



## Impact of newly adopted guidelines for management of children with isolated skull fracture



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### ABSTRACT

**Purpose:** In an effort to standardize practices and reduce unnecessary hospital resource utilization, we implemented guidelines for management of patients with isolated skull fractures (ISF). We sought to examine the impact of these guidelines.

**Methods:** Patients with nondisplaced/depressed fracture of the skull vault without intracranial hemorrhage were prospectively enrolled from February 2010 to February 2014.

**Results:** Eighty-eight patients (median age = 10 months) were enrolled. Fall was the most common mechanism of injury (87%). The overall admission rate was 57%, representing an 18% decrease from that reported prior to guideline implementation (2003–2008;  $p = 0.001$ ). Guideline criteria for admission included vomiting, abnormal neurologic exam, concern for abuse, and others. Forty-two percent of patients were admitted outside of the guideline, primarily because of young age (20%). Patients transferred from another hospital (36%) were more likely to be admitted, though the majority (63%) did not meet admission criteria. No ED-discharged patient returned for neurologic symptoms, and none reported significant ongoing symptoms on follow-up phone call.

**Conclusions:** Implementation of a new guideline for management of ISF resulted in a reduction of admissions without compromising patient safety. Young age remains a common concern for practitioners despite not being a criterion for admission. Interhospital transfer may be unnecessary in many cases.

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Head injuries in children remain a common cause of emergency department (ED) visits in the United States [1,2]. Children with normal mental status presenting to an ED with head injury and found to have an isolated skull fracture (ISF) without intracranial injury typically have a good neurologic outcome [3–5], and the need for neurosurgical intervention is very low [3–6]. Yet in a recent retrospective study of 235 children treated at our institution with ISF [3], 75% were admitted for observation and no patient experienced neurologic deterioration during the period of observation—a trend seen across the United States [4]. We hypothesized that admission of these children was unnecessary, and the additional hospital resources, costs, and potential strain to families that are associated with admission may not be justified.

Based on the findings of our review [3], institutional guidelines were developed for the management of children with an ISF in order to help standardize criteria for discharge from the ED versus hospital admission (see Fig. 1). These guidelines were adopted in January of 2012. The aim of this prospective observational study was to determine the impact of

this treatment algorithm, specifically on admission rate, and to further evaluate clinical decision-making for these patients.

### 1. Methods

Patients treated at our pediatric level I trauma center between February 9, 2012 and February 8, 2014 with a skull fracture identified using computed tomography were considered for study inclusion. Patients were screened and enrolled at the time of their treatment by a member of the study team, or identified after discharge using hospital information systems and ICD9 diagnoses codes. In either case, patients with a Glasgow coma score of 15 on arrival were considered eligible for enrollment, unless any of the following exclusion criteria were met: 1) other injuries that influenced admission status, 2) a midface or basilar skull fracture (occipital fractures were included if not reaching the foramen magnum), 3) a significantly displaced or depressed skull fracture, 4) intracranial injury, or 5) the injury occurred more than one day prior to the initial evaluation.

Caregivers of eligible patients were approached for consent to collect data 24–48 hours after ED evaluation regarding any ongoing symptoms (see Table 1). Attempts were made to contact patient caregivers by phone if discharged prior to 24 hours. For patients still hospitalized at

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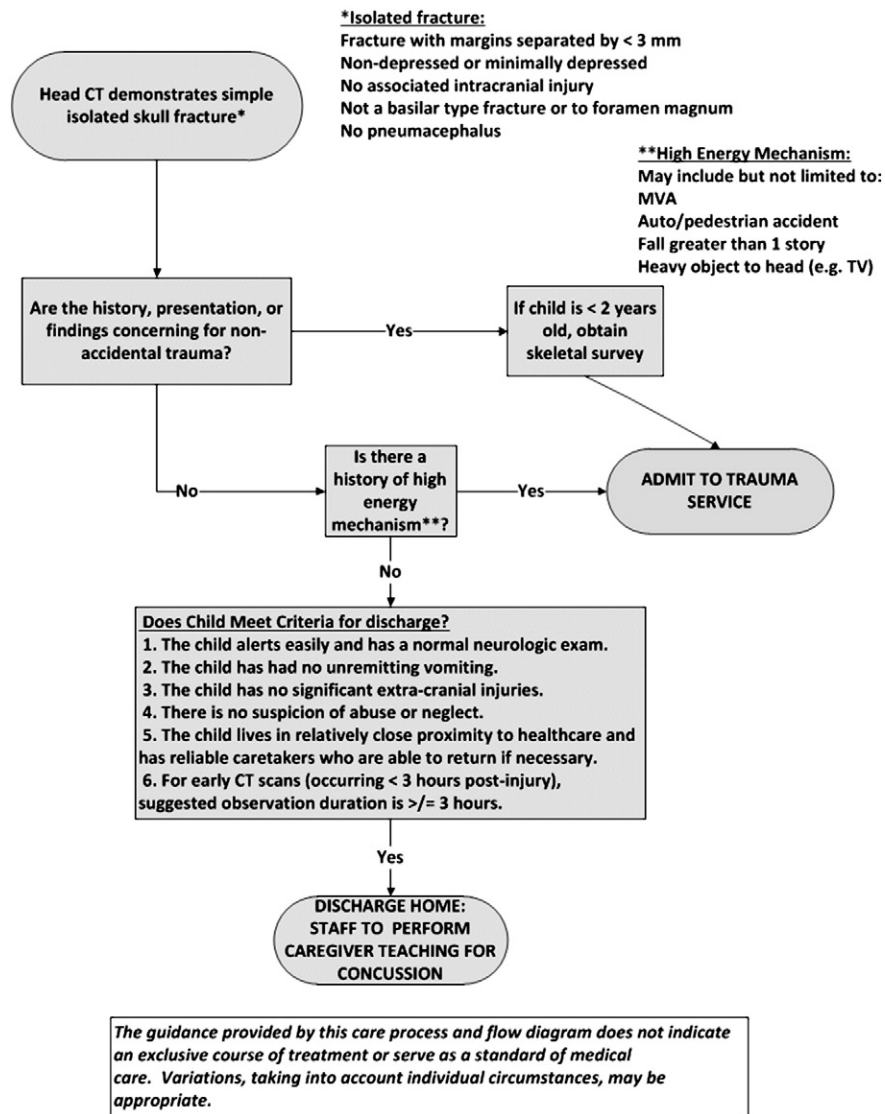


Fig. 1. Management Algorithm for Isolated Skull Fracture. Flow diagram of guidelines for management of isolated skull fracture adopted at our institution in January 2012.

**Table 1**  
 Symptoms assessed on follow-up questionnaire.

Major symptoms:
Slurred speech
Confusion
Dripping fluid from nose or ears
Seizure activity
Excessive drowsiness or difficult to wake
Weakness in the arms or legs
Pupils are unequal
Increasing scalp or face swelling
Vomiting more than 3 times since discharge
Minor symptoms:
Headaches
Light or noise sensitivity
Dizziness
Nausea
Blurry or double vision
Problems concentrating
Slow to answer questions
Problems remembering
Irritable or quick tempered
Personality changes
Sleeping difficulties

24–48 hours, the trauma nurse practitioner completed the questionnaire. Three patients declined consent to conduct the follow-up data.

Study data elements included patient age, mechanism of injury, origin of transport to our hospital, radiographic findings, presenting symptoms, ED disposition, hospital services provided, reasons for hospital admission, information about any return visits to medical care, and symptoms reported on the follow-up questionnaire. Descriptive statistics were then performed on these variables. Tests for association were conducted using the Pearson chi-squared method, and differences in distributions using the Wilcoxon rank-sum test. Statistical differences were considered significant if the probability of a type I error was <5% ( $p < 0.05$ ). Study data were collected and managed using Research Electronic Data Capture (REDCap) tools hosted at University of Utah [7]. Approval to conduct this research was obtained from the University of Utah Institutional Review Board.

**2. Results**

Eighty-eight patients met eligibility criteria for inclusion in the study. This represents 14% of all patients with a skull fracture, and 1.7% of all patients with any head injury treated at our hospital over

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