care costs. Predominantly, these injuries are unintentional. There are several reasons attributed to the trauma; falls being the most common cause.

In rare cases, abusive injuries and motor vehicle accidents have been reported. Studies have documented that 80 out of every 100,000 children with head trauma undergo hospitalization.[2]

Considering the acute nature of the condition, there is a growing need for prompt and accurate diagnosis. Several studies have proven that children exhibit a specific pathological response to trauma, in addition to neurological symptoms. Computerized Tomography (CT) head plays an increasingly important role in the diagnosis of head trauma in these cases. In recent times, CT has been relied upon as an essential diagnostic tool with an increase in the prevalence of 34% in 2008 from 12% in 1997.[3] Despite the fact that CT has greater diagnostic validity in head trauma, there are certain allegations that 30% of all the CT examinations are unwarranted.[4]

Any trauma presenting in the ER needs to be clinically evaluated first. The clinical presentation in pediatric age group is extremely variable and also depends on the extent and nature of the trauma. Pediatric Glasgow Coma Scale (PGCS) may be used to assess the level of consciousness and severity of the injury. The head injuries are unique in pediatric age group due to certain unique biochemical properties which occurs as a result of plasticity and deformity. Moreover, the neck muscles in the children are weak; thereby any trauma disturbs the cranio cervical stability, affecting the vertebrae.[5]

In all cases of pediatric head trauma, the role of clinical examination should never be undermined. From specific primary injuries including scalp injury, concussion, contusion intraventricular hemorrhages and penetrating injuries, initial clinical examination of the general condition and specific local examination will help in formulating a differential diagnosis among the patients.

The objective of this study was carried out to evaluate the validity of clinical examination in screening pediatric minor head trauma with loss of consciousness.

## METHODS

### *Study setting and study participants*

This cross-sectional study was carried out among the pediatric patients visiting the casualty of our tertiary care hospital for a period of twelve months between June 2017 and May 2018. A total of 355 patients were selected for the study by convenient sampling.

### *Inclusion criteria*

- Age of the participant must be between one and fifteen years
- Pediatric GCS must be 13-15
- Closed minor head trauma with loss of consciousness

### *Ethical approval and informed consent*

Institutional ethics was followed prior to the commencement of the study. Each participant and their parents were explained in detail about the study and informed consent was obtained.

### *Data collection*

On arrival to the ER, airway, breathing and circulation were examined first. Each participant was examined in detail to assess the GCS. A GCS score less than 13 were excluded. Closed minor head head trauma with loss of consciousness GCS 13-15, a general physical examination and examination of vitals were carried out.

A detailed examination of the head and neck region was carried out to look for lacerations, tear, contusions and concussions. Scalp was thoroughly examined. A detailed examination of pupil size and fundus was done. Orifices were examined to look for bleeding or discharge. Mobility of head and neck were assessed to look out for fractures. Spine was also examined for bulges and protrusions. Presence of any of the above signs in clinical examination was taken as positive finding in clinical examination. All the participants were subjected to CT examination. Presence of any findings in the CT examination was taken as positive for CT examination.[6]

### *Data analysis*

Data was entered and analyzed using Microsoft excel spreadsheet. The prevalence of minor head trauma was expressed as percentages. Validity of clinical examination as a screening tool was expressed in terms of sensitivity, specificity and predictive value of positive and negative result.

## RESULTS

This study was carried out among 355 pediatric patients attending the ER of our tertiary care hospital. Majority of the participants belonged to 1-5 years of age (45.6%). The background characteristics of the study participants are given in Table 1.

About 32.4% of the participants belonged to 6-10 years of age. Among the study participants, 215 were males and 140 were females. The prevalence of head trauma among the study participants detected by diagnostic CT examination was 21.4%.

**Table 1: Background characteristics of the study participants.**

| Characteristics | Frequency (n=355) | % |
|---|---|---|
| **Age (in years)** | | |
| 1-5 | 162 | 45.6 |
| 6-10 | 115 | 32.4 |
| 11-15 | 78 | 22 |
| **Gender** | | |
| Male | 215 | 60.6 |
| Female | 140 | 39.4 |
| Prevalence of minor head trauma | 76 | 21.4 |

The validity of clinical examination as a screening tool for evaluating pediatric minor head trauma is given in Table 2. Out of 76 participants who were diagnosed positive by CT, 54 participants were detected positive by clinical examination. Therefore, the sensitivity, i.e. the probability of detecting true positives using clinical examination as a screening tool was 71%, which indicates the sensitivity.

**Table 2: Validity of clinical examination as a screening tool.**

| Clinical examination | CT scan finding | | Total |
|---|---|---|---|
| | Positive | Negative | |
| Positive | 54 | 101 | 155 |
| Negative | 22 | 178 | 200 |
| Total | 76 | 279 | 355 |

Moreover, out of 279 participants who were found to be negative by CT scan, 178 participants were found to be negative through clinical examination. Therefore, the probability of detecting true negatives using clinal examination was 63.8%, which indicates the specificity. The predictive value of a positive result was 34.8% while the predictive value of a negative result was 89%.

## DISCUSSION

Head injury is widely prevalent in pediatric age group, warranting emergency care and management. Head injury results in both primary and secondary brain damage; while primary directly impacts the brain through mechanical injury, secondary brain damage is mediated at the cellular level. Though CT has been established as a gold standard in the diagnosis of head trauma, the amount of radiation exposure through CT is considerably high for the pediatric age group. A study done by Rice et al showed that the incidence of lethal cancer in pediatric age group is as high as 1 per 1000 CT scans.[7]

In children with minor head trauma, it is not common to observe loss of consciousness, as it is related to increased risk of intracranial injury. Present study has examined the validity of clinical examination in evaluating minor head trauma. Our study has reported a sensitivity of 71% and a specificity of 63.8% for clinical examination. There is possibility of intracranial injury, in minor head trauma associated with loss of consciousness.

A study done by Farizal F et al also reported similar findings.[8] However, our study reported a higher negative predictive value of 89%, indicating that a child found negative for head trauma by clinical examination has 89% chances that he/she is actually free from any head injury. Therefore, despite lower sensitivity and specificity, clinical examination can't be ruled out in the screening of head trauma, owing to a high negative predictive value. A study done by Miller EC et al examined and developed a simple clinical criterion, which may be used to substitute CT examination. The investigator compared patients with clinical symptoms and risk factors with patients without risk factors. It was observed that CT scan done on patients without risk factors did not produce statistically significant results.[9]

## CONCLUSION

Our study has elucidated the role of clinical examination in screening of pediatric patients with minor head trauma. In spite of low sensitivity and specificity, clinical examination may still be considered for initial screening as the present study documented 89% negative predictive value. Generalized clinical examination, specific clinical screening criterion, will incorporate key factors for diagnosis of head trauma. Intracranial injury cannot be excluded only by clinical examination, in minor head trauma associated with loss of consciousness.

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