



Complete Summary

GUIDELINE TITLE

Ottawa Knee Rule for knee injury radiography.

BIBLIOGRAPHIC SOURCE(S)

Ottawa knee rule for knee injury radiography. Ottawa (ON): Ottawa Health Research Institute at the Ottawa Hospital; 1999 Jan . Various p. [4 references]

COMPLETE SUMMARY CONTENT

SCOPE

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INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT

CATEGORIES

IDENTIFYING INFORMATION AND AVAILABILITY

SCOPE

DISEASE/CONDITION(S)

Knee fractures

GUIDELINE CATEGORY

Diagnosis

Evaluation

CLINICAL SPECIALTY

Emergency Medicine

INTENDED USERS

Physicians

GUIDELINE OBJECTIVE(S)

To present a clinical decision rule to aid physicians in the efficient use of radiography in the evaluation of acute knee injuries and to safely reduce the number of knee radiographs ordered in adults with knee injuries

TARGET POPULATION

Adults 18 years of age and older who have suffered an acute injury to the knee

INTERVENTIONS AND PRACTICES CONSIDERED

Use of Ottawa knee clinical decision rules to evaluate acute knee injuries and decide on use of knee radiography

MAJOR OUTCOMES CONSIDERED

Refinement and prospective validation

- Sensitivity and specificity of the decision rules for detecting clinically important knee fractures
- Accuracy and reliability of the physicians' interpretation of the rules

Source:

- Prospective validation of a decision rule for the use of radiography in acute knee injury. *JAMA* 1996 Feb 28; 275(8):611-15.

Implementation of the Ottawa Knee Rules

- Proportions of patients referred for knee radiography
- Accuracy and reliability of the rule
- Mean time in emergency department and mean charges

Source:

- Implementation of the Ottawa Knee Rule for the use of radiography in acute knee injuries. *JAMA* 1997 Dec 17; 278(23):2075-9.

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

A search of Medline was performed.

NUMBER OF SOURCE DOCUMENTS

Not stated

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Not stated

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Not applicable

METHODS USED TO ANALYZE THE EVIDENCE

Other

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

Prospective Validation

Statistical Analysis from Pilot Study

The classification performance of the decision rule for identifying patients with a clinically important fracture was assessed by calculating sensitivity and specificity with 95% confidence intervals (CIs). Because of the binary predictive nature of the decision rule, no attempt was made to construct a receiver operating characteristic curve. The physicians' accuracy interpreting the decision rule was measured by the percentage agreement with the actual rule as judged by the investigators. The reliability of the physicians' interpretation was assessed by the K coefficient of interobserver agreement. The potential relative reduction in radiography referral was estimated by comparing the theoretical referral rate in this study with the baseline referral rate documented at area hospitals. Finally, likelihood ratios and the probability of a fracture, given a "negative" decision rule, were calculated from the combined data of the derivation and validation sets.

The data collected were further analyzed to assess the potential for refining the decision rule to achieve a sensitivity of 1.0 with the highest possible specificity and with the fewest number of variables. Two combined variables were created by grouping the individual variables "patellar tenderness" and "direct blow", as well as "inability to bear weight immediately and in the emergency department". The 16 individual and combined variables were assessed for interobserver agreement by calculating the K coefficient with 95% confidence intervals. Furthermore, the association of the variables with clinically important fracture was assessed by the χ^2 test with 1 df. Those variables found to be both reliable (highest k values) and strongly associated with a fracture (highest χ^2 values) were analyzed by a χ^2 recursive partitioning technique to confirm the best combination of predictor variables.

Source:

- Prospective validation of a decision rule for the use of radiography in acute knee injury. JAMA 1996 Feb 28; 275(8): 611-15.

Clinical Validation – Trial Implementation

Statistical Analysis from Trial Implementation Study

Every eligible knee injury patient seen during the 4 study periods was included in the primary analysis. No patient was excluded during the after-intervention period because a data collection form was not completed or because of physician noncompliance with the decision rule. Any patient losses to follow-up did not affect the primary outcome, the proportion offered for knee radiography. A χ^2 analysis was used to test the null hypothesis – that there was no difference in the proportion of patients undergoing knee radiography during the before and after periods – for each hospital separately, as well as for the intervention and control groups. Ninety-five percent confidence intervals were calculated for the relative reductions in radiography referral. The absolute difference in proportions, from the before period to the after period, of patients referred for knee radiography were compared between the intervention and control groups using the χ^2 test for homogeneity. All P values were 2-tailed. Comparison of patient characteristics were tested with χ^2 or the Student t test analyses, as appropriate.

For patients seen during the after-intervention period, the physicians' accuracy in interpreting the decision rule was measured by the percentage agreement with the actual rule as judged by the investigators. The reliability of the interpretation of pairs of physicians was assessed by the kappa coefficient of interobserver agreement. The classification performance of the decision rule for identifying clinically important fractures was assessed by calculating sensitivity and specificity with 95% confidence intervals.

Additional comparisons apply only to those patients followed up by telephone, i.e., nonfracture cases in the after-intervention group. The mean time spent in the emergency department from registration to discharge was compared with the Student t test for patients receiving radiography versus those not receiving radiography. Mean charges were also compared by the Student t test and were calculated in United States dollars from the following estimated medical charges: emergency department physician fee (\$50), emergency department knee radiographic series technical and professional fees (\$100), follow-up office physician visit fee (\$60), and follow-up radiographic series fee (\$100). These medical charges were representative of figures provided to us by several United States hospitals. No attempt was made to estimate other direct or indirect medical costs.

Source:

- Implementation of the Ottawa knee rule for the use of radiography in acute knee injuries. JAMA 1997 Dec 17;278(23):2075-9.

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Not stated

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Not stated

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

Clinical Validation-Pilot Testing
Clinical Validation-Trial Implementation Period

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

Clinical Validation – Pilot Testing

To validate a previously derived decision rule for the use for the use of radiography in patients with acute knee injury, a survey was prospectively administered in emergency departments of two university hospitals serving adults. Patients consisted of a convenience sample of 1,096 of 1,251 eligible adults with acute knee injuries; 124 patients were examined by two physicians. Attending emergency physicians assessed each patient for standardized clinical variables and determined the need for radiography according to the decision rule. Patients who did not have radiography underwent a structured telephone interview at day 14 to determine the possibility of a fracture. The rule was assessed for ability to correctly identify the criterion standard, fracture of the knee. An attempt was made to refine the rule by means of univariate and recursive partitioning analyses.

Source:

- Prospective validation of a decision rule for the use of radiography in acute knee injury. *JAMA* 1996 Feb 28;275(8):611-15.

Clinical Validation – Trial Implementation Period

To assess the impact on clinical practice of implementing the Ottawa Knee Rule, a controlled clinical trial with before-after and concurrent controls was conducted in emergency departments of 2 teaching and 2 community hospitals. Patients consisted of all 3,907 consecutive eligible adults seen with acute knee injuries during two 12-month periods before and after the intervention. During the after period in the 2 intervention hospitals, the Ottawa Knee Rule was taught to all house staff and attending physicians who were encouraged to order knee radiography according to the rule. The main outcome measures included referral for knee radiography, accuracy and reliability of the rule, mean time in emergency department and mean charges.

Source:

- Implementation of the Ottawa knee rule for the use of radiography in acute knee injuries. *JAMA* 1997 Dec 17;278(23):2075-9.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

A knee x-ray series is only required for knee injury patients with any one of these findings:

1. Age 55 or older
2. Isolated tenderness of patella (no bone tenderness of knee other than patella)
3. Tenderness of head of fibula
4. Inability to flex to 90 degrees
5. Inability to bear weight both immediately and in the emergency department for 4 steps

Tips for Accurate Usage:

1. Tenderness of patella only counts if it is the only area of the bone tenderness in the knee
2. Inability to bear weight means patient is unable to transfer weight twice onto each leg regardless of limping

CLINICAL ALGORITHM(S)

None provided

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The type of supporting evidence is not specifically stated for each recommendation. These recommendations are based on research with rigorous methods and a multiphase methodological approach to derive, validate, and implement the Ottawa Knee Rule. Studies involved data prospectively collected on large patient numbers, unique efforts to determine the interobserver agreement for clinical findings, prospective validation in new patient populations, and finally the clear demonstration of impact on clinical practice through multicenter clinical trials.

Source:

- Implementation of the Ottawa knee rule for the use of radiography in acute knee injuries. JAMA 1997 Dec 17;278(23):2075-9.

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

Reduction in the proportion of patients referred for knee radiography. In a trial implementation study, there was a relative reduction of 26.4% in the

proportion of patients referred for knee radiography in the intervention group (77.6% versus 57.1%; $P < .001$), but a relative reduction of only 1.3% in the control group (76.9% versus 75.9%; $P = .60$). These changes over time were significant when the intervention and control groups were compared ($P < .001$).

Sensitivity and reliability of the rule for detecting knee fractures. In a prospective validation study, the rule was found to have a sensitivity of 1.0 (95% confidence interval for identifying 63 clinically important fractures). The same sensitivity results were found in a trial implementation study detecting 58 knee fractures. The k coefficient for interpretation of the rule in the prospective validation study was 0.77 (95% confidence interval, 0.65 to 0.89) and in the trial implementation study was 0.91 (95% confidence interval, -.82-1.0).

Reduction in waiting time for patients and health-care costs. In a trial implementation study, those discharged without radiography spent less time in the emergency department compared with nonfracture patients who underwent radiography during the after-intervention period, (85.7 minutes versus 118.8 minutes) and incurred lower estimated total medical charges for physician visits and radiography (US \$80 versus US \$183).

Sources:

- Implementation of the Ottawa knee rule for the use of radiography in acute knee injuries. *JAMA* 1997 Dec 17;278(23):2075-9.
- Prospective validation of a decision rule for the use of radiography in acute knee injury. *JAMA* 1996 Feb 28;275(8):611-15.

POTENTIAL HARMS

Not stated

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

Physicians must keep in mind that the Ottawa Knee Rule has not been tested on, and should not be used for, patients younger than 18 years. Furthermore, clinical judgment should always take precedence over the rule, particularly in situations where examination may be unreliable, e.g., intoxication, multiple trauma with distracting injuries, language barrier, or diminished sensation in the legs.

The guideline developers acknowledge that during the trial implementation of the Ottawa Knee Rule, several maneuvers used in the trial may have boosted compliance by physicians beyond what might be expected in normal practice. In particular, the data collection forms served as reminders to apply the rule and the knowledge that patients were being followed up by telephone may have led physicians to feel more secure in withholding radiography.

Source:

- Implementation of the Ottawa knee rule for the use of radiography in acute knee injuries. JAMA 1997 Dec 17;278(23):2075-9.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

The Ottawa Knee Rules are simple guidelines summarized on a poster or handy laminated pocket card that have been developed to aid emergency physicians in deciding when to use radiography for patients with injuries to the knee. Each kit includes a 12" x 18" poster for placement in an emergency room for quick reference plus 10 laminated pocket cards.

The Ottawa Knee Rules are available in hard copy, on-line (Shockwave Flash version) and off-line (.ZIP version) from the Ottawa Health Research Institute. Refer to the [Ottawa Health Research Institute Web site](#) for more information.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Getting Better

IOM DOMAIN

Effectiveness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

Ottawa knee rule for knee injury radiography. Ottawa (ON): Ottawa Health Research Institute at the Ottawa Hospital; 1999 Jan . Various p. [4 references]

ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

1999

GUIDELINE DEVELOPER(S)

Ottawa Health Research Institute - Hospital/Medical Center

SOURCE(S) OF FUNDING

Ontario Ministry of Health

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

Stiell IG, Wells GA, Hoag RH, Sivilotti ML, Cacciotti TF, Verbeek PR, Greenway KT, McDowell I, Cwinn AA, Greenberg GH, Nichol G, Michael JA, Smith NA, McKnight RD

FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

GUIDELINE STATUS

This is the current release of the guideline.

An update is not in progress at this time.

GUIDELINE AVAILABILITY

Electronic copies: Available from the [Ottawa Health Research Institute Web site](#).

Print copies: Available from the Ottawa Health Research Institute by writing to the Clinical Epidemiology Unit C4, Loeb Health Research Institute, 1053 Carling Ave., Ottawa, ON, K1Y 4E9, Canada; or by calling 1-888-240-7002 (toll-free) or (613) 761-5499. Order forms are also available for download from the [Ottawa Health Research Institute Web site](#).

AVAILABILITY OF COMPANION DOCUMENTS

The following are available:

- Stiell IG, Wells GA. Methodologic standards for the development of clinical decision rules in emergency medicine. *Ann Emerg Med* 1999 Apr; 33(4):437-47.
- Stiell IG, Wells GA, Hoag RH, Sivilotti ML, Cacciotti TF, Verbeek PR, Greenway KT, McDowell I, Cwinn AA, Greenberg GH, Nichol G, Michael JA. Implementation of the Ottawa knee rule for the use of radiography in acute knee injuries. *JAMA* 1997 Dec 17; 278(23):2075-9.
- Stiell IG, Greenberg GH, Wells GA, McDowell I, Cwinn AA, Smith NA, Cacciotti TF, Sivilotti ML. Prospective validation of a decision rule for the use of radiography in acute knee injuries. *JAMA* 1996 Feb 28; 275(8):611-15.
- Stiell IG, Wells GA, McDowell I, Greenberg GH, McKnight RD, Cwinn AA, Quinn JV, Yeats A. Use of radiography in acute knee injuries: need for clinical decision rules. *Acad Emerg Med* 1995 Nov; 2(11):966-73.
- Stiell IG, Greenberg GH, Wells GA, McKnight RD, Cwinn AA, Cacciotti TF, McDowell I, Smith NA. Derivation of a decision rule for the use of radiography in acute knee injuries. *Ann Emerg Med* 1995 Oct; 25(4):405-13.

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Ottawa, ON, K1Y 4E9, Canada; or by calling 1-888-240-7002 (toll-free) or (613) 761-5499.

PATIENT RESOURCES

None available

NGC STATUS

This summary was completed by ECRI on October 24, 2002. The information was verified by the guideline developer on March 14, 2002.

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