The accuracy of the Ottawa knee rule to rule out knee fractures

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CRD summary
This review assessed the accuracy of the Ottawa knee rule to detect fractures in patients with acute knee injuries. It concluded that a negative result on an Ottawa knee rule test accurately excludes knee fractures after acute knee injury. The authors’ conclusions are likely to be reliable, and they recommend further large-scale research.

Authors' objectives
To assess the accuracy of the Ottawa knee rule in ruling out knee fractures.

Searching
The following sources were searched up to January 2003: MEDLINE and PREMEDLINE (from 1966), EMBASE (from 1980), CINAHL (from 1982), BIOSIS Previews (from 1990) and the Cochrane Library (Issue 3). The Science Citation Index was also searched. Details of the search strategy are available on request from the authors. The authors did not state whether any language restrictions were applied.

Study selection
Study designs of evaluations included in the review
Diagnostic accuracy studies were eligible for inclusion. All of the included studies were prospective, although further design details were not provided.

Specific interventions included in the review
Studies were eligible for inclusion if they assessed the Ottawa knee rule. This test consists of five questions, where at least one positive answer indicates the presence of a knee fracture, and a negative result is considered to be highly diagnostic of the absence of a fracture (see Other Publications of Related Interest).

Reference standard test against which the new test was compared
The presence or absence of knee fractures was confirmed radiologically or in combination with clinical follow-up.

Participants included in the review
Participant details were not specified as part of the inclusion criteria. The included studies assessed the use of the Ottawa knee rule in participants with acute knee injuries.

Outcomes assessed in the review
The inclusion criteria stated that the studies had to provide sufficient information for the construction of a 2x2 table. The outcomes used in the review were sensitivity, specificity and the negative likelihood ratio (LR).

How were decisions on the relevance of primary studies made?
Two reviewers independently assessed studies for inclusion using a checklist. Any disagreements were resolved by consensus, or with assistance from a third reviewer.

Assessment of study quality
The assessment of study quality was based on several existing recommendations for diagnostic accuracy studies. The following were assessed: consecutive patient recruitment; how the tests were performed, e.g. did all patients receive the reference standard; and whether the reference standard result was interpreted without knowledge of the index test result. Study quality was graded as high if all three criteria were met, intermediate if two were met, low if one was met, and very low if none of the criteria were met. Two reviewers independently assessed study quality.
Data extraction
Two reviewers independently extracted data on the methodological characteristics of the studies. The authors did not state how the results were extracted for the review, or how many reviewers performed the data extraction. The numbers of true- and false-positive and true- and false-negative results were extracted. Sensitivities, specificities and LRs were calculated together with their confidence intervals (CIs). If any values in the 2x2 tables were zero, 0.5 was added to each cell for the calculation of these values.

Methods of synthesis
How were the studies combined?
The pooled sensitivity and specificity were calculated using weighted averages, with the corresponding 95% CIs estimated using bootstrapping. The pooled negative LR and corresponding 95% CI were obtained using bootstrapping.

How were differences between studies investigated?
Differences between the sensitivities and specificities of the individual studies were assessed using the chi-squared test.

Results of the review
Eleven studies with a total of 5,986 patients were included in the review. Five studies were excluded from the pooled analysis because they were only available as abstracts, did not obtain complete follow-up data, or included children. Therefore, six studies, containing a total of 4,249 patients, were included in the pooled analysis.

The included studies that assessed adults were mostly of high quality: four were classed as high quality, one was intermediate quality and one was low quality. The results of the statistical tests for heterogeneity were not reported. However, the authors state that the sensitivities only varied slightly between the studies.

The pooled sensitivity was 98.5% (95% CI: 93, 100) and the pooled specificity was 49% (95% CI: 43, 51). The pooled negative LR was 0.05 (95% CI: 0.02, 0.23). The probability of a fracture after a negative test result, assuming a fracture prevalence of 7%, was 0.37% (95% CI: 0.15, 1.48).

The study that assessed children only reported a sensitivity of 92% (95% CI: 64, 100), a specificity of 50% (95% CI: 42, 56) and a probability of a fracture after a negative test result of 2% (95% CI: 0.3, 12).

Authors' conclusions
A negative result on an Ottawa knee rule test accurately excluded knee fractures after acute knee injury.

CRD commentary
This review had a clear research question. The inclusion criteria were specified in relation to the intervention, reference standard, study design and outcomes. However, the authors did not specify any inclusion criteria relating to the study settings or patient details, although given the likely use of the Ottawa knee rule in emergency departments this seems appropriate. The literature search was thorough, searching a number of databases, but it was not reported whether there were any language restrictions or attempts to locate unpublished research. Two reviewers independently assessed studies for inclusion and extracted data; this approach minimises reviewer bias. The quality assessment used criteria appropriate to diagnostic accuracy studies and was also conducted by two reviewers. Adequate details of the individual studies were available on the journal website (accessed 20/09/2005). See Web Address at end of abstract.

The authors did not report the results of the statistical tests for heterogeneity, or discuss any differences between the studies (e.g. settings, levels of experience in using the Ottawa knee rule), thus so it was not possible to assess whether pooling was appropriate. However five of the six studies included in the meta-analysis had a sensitivity of 100% for the detection of fractures, and without pooling sensitivities the overall conclusion would be similar. The authors also gave a good discussion of the limitations of the review. The authors' conclusions are likely to be reliable and contain recommendations for further research.
Implications of the review for practice and research

Practice: The authors stated that the potential use of the Ottawa knee rule in practice may be affected by patients’ preferences for examination, as some patients will expect to undergo radiography.

Research: The authors stated that validation studies of the Ottawa knee rule are needed. Further large-scale, multicentre studies are also needed to establish the cost-effectiveness of implementing the rule.

Bibliographic details


PubMedID
14734335

Original Paper URL
http://www.annals.org/cgi/content/full/140/2/121

Other publications of related interest


This additional published commentary may also be of interest. Lang ES. Review: the Ottawa knee rule accurately rules out knee fractures and can substantially reduce the need for X rays in patients with acute knee injuries. Evid Based Med 2004;9:151.

Indexing Status
Subject indexing assigned by NLM

MeSH
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Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.