# The Ottawa rules for ankle sprains

Patients presenting with acute ankle sprain are common in general practice and emergency departments. Many patients undergo radiography but only about 10–15% are diagnosed with a fracture of the ankle or mid-foot. The Ottawa ankle rules (*Table 1*) was developed to reduce the number of unnecessary radiographs (Stiell et al, 1992). The ankle assessment covers the ability to walk four steps (immediately after the injury or at the emergency department) and localized tenderness of the posterior edge or tip of either malleolus (four points). The midfoot assessment covers the ability to walk and the localized tenderness of the navicular or the base of the fifth metatarsal. The test is designed to rule out fractures of the malleolus and the mid-foot.

The authors performed a systematic review of studies of the accuracy of the Ottawa ankle rules (Bachmann et al, 2003). They identified 32 studies that met their inclusion criteria and critically assessed their methodological quality. The results demonstrate that the instrument appears to be highly sensitive, irrespective of patient population, risk category (prevalence of fractures) and time to referral. Based on these results the post-test probability of an ankle fracture if the rule is negative can be estimated using Bayes' theorem. Assuming a prevalence of fractures of 15% in patients with acute ankle injuries, the fracture probability would generally drop to less than 1.5% if the rule is negative (see footnote to *Table 1*). In other words, the presence of a fracture can be excluded with confidence.

In the review the authors were surprised to find specificity – an indicator of the number of unnecessary radiographs that may be avoided – ranging from 20% to 79%. They hypothesized that differences in experience of medical staff performing the Ottawa ankle rules may influence its accuracy.

In addition, the expression of pain, which is crucial for the interpretation of the Ottawa ankle rules, may have a cultural dimension. This could result in a higher false positive rate (among those with a relatively vivid expression of pain) or higher false negative rate (among stoic individuals) unless attending clinicians share their patients' cultural background. The (lack of) subtlety of palpation technique might explain some of the large variation in false positive rates, i.e. the percentages of patients who apparently indicated pain (or were unable to walk four steps) but had no fracture.

## ECONOMIC ASPECTS

Application of the Ottawa ankle rules would save approximately 40% of unnecessary radiographs. In a formal economic analysis, based on data from Canada and the USA, application of this instrument was shown to be associated with savings between US$ 614 000 and US$ 3 150 000 per 100 000 patients, including litigation costs, in 1995 (Anis et al, 1995).

Despite the potential of this prediction rule, it is not widely used in clinical practice in many countries. In a postal survey in five countries in Europe, the USA and Canada, more than 70% of all responding Canadian and British physicians reported frequent use of the rules compared with fewer than one third of American, French, and Spanish physicians (Graham et al, 2001). Fear of litigation and the expectation of patients to be investigated thoroughly, which in the latter's view should include radiography, were important reasons for non-use. The survey relied on physicians' self-reported behaviour, which may have led to overestimation of the actual use of these guidelines.

## BARRIERS TO THE OPTIMAL USE OF DIAGNOSTIC INFORMATION

### Decision-making theory

The barriers to the optimal use and appropriate interpretation of test evaluation data in clinical practice remain poorly understood. From the point of view of decision-making theory, decision rules such as the Ottawa ankle rules that allow the calculation of post-test probabilities should overcome many of the cognitive biases that are known to affect diagnostic problem solving.

Examples of such cognitive problems include the confusion of positive predictive value with sensitivity, conservatism (the hesitation to revise probabilities as new information becomes available), compression error (common conditions are underweighted, rare conditions are overweighted), and the conjunction fallacy (the erroneous assumption that a joint event is more probable than the probability of the component events

**TABLE 1.**
**The Ottawa ankle rules**

| | |
|---|---|
| An ankle X-ray series is required only if there is a pain in malleolar zone and any of these findings: | Bone tenderness at the posterior edge or tip of the medial or lateral malleolus (distal 6 cm) |
| | Inability to bear weight both immediately and in emergency department |
| A foot X-ray series is required only if there is a pain in midfoot zone and any of these findings: | Bone tenderness at the base of the fifth metatarsal or at the navicular |
| | Inability to bear weight both immediately and in emergency department |

Assuming a fracture probability in patients with acute ankle sprains of 15% and a negative likelihood ratio of 0.08 from the systematic review (Bachmann et al, 2003), the post-test probability can be calculated using Bayes' theorem: post-test probability= likelihood ratio x pretest probability/ [1-pretest probability x (1-likelihood ratio)] = 0.015= 1.5%. From Steill et al (1993)

alone) (Elstein, 1999). Informal methods of opinion revision, however, still dominate in practice (Elstein and Schwarz, 2002).

**Handling probabilistic information**

Finally, many ways to convey probabilistic information exist (e.g. natural frequencies; Hoffrage and Gigerenzer, 1998) but it is unclear which ways are being used and would be most useful in practice, and how they are best synthesized and presented to GPs, emergency department physicians and patients.

## FUTURE USE

Use of the Ottawa ankle rules virtually rules out clinically important fractures of the ankle and mid-foot. Dozens of studies evaluating its performance and two systematic reviews have been published. However, the Ottawa ankle rules comes up short in clinical decision making. It is not followed, even when actively promoted.

**Can use of the Ottawa rules be increased?**

The authors believe that it is worthwhile learning more about the true reasons for under-use of diagnostic tools such as the Ottawa ankle rules. This requires a strong research agenda that explores the mechanisms, implicit and explicit reasoning processes surrounding decision making in medicine.

Ultimately, however, it seems rational that society at large, and not the medical profession or patients themselves, decides what part of the full – theoretically possible – diagnostic armamentarium is offered at which stage in the diagnostic work-up. The Ottawa ankle rules probably deserves to be a first-line tool obviating the need for many radiographs. In such a system, there seems to be little place for litigation since medical professionals' use of the rules would be based on a broader societal consensus. HM

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### KEY POINTS

- The Ottawa ankle rules is a good triage instrument to exclude fractures of the ankle and midfoot and appears to be cost effective.
- Dozens of studies evaluating its performance and two systematic reviews have been published.
- In many countries, it is not widely used in clinical practice, despite the potential benefits of its use.
- There is a lack of understanding why diagnostic tools such as the Ottawa ankle rules are under used in practice.
- Research is required to recognize barriers of implementation into practice, in the diagnostic domain in particular.
- Beyond publication, effective dissemination of such decision rules into practice is important.

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