Accuracy of Point-of-Care Ultrasonography for Pediatric Ankle Sprain Injuries

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In children with lateral ankle injuries and no radiographic evidence of a fracture, the most common injury is of the anterior talofibular ligament (ATFL). The presence and extent of injury to this ligament may be important in prognosticating timelines for recovery.

We examined the sensitivity and specificity of point-of-care ultrasound (POCUS) in diagnosing ATFL injuries in radiograph negative ankle injuries compared to reference standard magnetic resonance imaging (MRI). We also determined the POCUS accuracy in the detection of distal fibular Salter-Harris I fracture, cortical fractures, and ankle effusions.
Materials and Methods

This was a prospective cohort pilot study. Children aged 5 to 17 years with an isolated, acute lateral ankle injury and ankle radiographs that did not demonstrate any visible bony fractures were eligible for enrolment.

POCUS trained pediatric emergency department (ED) physicians blinded to the MRI findings performed the ultrasound with a portable ultrasound system (zone ultra sp; Zonare Medical Systems, Mountain View, CA) using a 14-5 MHz linear ‘hockey stick’ transducer. The scanning protocol included imaging the distal fibular growth plate with measurements taken at the widest point in mm; the distal third of the fibula in three planes for a cortical fracture and/or fluid collection; the length of the ATFL for tears; finally, the anterior tibio-talar joint for the presence of a joint effusion. All images were then independently reviewed by an experienced fellowship-trained Pediatric ED sonologist blinded to the patient, initial ultrasound interpretations, and MRI findings.
Seven children were enrolled: mean age of participants was 12.1 (SD 3.0) years, and five (71.4%) participants were female. Overall, POCUS agreed with MRI with respect to ATFL injury in 4/7 (57%) of cases. Of the three cases with MRI-confirmed ligament damage, POCUS accurately identified and graded the extent of ligament damage in one case. POCUS falsely identified ligament injuries in two cases and missed a ligament injury in one child. POCUS accurately identified an effusion in 5/7 children (71%) and both imaging modalities confirmed the absence of cortical fractures in all seven cases. POCUS did not identify the one Salter-Harris I fracture of the distal fibula confirmed on MRI. For all findings, POCUS sensitivity and specificity were 57% and 86%, respectively.

### Table 1: Demographics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Case 1</th>
<th>Case 2</th>
<th>Case 3</th>
<th>Case 4</th>
<th>Case 5</th>
<th>Case 6</th>
<th>Case 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>12</td>
<td>12</td>
<td>7</td>
<td>15</td>
<td>13</td>
<td>10</td>
<td>16</td>
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<tr>
<td>Sex</td>
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<td>Female</td>
<td>Female</td>
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<tr>
<td>Number of days from ED presentation received US/MRI</td>
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<td>5</td>
<td>7</td>
<td>4</td>
<td>5</td>
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<td>3</td>
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<td>Bieri Face Pain Score during ultrasound</td>
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<td>1</td>
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<tr>
<td>Time to complete focused ultrasound scan (seconds)</td>
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<td>480</td>
<td>240</td>
<td>540</td>
<td>420</td>
<td>360</td>
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<td>Sonographer type</td>
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<td>Pediatric emergency medicine fellow</td>
<td>Pediatric emergency medicine POCUS fellow</td>
<td>Pediatric emergency medicine fellow</td>
<td>Pediatric emergency medicine POCUS fellow</td>
<td>Pediatric emergency medicine POCUS fellow</td>
<td>Pediatric emergency medicine fellow</td>
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<tr>
<td>Sonographer confidence (0-100%)</td>
<td>60</td>
<td>75</td>
<td>75</td>
<td>50</td>
<td>83</td>
<td>100</td>
<td>70</td>
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Figure 3: 7 year old boy with a lateral ankle injury demonstrating a partial tear of the anterior talofibular ligament (ATFL) on ultrasound and magnetic resonance imaging. Partial tear (*) and accompanied by blood/edema under the ligament (+) are noted on the ultrasound (A and B). On magnetic resonance imaging, there is thickening and indistinct fibers of the ATFL (arrow) compatible with a partial injury (C). This appearance is in contrast to a normal well-defined ligament (arrow) on the contralateral side (D).
In this pilot study, we established that POCUS diagnosed the specific pathology of radiograph negative lateral ankle injuries with poor sensitivity but good specificity. Thus, POCUS could act as a tool to exclude significant ligamentous and radiographically occult bony injury in these cases. A larger study is needed to validate the utility of POCUS for this injury.

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