Introduction

Accurate first time diagnosis of distal radius buckle fractures is increasingly important as management continues to transition from specialty care to the primary care setting.

More severe distal radius fractures treated as buckle fractures may be at greater risk for nonunion, malunion, and growth disturbance.

Method

In this retrospective review, patients under age 18, diagnosed with a distal radius fracture within a 6 month period were selected. Exclusion criteria included bilateral fractures, significant joint/bone deformity, previous wrist surgery, systemic diseases, multiple traumas, infections.

Three blinded raters, specialized in interpreting pediatric musculoskeletal radiographs, independently rated 676 radiographs to assess whether or not each distal radius fracture was a buckle fracture. A buckle fracture was diagnosed if there was buckling of the cortex on both the AP and lateral views without evidence of cortical disruption, indicative of complete fracture, or longitudinal radiolucency to the physis, indicative of a Salter-Harris II fracture. Accuracy was determined by comparing the diagnosis made by the radiologist and treating physician to the reference diagnosis.

Results

- 585 patients (309 males, 276 females) with unilateral distal radius fractures were diagnosed during the six month period.

<table>
<thead>
<tr>
<th>TABLE I</th>
<th>Accuracy of Pediatric Distal Radius Buckle Fracture Diagnosis</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Radiologist</td>
</tr>
<tr>
<td>True positive</td>
<td>20% (15/75)</td>
</tr>
<tr>
<td>False positive</td>
<td>10% (12/115)</td>
</tr>
<tr>
<td>False negative</td>
<td>40% (51/125)</td>
</tr>
<tr>
<td>True negative</td>
<td>5% (5/115)</td>
</tr>
</tbody>
</table>

- Misdiagnosed non-buckle fractures were more likely to be treated with a splint (6%, 6/105) than correctly diagnosed non-buckle fractures (2%, 6/338) (p=0.041, Table II).

<table>
<thead>
<tr>
<th>TABLE II</th>
<th>Pediatric Distal Radius Buckle Fracture Treatment Based on Diagnosis</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Splint</td>
</tr>
<tr>
<td>p-value</td>
<td></td>
</tr>
<tr>
<td>Buckle fracture</td>
<td>16 (11%)</td>
</tr>
<tr>
<td>False positive</td>
<td>6 (9%)</td>
</tr>
<tr>
<td>False negative</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Nonbuckle fracture</td>
<td>12 (13%)</td>
</tr>
<tr>
<td>True positive</td>
<td>2 (2%)</td>
</tr>
<tr>
<td>False negative</td>
<td>6 (9%)</td>
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</tbody>
</table>

- Misdiagnosed non-buckle fractures were also more likely to be treated with a below elbow cast than an above elbow cast (83%, 82/99 vs. 40%, 132/327) (p<0.001, Table II).

Conclusion

Fractures with cortical buckling but also with evidence of cortical disruption or physeal injury were frequently mistaken for benign buckle fractures in children. These more severe non-buckle fractures are at risk for significant complications including displacement and subsequent malunion and Salter-Harris II fractures are at risk for growth arrest and deformity. Careful attention must be taken to ensure the proper diagnosis of buckle fractures in children. Using rigid diagnostic criteria, appropriate diagnosis can be readily made, which will help limit treatment complications and adverse outcomes.

References


Acknowledgements

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