# Reliability of Triage Nurses and Emergency Physicians for the Interpretation of the C-3PO Rule for Head Trauma in Children

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**Contribution to Emergency Nursing Practice**

- This study demonstrates an excellent reliability between triage nurses and emergency physicians in interpreting the C-3PO rule when evaluating children who presented at an emergency department for a head trauma.
- Based on this, triage nurses could apply the rule at triage to identify children younger than 2 years of age at risk of skull fracture.

## Abstract

**Introduction:** The C-3PO rule has been validated for use by emergency physicians to identify young children at risk of skull fracture following head trauma. The use of the rule by triage nurses could improve patient flow in the emergency department.

**Objectives:** To evaluate the interobserver agreement of triage nurses and emergency physicians in the interpretation of the C-3PO rule in a pediatric emergency department.

**Methods:** This was a prospective observational study performed in a consecutive sample of children visiting a single emergency department. Participants were all children younger than 24 months of age who presented at the emergency department for head trauma that had occurred in the previous 24 hours. The primary outcome was the interobserver agreement between nurses and emergency physicians as to whether the child was at high risk of skull fracture according to the interpretation of the C-3PO rule. All study participants were evaluated sequentially by a triage nurse and an emergency physician. Outcome of evaluation was kept blinded between nurses and physicians. The primary analysis was the interrater reliability using the kappa score. The sample size was set to provide lower boundary of 0.70 for a 95% confidence interval (95% CI) for kappa coefficient of at least 0.80.

**Results:** A total of 226 children were evaluated by a physician and a nurse. Among them, 10 had skull fractures. A total of 34 nurses and 42 physicians evaluated between 1 and 21 children. The interrater reliability was excellent, as demonstrated by a kappa score of 0.85 (95% CI: 0.77–0.92). Moreover, all children with skull fractures were categorized at "high risk" by the nurse and the physician.

**Conclusion:** This study demonstrates an almost perfect interrater reliability between triage nurses and emergency physicians in interpreting the C-3PO rule when evaluating children who presented at an emergency department for head trauma.

**Keywords:** Triage; Nurse; Emergency department; Children; Head trauma

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Head trauma is a common presenting condition of children visiting the emergency department. In the United States alone, head trauma represented more than 600,000 ED visits, 95,000 admissions, and costs were approximately 1 billion dollars per year.[1] More recently, the National Clinical Guideline Centre (UK) reported that head injury in children is responsible for more than 500,000 emergency department visits per year in England and Wales.[2] Between 6% and 30% of children younger than 2 years of age with head trauma present with skull fractures.[3–8] It is important to detect the presence of a skull fracture because it could be complicated by

leptomeningeal cyst[9] or growing fracture.[10] Also, a small proportion of skull fractures are depressed, requiring further management.[11] Although growing fractures are uncommon (2% of all fractures), their detection is vitally important because of the risk of brain herniation if left untreated.[10,12–14] With rapid identification, growing fractures can be corrected with a simple neurosurgical intervention.[15]

There is controversy regarding the proper use of radiology for head trauma in children. Although some national guidelines suggest a wide spectrum of criteria to perform a radiologic evaluation, others are very strict.[1,16–18] Large, well-conducted studies have identified predictive criteria of clinically important traumatic brain injury (ciTBI) and provided management stratification according to their risk.[19,20] Until recently, no predictive rule was developed to identify skull fracture. A recent survey demonstrated a significant practice variation in criteria submitted to case scenarios by Canadian pediatric emergency physicians who ordered skull radiography for young children with minor head trauma.[21] A clinical decision rule was recently suggested to identify children younger than 2 years old at risk of skull fracture.[22] A simple refinement of the rule improved its sensitivity to 98% while maintaining a specificity at 82%.[23] The modified rule stipulates that there is higher risk of cranial fracture for children 3 months old and younger or those having a swelling/hematoma on the parietal or occipital bones (C-3PO rule).

Emergency department triage nurses frequently order tests directly following triage using their clinical judgment before the physician's evaluation. Such practice is believed to improve patient throughput times and patient satisfaction, although the effect on cost-effective delivery of care is unknown.[24,25] Application of the C-3PO rule by triage nurses could improve process of care in the emergency department for young children suffering from head trauma. Based on this, it was decided to evaluate the interobserver agreement between triage nurses and emergency physicians on the overall interpretation of the C-3PO rule to identify young children at risk of skull fracture following head trauma.

## Methods

### DESIGN

This was a prospective observational study performed among a convenience sample of children visiting a single emergency department for head trauma in the previous 24 hours.

### SETTING

The study was conducted in a tertiary-care pediatric hospital, with approximately 80,000 visits annually. The emergency department is staffed by pediatric emergency physicians, pediatricians, emergency and family medicine physicians, all certified by the Royal College of Physicians and Surgeons of Canada. In this setting, all emergency triage nurses have more than 12 months of experience in the emergency department. They received a training specific to triage by an experienced nurse educator and have been evaluated as competent in triage, following a standardized local evaluation.

### PARTICIPANTS

A convenience sample of eligible children was recruited to participate in the study. All children younger than 24 months visiting the emergency department for mild, blunt head trauma were eligible. More specifically, inclusion criteria were as follows:

- Age < 24 months
- Head trauma defined as a transfer of energy to the head with or without laceration
- Trauma in the previous 24 hours

Exclusion criteria were as follows:

- Patients needing a head computed tomography (CT) scan for
  - Moderate or severe TBI
  - Mild TBI needing a CT scan according to the PECARN rule[19] (Glasgow < 15 after 2 hours, suspicion of open or depressed skull fracture, irritability on examination)
- Injury solely to the face with no skull involvement
- Inability to obtain a parental informed consent

TABLE 1
**Baseline demographics of the participants (n = 226)**

| Characteristics | N (%) |
|---|---|
| Median age in months (1st and 3rd quartile) | 8 (4 and 12) |
| Male sex | 127 (0.56) |
| Height of fall | |
| • No fall | • 22 (0.10) |
| • Own height | • 26 (0.12) |
| • 1-3 feet | • 133 (0.59) |
| • >3 feet | • 45 (0.20) |
| Fall from a parent's arm | 24 (0.11) |
| Fall down stairs | 23 (0.10) |
| Radiologic evaluation | 74 (0.33) |