Prospective survey to verify the Ottawa ankle rules

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Abstract

Objective—To determine if the Ottawa ankle rules are valid in the setting of an urban teaching hospital in the UK.

Design—A prospective survey.

Setting—Accident and emergency department, Western Infirmary, Glasgow from 1 April 1995 to 31 August 1995.

Subjects—800 patients with an acute ankle injury.

Results—800 patients were used for analysis of which 584 (73%) were radiographed; 70 (12%) had fractures, 63 (10.8%) of which were significant. Four of these patients with fractures fulfilled none of the Ottawa ankle rules criteria for plain radiography.

Conclusion—Application of the Ottawa ankle rules to this group of patients would have produced a sensitivity of 93.6%. Although useful, decision rules should be used with care and not replace clinical judgment and experience.

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Keywords: Ottawa ankle rules; ankle fractures

Ankle injuries are one of the most common problems presenting to an accident and emergency (A&E) department. Most patients are referred for radiography but it is estimated that only 15% will have a fracture.¹ Several authors have reviewed the use of radiography in patients with ankle injuries and have come to differing conclusions. Some have suggested that it is not possible to safely reduce the number of radiographs,² while others have attempted to develop clinical guidelines that could identify those patients requiring radiography³; however, none of these has been widely accepted into clinical practice. More recently, Stiell and colleagues derived a set of guidelines, which have gained some acceptance and are commonly referred to as the Ottawa ankle rules.⁴ Their initial study involved 750 patients in which 32 clinical variables were analysed for their reliability to predict the presence of a fracture. The Ottawa ankle rules state that radiography is only necessary if, after trauma, there is pain near the malleoli and one or more of the following findings are present: (A) the patient is >55 years or, (B) the patient is unable to weight bear immediately after the injury and unable to take four steps in the A&E department or, (C) there is evidence of bony tenderness at the posterior edge or tip of either malleolus.⁴

The original authors in two subsequent studies validated these rules.^{5,6} If the rules are correctly applied it is claimed that ankle radiography could be reduced by a third and the rate

of significant missed fractures not increased.⁵ The aim of this study was to determine if such rules were valid in the setting of an urban teaching hospital in the UK.

Method

Data were collected from patients presenting to our A&E department with ankle injuries over a period of five months from 1 April 1995 until 31 August 1995. The department has a catchment area of 250 000 of mixed socioeconomic groups. In 1995, 59 608 new patients were seen. Staffing comprised two consultants, one senior registrar, one specialist registrar, two senior house officers, six senior house officers, and a number of clinical assistants of varied backgrounds. Patients who were under the age of 18, intoxicated with alcohol or drugs, had sustained multiple injuries, or transferred from other hospitals were excluded.

The patients were thus seen by a variety of doctors, none of whom had received any formal teaching within the department with respect to the Ottawa ankle rules. However, it was accepted that some of the doctors may have had knowledge of the rules from their own reading.

After clinical assessment, data were recorded in a standard format by way of a stamper in the A&E record card (table 1). Apart from the authors, all the doctors working in the A&E department were blinded to the study. They were simply asked to use the stamper for every patient whom they managed with an ankle injury and not to change their usual clinical practice. Twelve parameters were recorded only four of which—age, posterior malleolar tenderness, inability to weight bear immediately, and weight bear in the A&E department—were required for the study. None of the doctors was informed of the study or which specific parameters were being analysed.

Patients were identified from a coded computer register of all A&E attendances. Any patient thought to require radiographic examination at the discretion of the examining

Table 1 Ankle injury stamper data: answer "yes" or "no"

Fall from a height
Inversion injury
Bruising
Swelling
Inability to weight bear (immediately)
Inability to weight bear (in department)
Age >55
Bony tenderness anterior edge of malleolus
Bony tenderness posterior edge of malleolus
Pain
Limitation of dorsiflexion
General practitioner request
Patient request
Other (please specify)

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Figure 1 Summary of all patients; *ability to weight bear immediately and take four steps in the A&E department.

doctor received standard anterior/posterior and lateral ankle views.

The radiographs were subsequently reported by one consultant radiologist who was blind to the clinical data. The radiographs were reported in a standard fashion, with all fractures being considered significant except avulsions of 3 mm or less in diameter.⁴

Results

Over the five month period (April to August 1995) a total of 25 764 new patients attended the A&E department, 1175 (4.6%) of whom presented with an "ankle injury" (see fig 1). One hundred and eighty one were children, 13 had foot injuries, 29 had other conditions, two had old injuries, and 23 transferred from other hospitals; all of these patients were excluded from further analysis. An additional 127 patients had to be excluded because of missing data, radiographs, or both. A total of 800 patients was thus available for analysis. Of these 584 (73%) were radiographed. Seventy fractures (12%) were identified of which 63 (10.8%) were significant (table 2).

Of these 63 patients, four fulfilled none of the Ottawa ankle rules for plain radiography,

Table 3 Details of patients not fulfilling Ottawa ankle rules for plain radiography

Patient	Age (years)	Site of ankle fracture
1	20	Posterior malleolar fracture
2	33	Lateral malleolar fracture
3	50	Bimalleolar fracture
4	54	Lateral malleolar fracture

giving a sensitivity of 93.6%, and specificity of 46% (table 3). The positive predictive value was 17.98% and negative predictive value 98.39%. Of the 514 patients whose radiographs were negative, 269 (52%) had one or more indications for radiography. Analysis of the 215 patients who were not radiographed revealed that 41 (19%) had one or more indication for radiography. None of these patients were known to have returned to this A&E department during the study period.

The case records of those patients with significant fractures but who would not have had radiography had the rules been applied were reviewed retrospectively. Appropriate documentation had been completed and there were no apparent reasons to explain why the rules did not identify the four patients in this category.

Discussion

The Ottawa ankle rules have previously been verified by the original authors in a multicentre trial involving eight Canadian hospitals.⁶ The rules were introduced by means of a one hour lecture, a hand out, pocket cards, and posters. During a six month period, Stiell and colleagues collected data on 6489 patients. Compared with the previous 12 months, before the introduction of the rules, there was an approximate 20% reduction in the use of ankle radiography. Of their 1082 significant fractures, five (0.46%) patients had ankle fractures diagnosed in which the rules were interpreted as negative. Review of these cases indicated that either there was gross swelling preventing adequate examination for bony tenderness or the rules had been misinterpreted. Nine of their patients had a fracture diagnosed subsequently after discharge, because either the radiograph had been misread or the rules were retrospectively found to have been misinterpreted.

Our study has shown that if the Ottawa ankle rules had been applied in our department there may have been a 30% reduction in radiography rate during that time period with associated cost benefit. However, four out of 63 (6.3%) significant ankle fractures would have been missed, a much higher percentage than that found in the study of Stiell *et al.*^{4,5}

The impact of such missed fractures is difficult to quantify but is likely to result in increased morbidity for the patient and may have medicolegal consequences. Review of the case notes of these patients did not provide any explanation as to why the rules were interpreted as negative. It is possible that the examining doctor may have incorrectly recorded his/her findings. Data about malleolar tip tenderness were not recorded on our stamper, which could have underestimated the number

Table 2 Patients with significant fractures

No of patients	Description of fracture
40	Lateral malleolar
2	Medial malleolar
5	Posterior malleolar
6	Bimalleolar
5	Trimalleolar
1	Calcaneal
4	Others

of patients who were "Ottawa positive" and, therefore, may have picked up a "potentially missed fracture" had the rules been applied. Of those patients discharged without receiving radiography, it is not known how many, if any, presented to another department in the city, or elsewhere, and were subsequently found to have a fracture.

Our study had other limitations. From a scientific point of view it could be argued that the most appropriate course of action would have been to take radiographs of the whole study group leaving no unanswered questions about the 41 patients who were "Ottawa positive" but not radiographed. Similarly it is entirely possible that some patients who were Ottawa negative and did not have radiographs taken could have undiagnosed fractures. This issue was considered when devising the study but we felt that it was unethical to expose a significant number of patients to unnecessary radiation. We, therefore, simply advised doctors to continue with their usual practice. Published evidence on this topic is conflicting. A number of researchers have highlighted the usefulness of the Ottawa ankle rules^{7,8} and, indeed, one recent study from the UK stated that they could be safely applied by appropriately trained nursing staff; however their radiography rate was 73% (as in our study) perhaps suggesting a more liberal interpretation of the rules.⁹ By contrast, other studies have been unable to validate the rules in a local setting.^{10,11}

Although our study involved a smaller number of patients to that of Stiell, it does draw attention to the potential dangers of rigidly adhering to decision rules. It is interesting to note the much higher fracture rate in Stiell's study in comparison to our own (1082/6489, 16.7% *v* 63/800, 7.9%). This suggests that the two patient groups may be different, perhaps with a larger number of our patients attending with more "trivial" injuries, than in

Canada, questioning, therefore, the direct application of decision rules that have been developed in a different population base.

Our study provides additional supporting evidence that clinical decision rules are not infallible. It is our contention that while such rules may be useful, they must always be tempered by clinical judgment and experience. A&E departments should be cautious about the rigid application of the Ottawa ankle rules and junior doctors should be encouraged to exercise careful clinical judgment and seek more senior advice where necessary.

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