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CORRESPONDENCE

Artificial intelligence in paediatric head trauma: enhancing diagnostic accuracy for skull fractures and brain haemorrhages

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Abstract

Pediatric head trauma is a significant cause of morbidity and mortality, with children, particularly those under two years old, being more susceptible to skull fractures due to their unique physiological and developmental characteristics. A recent study by Azusa Ono et al. examined the impact of repeated imaging in children under 24 months with minor head trauma, revealing that 40.6% of those who underwent follow-up MRI after an initial CT scan showed new intracranial findings. The study emphasizes the importance of careful consideration of repeated imaging based on initial findings and associated risk factors, such as the presence of subcutaneous hematoma and fractures intersecting coronal sutures. This underscores the need for improved diagnostic approaches to minimize radiation exposure while ensuring accurate diagnosis.

Artificial Intelligence (AI) offers a promising solution, with research indicating that AI models can significantly improve diagnostic precision, increasing accuracy from 78.1 to 85.2% and reducing errors by two to three times. Additionally, AI has demonstrated high accuracy in detecting various types of brain hemorrhages, potentially facilitating earlier and more precise detection of hematomas associated with skull fractures. Integrating AI into diagnostic practices could enhance early detection, reduce diagnostic errors, and improve outcomes for pediatric head trauma cases. The study underscores the critical need for advanced diagnostic methods to better manage and treat head injuries in young children, where timely and accurate diagnosis is crucial.

Keywords Head trauma · Skull fractures · Imaging · Artificial intelligence · Haemorrhages

Dear Editor,

Head trauma is a leading cause of morbidity and mortality in children, who are more susceptible to skull fractures than adults [1]. The incidence of skull fractures in children evaluated for head trauma on an outpatient basis range from 2 to 20%, with the parietal bone being the most commonly affected, followed by the occipital, frontal, and temporal bones. Linear fractures are the most frequent type, followed by depressed and basilar fractures. This risk is particularly concerning in infants and toddlers under 2 years old, who are more vulnerable due to their distinct physiological and developmental traits. In infants under 24 months, minor falls can lead to skull fractures, and their limited symptom communication, combined with the risks of repeated imaging, necessitates careful consideration to minimize radiation exposure and explore alternative diagnostics [2].

A recent study by Azusa Ono et al. evaluated the significance of repeated head imaging in children under 24 months with minor blunt force head trauma who initially underwent computed tomography (CT) scans following Emergency Care Applied Research Network (PECARN) rules [2]. The study included children under 24 months with minor head trauma who met the PECARN criteria for initial CT imaging. Notably, out of 741 children, 110 had skull fractures. Among those, 96 underwent follow-up MRI, and 40.6% exhibited new intracranial findings. Interestingly, significant factors associated with new intracranial findings included the presence of subcutaneous hematoma at admission and fractures intersecting with coronal sutures. Moreover, four children required neurosurgical intervention, all of whom

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had initial CT findings of skull fracture with intracranial injury. Thus, the study highlights the need for careful consideration of repeated imaging based on initial CT findings and associated risk factors.

To address the urgent need for better diagnostic methods, innovative approaches are being developed to improve patient outcomes and reduce mortality and morbidity rates, particularly in pediatric patients. Artificial Intelligence (AI) models have shown exceptional accuracy and have significantly improved diagnostic precision in various medical disciplines. Research indicates that AI technologies are highly effective in detecting fractures, reducing diagnostic errors by two to three times, and increasing accuracy from 78.1 to 85.2% [3]. Moreover, AI systems have successfully identified fractures that were missed during routine examinations, underscoring their critical value in clinical practice.

Moreover, the AI model demonstrated high accuracy in identifying various types of brain hemorrhages, with area under the curve (AUC) values of 0.942 to 0.993 across different hemorrhage types on both thin and thick series. Each condition had at least one operating point with sensitivity and specificity exceeding 80% [4]. Therefore, it could facilitate earlier and more accurate detection of hematomas associated with skull fractures, leading to improved patient management and better outcomes.

In conclusion, the susceptibility of pediatric patients to skull fractures and the potential for severe complications underscore the importance of accurate and timely diagnosis. The study by Azusa Ono et al. highlights the limitations of repeated imaging in young children with minor head trauma and emphasizes the need for improved diagnostic strategies. Advances in AI offer a promising solution, with AI models demonstrating exceptional accuracy in detecting fractures and associated brain hemorrhages. By integrating AI into diagnostic practices, we can enhance early detection, reduce diagnostic errors, and ultimately improve patient management and outcomes for pediatric head trauma cases.

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Declarations

Ethical approval Not applicable.

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