



SCIENTIFIC LETTER

Point-of-care ultrasound for the diagnosis of finger fractures in the pediatric emergency department[☆]



Ecografía clínica para la detección de fracturas de dedos de la mano en urgencias de pediatría

Dear Editor:

Traumatic injuries of the digits of the hand are a frequent reason for pediatric emergency department visits. The plain radiograph is considered the gold standard for diagnosis of fractures in this region. However, its interpretation may be difficult and generate uncertainty in some cases.¹

Point-of-care ultrasound (PoCUS) has been found to be somewhat useful for diagnosis of fractures in various locations.^{2,3} However, there is limited evidence on its applicability and usefulness for hand digit fractures. This led us to conduct a study to assess its diagnostic accuracy for this indication.

The study was approved by the Clinical Research Ethics Committee of the Hospital Universitario Basurto. The case series included pediatric patients aged up to 14 years managed in the pediatric emergency department in 2023 who presented with hand injuries requiring radiography to rule out fracture. We excluded patients with previous fractures, deformities or open wounds.

Following the initial care provided at the department, as long as one of the six researchers was present (five first-year medical intern-residents [MIRs] who received training before the study and one trained pediatric emergency physician), the injured area was assessed by PoCUS using the water bath immersion technique, with collection of bilateral comparative images using multiple planes (Fig. 1). The MIRs participated in a specific 4-h theoretical and practical course followed by supervised practice in the emergency department in the three months preceding the study. We defined fracture as the detection by ultrasound of discontinuity or angulation in cortical bone. Subsequently, following

performance of the X-rays requested by participating MIRs, the patients were assessed in the department of traumatology, which issued a diagnosis that served as the gold standard for reference.

The sample included 212 patients with a mean age of 10.3 years (SD, 2.7), of who 60.4% were male. A total of 224 digits were assessed, and fractures were identified in 64 of them (28.6%). Fractures most frequently involved the proximal phalanx of the fifth digit (42.2% of the cases).

We found an overall sensitivity of 79.7% (95% CI, 67.8–88.7) and an overall specificity of 91.3% (85.8–95.1) of PoCUS for the detection of the finger fractures. The positive predictive value was 78.5% (69.2–86.3) and the negative predictive value 87.9% (87.0–94.6). The diagnostic accuracy of the pediatrician (n = 77) was greater compared to the MIR group (n = 147), with a sensitivity of 85.2% (71.79–98.58) compared to 75.7% (61.85–89.5) ($P = .3504$), and a positive predictive value of 88.5% (76.18–100) compared to 71.8% (57.67–85.92) ($P = .1093$). The performance of MIRs improved in the second half of the sample, with the sensitivity increasing from 65.0% (40.7–84.6) to 88.2% (63.6–99.0) ($P = .1371$) and the negative predictive value from 87.5% (79.2–92.7) to 96.2% (86.5–99.0) ($P = .1638$).

Point-of-care ultrasound has been found to offer a high specificity but a lower sensitivity for assessment of these injuries. Our findings were consistent with those of Aksay et al.,⁴ who reported a sensitivity of 79.3% and a specificity of 90%. We also found that diagnostic accuracy improved with the experience of the operator, although the small sample size precluded identification of statistically significant differences.

The water bath PoCUS technique uses the water bath as the coupling medium, which can improve the quality and resolution of the images by increasing the ultrasound wave propagation velocity.⁵ It also has the advantage of being painless, as it eliminates direct contact of the probe with the skin. In addition, it allows bilateral comparisons, facilitating the analysis of subtle differences between the affected and contralateral sides. However, it takes longer to perform, which could limit its use in high-volume care settings.⁶

Errors are common in the diagnosis of finger fractures and can have significant consequences, such as inadequate consolidation or functional impairment.¹ Based on the above findings, we propose a diagnostic algorithm that limits the use of ultrasound to cases in which there is a level of uncertainty after the clinical and radiographic assessment (Fig. 2). This approach would not dispense with radiographs, but

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Figure 1 Point-of-care ultrasound for detection of hand digit fractures.

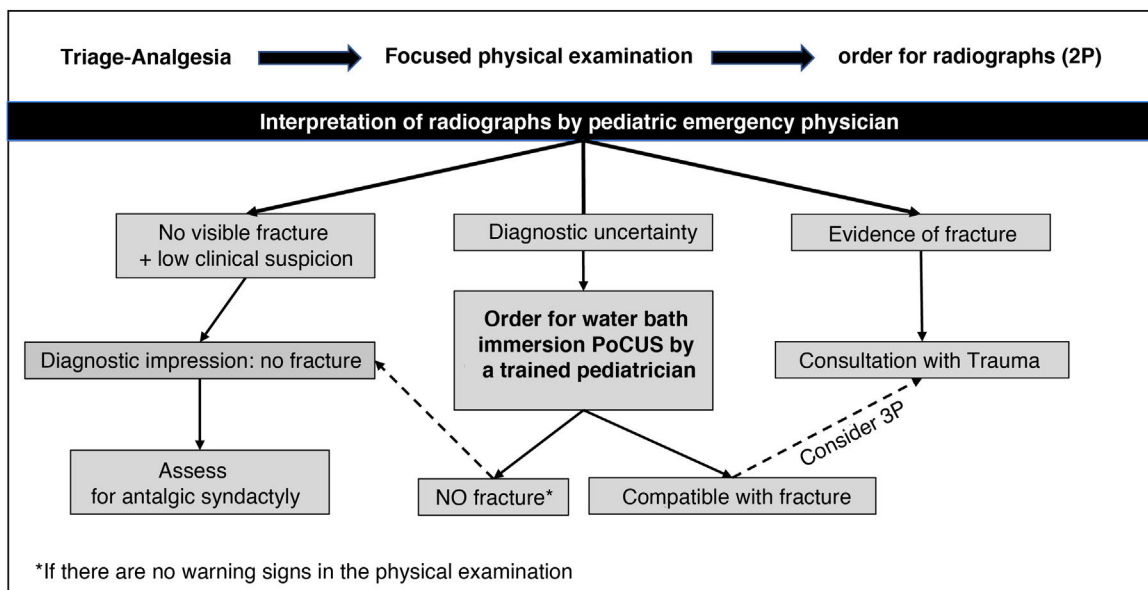


Figure 2 Use of point-of-care ultrasound in traumatic finger injuries in pediatric emergency care.

rather use PoCUS as a complementary tool to enhance the diagnosis in select cases.

The main limitation of the study was the lack of assessment of inter-observer agreement, as each assessment was performed by a single operator.

In conclusion, PoCUS is a feasible and highly specific technique for detection of fractures in the digits of the hand, with the added benefit that it is noninvasive and

does not entail exposure to radiation. Its diagnostic accuracy improves with the experience of the operator, which underscores the importance of adequate training on the technique. When implemented by trained pediatricians, PoCUS can be a valuable resource to complement the clinical and radiographic evaluation, particularly in the case of diagnostic uncertainty.

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Declaration of competing interest

The authors have no conflicts of interest to declare.

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