Trends in Pediatric Head CT Use: Looking Beyond the Ivory Tower

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In this month's *Pediatrics*, Burstein et al[1] report disappointing statistics in their work entitled "Use of CT for Head Trauma: 2007–2015." Using the National Hospital Ambulatory Medical Care Survey, a representative data set for emergency department (ED) visits,[2] they found that 32% of pediatric patients presenting for head trauma had computed tomography (CT) imaging as part of their evaluation. This proportion was unchanged over the study period despite publication of algorithms[3–5] and an international effort intended to safely decrease unnecessary radiation exposure from head CTs among infants and children with head injuries. Additionally, they reported that ∼90% of US children received their trauma care at general (nonteaching and nonchildren's) hospitals, where CT use was higher.[1]

Some history regarding CT use for pediatric head injury is helpful. In 1999, the American Academy of Pediatrics reviewed treatment of minor head injury and divided recommended evaluation and treatment by whether there was brief loss of consciousness (LOC).[6] Head CT imaging was recommended for patients with LOC. If the LOC was brief, then 12 to 24 hours of hospital observation was recommended. Together, these recommendations resulted in hospital admission for nearly one-third of patients with head injuries at that time. Unfortunately, broader CT use was encouraged by a rationale that, if the head CT was normal among the subset of neurologically normal patients, the child could be discharged without hospital observation because "they were at extremely low risk for subsequent problems."[7,8]

The association between radiation from medical imaging and subsequent malignancy,[9] especially among infants and preschool-aged children, and the rising use of CT imaging in mild traumatic brain injury (TBI) spurred investigations into how to safely limit radiation exposure in this setting.[10] The Pediatric Emergency Care Applied Research Network (PECARN) developed and validated guidelines for identification of children at low risk of clinically important traumatic brain injury (ciTBI) after head trauma.[4] The network performed a large prospective cohort study in 2006 of children seen within 24 hours with mild TBI (Glasgow Coma Scale of 14–15) but excluded those with trivial injury (skin or soft tissue), a preexisting neurologic condition, or penetrating head trauma. Overall, 35% had a CT, and 5.2% had traumatic injuries on CT. Nine percent were admitted to the hospital. Among those with a CT scan, 0.9% had ciTBI, defined as any of the following caused by TBI: death, receipt of neurosurgery, intubation >24 hours, or hospital admission >2 days associated with TBI on CT. Although Burstein et al[1] found a similar CT rate (32%), the current study hospital admission rate was only 2%, revealing a sustained use of CT scans despite apparently, on average, less severely injured patients compared with patients in the earlier PECARN cohort.

The PECARN algorithms differ for patients <2 years of age or ≥2 years of age and revealed that absence of all clinical risk factors in the algorithms

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had negative predictive values for ciTBI of >99.9%. The factors assessed were altered mental status, scalp hematoma, LOC, high-impact mechanism of injury, palpable skull fracture and/or signs of basilar fracture, vomiting, severe headache, and parental assessment of acting "normal." Excess CT use was reported in 24% of subjects <2 years old and 21% of those ≥2 years old because they had low predicted risk of ciTBI. Subsequent publication regarding implementation of the prediction algorithms reported declining CT use.[11–15] However, the patients studied were limited to those cared for at children's hospitals or affiliated sites. Burstein et al[1]'s findings reveal that improvements achieved in refining CT use at children's and teaching hospitals were the exception, with no measurable change on a broader, national level.

It is disappointing that US children have generally not benefitted from current best practice research and continue to experience unnecessary radiation exposure. This is a reminder that pediatric research and education efforts are frequently not focused where most US children receive their medical care. Nationally representative data sources, such as the National Hospital Ambulatory Medical Care Survey used by Burstein et al,[1] reveal that the vast majority of children receive ED care at nonteaching, nonpediatric EDs, but the majority of funding for pediatric research is centered in a handful of academic institutions.[16] Better diffusion of best practices is likely possible if attention is given to care delivered outside of children's hospitals. A recent study of a community ED revealed that a maintenance of certification program sponsored by a children's hospital was associated with lowered CT scan use from 29% to 17%.[17] If the medical community aims to accurately describe and comprehensively improve pediatric health care to benefit all children, then greater research in nonacademic health care settings and a stronger commitment to dissemination and implementation beyond children's hospitals are sorely needed.

ABBREVIATIONS

ciTBI: clinically important traumatic brain injury
CT: computed tomography
ED: emergency department
LOC: loss of consciousness
PECARN: Pediatric Emergency Care Applied Research Network
TBI: traumatic brain injury

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