The Ottawa Knee Rules accurately identified fractures in children with knee injuries


In children presenting to the emergency department (ED) with a knee injury, how accurate are the Ottawa Knee Rules (OKR) in identifying knee fractures?

**METHODS**

- **Design:** blinded comparison of the OKR with knee x rays.
- **Setting:** 5 urban academic paediatric EDs in Canada.
- **Patients:** 750 children aged 2–16 years (mean age 12 y, 59% boys) who presented to the ED with an acute injury to the knee sustained in the preceding 7 days and had evidence of bony injury to the knee on physical examination. Exclusion criteria: isolated injuries to the skin, altered level of consciousness, multiple distracting injuries, metabolic bone disease, underlying disease with sensory abnormalities, referral from outside the hospital with a diagnosed fracture, or return for reassessment of the same knee injury.
- **Description of test:** trained emergency physicians assessed the following variables of the OKR: tenderness at the head of the fibula, isolated tenderness of the patella, inability to flex 90 degrees, and inability to bear weight (4 steps) immediately and in the ED.
- **Diagnostic standard:** knee x rays were ordered at the physician’s discretion (n = 670 children). A negative outcome was defined as no fracture on x ray (interpreted by a radiologist who was blinded to the OKR results). Children who did not receive x rays (n = 80) had telephone follow up by nurse research assistants (who were blinded to the OKR results) using structured interview questions (proxy outcome). Children without an x ray who were asymptomatic after 14 days were considered to have a negative outcome (no fracture).
- **Outcomes:** sensitivity, specificity, and positive and negative likelihood ratios of the OKR for identifying any fracture regardless of size.

**MAIN RESULTS**

70 children (9%) had fractures. Sensitivity, specificity, and positive and negative likelihood ratios of the OKR for identifying knee fractures in children are displayed in the table according to age.

**CONCLUSION**

The Ottawa Knee Rules accurately identified fractures in children presenting to the emergency department with a knee injury.

**Commentary**

Validity testing has shown that use of the OKR in adults can reduce the need for knee x rays without jeopardizing clinical outcome. The study by Bulloch et al examined the use of the OKR in assessing children’s knee injuries. Of the 670 children x rayed after OKR assessment, 70 were found to have fractures. In every case, the need for x ray was identified by the OKR.

The training of participating physicians in the use of the OKR, good interobserver reliability testing, and blinding of x ray reviewers to OKR assessments add to the study’s scientific merit. Of interest is the finding that only 209 of the 460 children would have required x rays if they had been assessed using only the OKR, a reduction of 31%.

Although these results are promising, the OKR should be used with caution when assessing children in the youngest age group studied. Some study sites were over-represented in the data, and only 45% of the 750 children were between 2–5 years of age. This, together with the fact that 34% of eligible children were not enrolled, limits the generalisability of the findings to all children.

Bulloch et al’s claim that use of the OKR can safely reduce the necessity for knee x rays in children and lead to important healthcare savings seems to be true for children over 5 years. More research is needed about its diagnostic value in younger children. However, recent research has shown differences among emergency physicians in the US, Canada, and the UK in terms of their knowledge and use of decision rules, such as the OKR. Therefore, additional work to determine factors that influence the adoption of clinical rules may be equally relevant.

Jeanette Robertson RN, MSc, FRCA
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**Operating characteristics of the Ottawa Knee Rules for identifying knee fractures in children according to age* **

<table>
<thead>
<tr>
<th>Age groups</th>
<th>Sensitivity (95% CI)</th>
<th>Specificity (CI)</th>
<th>+LR</th>
<th>–LR</th>
</tr>
</thead>
<tbody>
<tr>
<td>2–5 y (n = 45)</td>
<td>100% (48 to 100)</td>
<td>60% (43 to 75)</td>
<td>2.5</td>
<td>0</td>
</tr>
<tr>
<td>6–12 y (n = 375)</td>
<td>100% (89 to 100)</td>
<td>47% (42 to 52)</td>
<td>1.9</td>
<td>0</td>
</tr>
<tr>
<td>13–16 y (n = 530)</td>
<td>100% (90 to 100)</td>
<td>36% (30 to 41)</td>
<td>1.6</td>
<td>0</td>
</tr>
<tr>
<td>All children (n = 750)</td>
<td>100% (95 to 100)</td>
<td>43% (39 to 47)</td>
<td>1.7</td>
<td>0</td>
</tr>
</tbody>
</table>

*LR = likelihood ratio. Diagnostic terms defined in glossary. –LRs calculated from data in article.

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