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Feasibility and Accuracy of Fast MRI Versus CT for Traumatic Brain Injury in Young Children

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Abstract

Background: Computed tomography (CT) is commonly used for children when there is concern for traumatic brain injury (TBI) and is a significant source of ionizing radiation. Our objective was to determine the feasibility and accuracy of fast MRI (motion-tolerant MRI sequences performed without sedation) in young children.

Methods: In this prospective cohort study, we attempted fast MRI in children <6 years old who had head CT performed and were seen in the emergency department of a single, level 1 pediatric trauma center. Fast MRI sequences included 3T axial and sagittal T2 single-shot turbo spin echo, axial T1 turbo field echo, axial fluid-attenuated inversion recovery, axial gradient echo, and axial diffusion-weighted single-shot turbo spin echo planar imaging. Feasibility was assessed by completion rate and imaging time. Fast MRI accuracy was measured against CT findings of TBI, including skull fracture, intracranial hemorrhage, or parenchymal injury.

Results: Among 299 participants, fast MRI was available and attempted in 225 (75%) and completed in 223 (99%). Median imaging time was 59 seconds (interquartile range 52-78) for CT and 365 seconds (interquartile range 340-392) for fast MRI. TBI was identified by CT in 111 (50%) participants, including 81 skull fractures, 27 subdural hematomas, 24 subarachnoid hemorrhages, and 35 other injuries. Fast MRI identified TBI in 103 of these (sensitivity 92.8%; 95% confidence interval 86.3-96.8), missing 6 participants with isolated skull fractures and 2 with subarachnoid hemorrhage.

Conclusions: Fast MRI is feasible and accurate relative to CT in clinically stable children with concern for TBI.

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Trial registration: [ClinicalTrials.gov NCT02392975](https://clinicaltrials.gov/ct2/show/study/NCT02392975).

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