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Ottawa Ankle Rule

Introduction: The Ottawa Ankle Rule shows the areas of tenderness to be evaluated in ankle trauma patients to determine the need for imaging.

Points & Pearls

- The Ottawa Ankle Rule was derived to aid in the efficient use of radiography in acute ankle and midfoot injuries.
- It has been prospectively validated on multiple occasions in different populations and in both children and adults.
- Sensitivities for the Ottawa Ankle Rule range from the high 90% to 100% range for “clinically significant” ankle and midfoot fractures. This is defined as a fracture or an avulsion > 3 mm.
- Specificities for the Ottawa Ankle Rule are approximately 41% for the ankle and 79% for the foot, although the rule is not designed or intended to make a specific diagnosis.
- The Ottawa Ankle Rule is useful in ruling out fracture (high sensitivity), but does poorly at ruling in fractures (many false positives).

Advice

Tips from the creators at the University of Ottawa:

- Palpate the entire distal 6 cm of the fibula and tibia.
- Do not overlook the importance of medial malleolar tenderness.
- “Bearing weight” counts even if the patient limps.
- Use with caution in patients aged < 18 years.

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Precautions from the creators at the University of Ottawa:

- Clinical judgment should prevail if the examination is unreliable due to:
 - » Intoxication
 - » Uncooperative patient
 - » Distracting painful injuries
 - » Diminished sensation in legs
 - » Gross swelling that prevents palpation of malleolar tenderness
- Always provide written instructions.
- Encourage followup in 5 to 7 days if pain and ability to walk do not improve.

Critical Actions

Patients who fulfill none of the Ottawa Ankle Rule criteria do not need an ankle or foot x-ray. Patients who fulfill either the foot or ankle criteria need an x-ray of the respective body part. Many experts would consider this score “one directional.” Because the rule is sensitive and not specific, it provides a clear guide of which patients do not need x-ray if all criteria are met; however, if a patient fails the criteria, the need for x-ray can be left to clinical judgment.

Evidence Appraisal

The original derivation study in 1992 included non-pregnant patients aged > 18 years who presented to Ottawa civic and general hospitals with a new injury < 10 days old. The initial pilot study included 155 patients, while the full-scale study included 750 patients. Any fracture that was not an avulsion of ≤ 3 mm was considered a clinically significant fracture. This resulted in the initial criteria: aged ≥ 55 years, inability to bear weight immediately after the

Why to Use

Patients who do not have criteria for imaging according to the Ottawa Ankle Rule are highly unlikely to have a clinically significant fracture and do not need plain radiographs. As a result, application of the Ottawa Ankle Rule can reduce the number of unnecessary radiographs by as much as 25% to 30%, improving patient flow in the emergency department (ED).

When to Use

- The Ottawa Ankle Rule should be applied to all patients aged ≥ 2 years who have ankle or midfoot pain and/or tenderness in the setting of trauma.
- An ankle x-ray series is only required if the patient has pain in the malleolar zone AND any of these findings:
 - » Bone tenderness at the posterior edge or tip of the lateral malleolus, OR
 - » Bone tenderness at the posterior edge or top of the medial malleolus, OR
 - » Inability to bear weight both immediately after injury and in the ED.
- A foot x-ray series is only required if the patient has pain in the midfoot zone AND any of these findings:
 - » Bone tenderness at the base of the fifth metatarsal, OR
 - » Bone tenderness at the navicular, OR
 - » Inability to bear weight both immediately after injury and in the ED.

Next Steps

- If ankle pain is present and there is tenderness over the posterior 6 cm of the tibia or fibula or the tip of the posterior or lateral malleolus, then an ankle-ray is indicated.
- If midfoot pain is present and there is tenderness over the navicular or the base of the fifth metatarsal, then a foot x-ray is indicated.
- If there is ankle or midfoot pain and the patient is unable to take 4 steps both immediately after the injury and in the ED, then x-ray of the painful area is indicated.

Management

- X-ray
- RICE plan (Rest, Ice, Compression, Elevation)
- Splinting/crutches and pain medication, pending outcome

injury and for 4 steps in the emergency department, or bone tenderness at the posterior edge or tip of either malleolus for the ankle. For the foot, criteria included pain in the midfoot and bone tenderness at the navicular bone, cuboid, or the base of the fifth metatarsal.

Further validation and refinement was completed in 1993, through a prospective study of 1032 patients in the validation and refinement phase of the study with 121 clinically significant fractures. The rules were further refined by removing the age cutoff from the ankle rule and cuboid tenderness from the foot rule, but the weight-bearing criterion was added to the foot rule. Sensitivity of the refined rule for both foot and ankle fractures was 100%, and ankle specificity increased to 41% and foot specificity to 79%.

An additional 453 patients were then prospectively enrolled in the second phase of the study, where the refined rules were validated, yielding a sensitivity of 100% for both ankle and midfoot fractures.

A study of 670 children aged 2 to 16 years at 2 separate sites found that the Ottawa Ankle Rule

again had a sensitivity of 100% for both clinically significant ankle and midfoot fractures. This study also found that ankle x-rays could be reduced by 16% and foot x-rays by 29% if the rules were in use at the time of the study. Subsequent meta-analysis of the Ottawa Ankle Rule in children found 12 studies with 3130 patients and 671 fractures, with a pooled sensitivity of 98.5% and an overall reduction in x-ray utilization by 24.8%.

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Ottawa Ankle Rule Illustration

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Ottawa Knee Rule

Introduction: The Ottawa Knee Rule describes criteria for knee trauma patients who are at low risk for clinically significant fracture and do not warrant knee imaging.

Points & Pearls

- The Ottawa Knee Rule was derived to aid in the efficient use of radiography in acute knee injuries.
- It has been prospectively validated on multiple occasions in different populations and in both children and adults.
- Numerous studies found sensitivities for the Ottawa Knee Rule of 98% to 100% for clinically significant knee fractures. One study did find a sensitivity of just 86%.
- Specificities for the Ottawa Knee Rule typically range from 19% to 50%, although the rule is not designed or intended for specific diagnosis.
- When the Ottawa Knee Rule is used appropriately, the number of knee x-rays obtained can be reduced by 20% to 30%.
- The Ottawa Knee Rule is useful in ruling out fracture when negative (high sensitivity), but does poorly at ruling in fractures (many false positives).

Advice

Tips from the creators at the University of Ottawa:

- Tenderness of the patella is significant only if it is an isolated finding.

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- Use only for injuries with a duration of < 7 days.
- “Bearing weight” counts even if the patient limps.

Precautions from the creators at the University of Ottawa:

- Clinical judgment should prevail if the examination is unreliable due to:
 - » Intoxication
 - » Uncooperative patient
 - » Distracting painful injuries
 - » Diminished sensation in legs
- Always provide written instructions.
- Encourage followup in 5 to 7 days if pain and ability to walk do not improve.

Critical Actions

Patients who do not have any of the Ottawa Knee Rule criteria present do not need an x-ray. If 1 or more of the conditions are met, then an x-ray is recommended.

Many experts would consider this score “one directional.” Because the rule is sensitive and not specific, it provides a clear guide of which patients do not need x-ray if all criteria are met; however, if a patient fails the criteria, the need for x-ray can be left to clinical judgment.

Evidence Appraisal

The original derivation study by Stiell et al was done in 1995 and included non-pregnant patients aged > 18 years who presented to Ottawa civic and general hospitals with a new injury < 7 days old as a result of acute blunt trauma to the knee. The study

Why to Use

Knee trauma patients who do not have criteria for imaging according to the Ottawa Knee Rule are highly unlikely to have a clinically significant fracture and do not need plain radiographs. As a result, application of the Ottawa Knee Rule can cut down on the number of unnecessary radiographs by 20% to 30%. This has proven to be cost-effective for patients without reducing quality of care (Nichol 1999).

When to Use

- The Ottawa Knee Rule should be applied to all patients aged > 2 years who have knee pain and/or tenderness in the setting of trauma.
- A knee x-ray series is only required for knee injury patients with any of these findings:
 - » Age ≥ 55 years, OR
 - » Isolated tenderness of the patella (with no bone tenderness of the knee other than the patella), OR
 - » Tenderness of the head of the fibula, OR
 - » Inability to flex to 90°, OR
 - » Inability to bear weight both immediately after the injury and in the emergency department for 4 steps (unable to transfer weight twice onto each lower limb), regardless of limping.

Next Steps

- Patients who do not have any of the Ottawa Knee Rule criteria present do not need an x-ray.
- If 1 or more of the conditions are met, then an x-ray is recommended.
- For significant nonbony injuries, often crutches and a knee immobilizer can be helpful to assist with ambulation.

enrolled 1054 subjects, of whom 68 had fractures, with 66 of them deemed to be clinically significant (not a simple avulsion fragment of < 5 mm in breadth without associated complete tendon or ligament disruption). Using recursive-partitioning techniques, the authors derived the 5 variables of their decision rule. If applied to the study population, their decision rule had sensitivity of 100% and specificity of 54% for identifying fractures and would lead to a 28% relative reduction in x-ray utilization.

Stiell et al then prospectively validated their decision rule in the same patient population. They performed telephone followup 14 days after the emergency department visit to determine the possibility of a missed fracture. Sensitivity of the decision rule was again 100%, identifying 63 clinically important fractures out of 1096 patients. Specificity was similar to the derivation study at 49%, and there was a 28% relative reduction in x-ray utilization.

Stiell et al prospectively implemented the decision rule in different teaching and community emergency departments. They found a relative reduction in x-ray usage of 26.4%, while maintaining a sensitivity of 100% for detecting 58 knee fractures out of 3907 patients, and a specificity of 48%. Moreover, there was a significant reduction in time to discharge and total medical charges in patients who did not get an x-ray.

The Ottawa Knee Rule has also been prospectively validated in populations outside of Canada. Two studies, 1 done in Spain and another in the United States, found that the Ottawa Knee Rule had a sensitivity of 100% and 98%, specificity of 52% and

19%, and a reduction in x-ray usage by 49% and 17%.

The rule was applied to children aged 2 to 16 years in a prospective, multicenter validation study in 2003. That study found the decision rule to be 100% sensitive in finding 70 fractures out of 750 children, with a specificity of 42.8% and a potential reduction in x-ray usage by 31.2%.

The Ottawa Knee Rule has also been compared to the Pittsburgh Decision Rule, another well-validated clinical decision rule. A cross-sectional comparison of the 2 rules showed that both had sensitivities of 86%, although the Pittsburgh Decision Rule was significantly more specific. However, this study only included patients aged 18 to 79 years and excluded pediatric patients.

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