



The Ottawa ankle rules for the use of diagnostic X-ray in after hours medical centres in New Zealand

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Abstract

Aims The aims of this study were to measure baseline use of Ottawa ankle rules (OAR), validate the OAR and, if appropriate, explore the impact of implementing the Rules on X-ray rates in a primary care, after hours medical centre setting.

Methods General practitioners (GPs) were surveyed to find their awareness of ankle injury guidelines. Data concerning diagnosis and X-ray utilisation were collected prospectively for patients presenting with ankle injuries to two after hours medical centres. The OAR were applied retrospectively, and the sensitivity and specificity of the OAR were compared with GPs' clinical judgement in ordering X-rays. The outcome measures were X-ray utilisation and diagnosis of fracture.

Results Awareness of the OAR was low. The sensitivity of the OAR for diagnosis of fractures was 100% (95% CI: 75.3 – 100) and the specificity was 47% (95% CI: 40.5 – 54.5). The sensitivity of GPs' clinical judgement was 100% (95% CI: 75.3 – 100) and the specificity was 37% (95% CI: 30.2 – 44.2). Implementing the OAR would reduce X-ray utilisation by 16% (95% CI: approx 10.8 – 21.3).

Conclusions The OAR are valid in a New Zealand primary care setting. Further implementation of the rules would result in some reduction of X-rays ordered for ankle injuries, but less than the reduction found in previous studies.

The aims of this study were to measure baseline use of the Ottawa ankle rules (OAR) for suspected fracture of the ankle, validate the OAR in a New Zealand primary health care setting and, if appropriate, explore the impact of implementing the rules in general practice after hours settings.

The OAR were developed upon the basis of a series of studies of ankle injuries,¹⁻³ which were analysed to find clinical indicators for an X-ray of the ankle or foot. The full formulation of the OAR is shown in Figure 1.⁴

The Accident Compensation Corporation (ACC) has recommended that the OAR be used in New Zealand.⁵ There has been one attempt to validate the OAR in the New Zealand setting,⁶ which showed that up to 7% of fractured ankles might have been missed if the OAR had been implemented. This study has been criticised upon the methodological grounds that it used an earlier version of the OAR and only tested one part of the OAR.⁷ The authors of the New Zealand study contended that the failed validation reflected the inexperience of junior staff in the assessment of limb injuries and in applying the OAR.⁸

A pilot study, conducted before this study began, suggested that use of the OAR had the potential to reduce the number of unnecessary X-rays in a New Zealand setting.

Figure 1. The Ottawa ankle rules

An ankle radiographic series is only required if there is any pain in the malleolar zone and any of these findings is present:

- bone tenderness at the posterior edge or tip (within 6 cm) of the lateral malleolus
- bone tenderness at the posterior edge or tip (within 6 cm) of the medial malleolus
- inability to bear weight both immediately and at presentation

A foot radiographic series is only required if there is any pain in the midfoot zone and any of these findings is present:

- bone tenderness at the base of the fifth metatarsal
- bone tenderness at the navicular
- inability to bear weight both immediately and at presentation

Data concerning the utilisation of X-rays in the management of 159 patients with ankle injuries presenting to Wellington's After Hours Medical Centre (AMC) over a three month period were collected with a retrospective notes audit. Analysis of these data showed that ankle injuries are common (approximately 600 cases per annum), frequently X-rayed (73% of ankle injuries), and the majority of these X-rays (75%) are normal. Similar data have been published in other centres throughout the world.⁹⁻¹¹ Implementation of the OAR overseas has resulted in a reduction of up to 34% in the number of X-rays performed, without a corresponding increase in the number of undiagnosed fractures.^{3, 12-16} Even where the Rules have not been fully validated, they were found to be more sensitive than clinical suspicion alone.¹⁷

Methods

Survey To find the baseline use of the OAR, postal questionnaires were sent to general practitioners (GPs) on the rosters for the Wellington and Christchurch AMCs. The questionnaire asked about the use of six guidelines to avoid specific prompting about the OAR. GPs were asked to indicate on five point scales, from never to always, how often they used guidelines for heavy menstrual bleeding, lipid disorders, back pain, ankle injuries, depression and youth suicide. A reply-paid envelope was included. A second questionnaire and reminder letter was sent to non respondents.

Validation of Ottawa ankle rules The research was conducted at the Wellington AMC and the Christchurch 24 Hour Surgery. Prospective data were collected on eligible patients over a six-month period. In each case, the general practitioner seeing the patient was asked to determine whether the patient was eligible to participate in the study and to seek consent from the patient. The GPs managed patients in their usual manner and recorded their findings on a data collection sheet that included (but did not emphasise) the observations necessary to apply the OAR. X-ray results were later recorded by the research team. Patients who did not receive X-rays were followed up with a phone call to determine their outcome seven to ten days after the initial consultation.

The outcome measures were X-ray utilisation and diagnosis of fracture. The sample size was based on the number of patients required to detect a 20% difference in X-ray rates before and after the implementation of the OAR. A sample size of 200 patients from each centre would enable us to detect a 20% difference with a power of 80% at the 95% confidence level.

Inclusion and exclusion criteria Patients were included in the study if they were aged 18 years or over, had pain and/or tenderness secondary to blunt trauma due to any mechanism of injury, including twisting, falling or direct blow, affecting any of the following anatomical sites: the distal 6 cm of the tibia and/or fibula; the talus; the navicular, cuboid and cuneiform bones; the anterior process of the calcaneus and/or overlying soft tissues. Patients were excluded if they: were pregnant; had isolated

injuries of the skin; had an injury sustained more than 10 days prior to the consultation; had an altered mental state (such as alcohol intoxication); a penetrating injury; multiple trauma; or an underlying physical condition preventing application of the OAR. Clinically insignificant fractures were defined as bone fragments less than 3 mm in breadth, following the initial study that validated the OAR.³

Data analysis Data were entered into a Microsoft Access database. Ottawa positive and negative status was determined retrospectively from the data for each patient by two GPs working independently and blinded to the X-ray results. Where there was disagreement, a third general practitioner reviewed the cases. Ineligibility due to insufficient information was determined in the same manner. Statistical tests were carried out in EpiInfo. Exact confidence limits were obtained from Documenta Geigy Scientific Tables for sample sizes of less than 100 and approximated for larger samples.¹⁸

The study was approved by the Wellington Ethics Committee.

Results

Survey 410 (87.1%) GPs completed the survey; 291 (94.5%) from Christchurch and 119 (73.0%) from Wellington. Eighty nine per cent of GPs reported that they never or hardly ever used ankle guidelines (Table 1), the lowest self-reported use for any of the guidelines.

Table 1. General practitioners' self-reported use of guidelines

Guideline	Reported use of the Guideline (%)					n
	Never	Hardly ever	Often	Very often	Always	
Heavy menstrual bleeding	131 (33)	169 (42)	81 (20)	19 (5)	2 (0)	402
Lipid disorders	61 (15)	102 (25)	154 (38)	62 (15)	22 (5)	401
Back pain	125 (31)	188 (47)	56 (14)	25 (6)	4 (1)	398
Ankle injuries	205 (52)	147 (37)	30 (8)	9 (2)	4 (1)	395
Depression	138 (34)	169 (42)	72 (18)	22 (5)	1 (0)	402
Youth suicide	203 (51)	152 (38)	34 (8)	10 (2)	2 (0)	401

Recruitment Data were collected from May to December 2001 for 109 consenting patients from Christchurch and 107 from Wellington. Comparison of recruited patients with completed ACC forms indicated a coverage of slightly more than 50% had been achieved. Seven patients from Christchurch and nine from Wellington were subsequently excluded from the analysis because the data collection forms had not been completed sufficiently to allow application of the OAR (13), they were ineligible due to an underlying physical condition (1), or they had fractures of the lower leg (2).

Recruited patients included 94 males and 106 females. There was no difference between Wellington and Christchurch with regard to age ($\chi^2 = 1.97$, $p = 0.742$) and gender ($\chi^2 = 0.34$, $p = 0.559$) of recruited eligible patients.

Data comparing recruited patients to non-recruited patients were available from Wellington, where ACC forms were audited and compared with recruitment forms. Study data collection forms were completed for 99 of 226 (43.8%) eligible patients for whom ACC forms were completed. The age ($\chi^2 = 1.48$, $p = 0.478$) and gender ($\chi^2 = 1.07$, $p = 0.302$) profile of patients not recruited for the study was not significantly different from recruited patients.

Table 2 shows the number of patients for whom the OAR were positive, whether they received X-ray, and whether they had a fracture.

Table 2. Comparison of the use of the OAR and usual practice in identifying ankle fractures

	Fracture*	No Fracture
Ottawa rules		
Positive	13	97
Negative	0	86
Usual clinical practice		
X-ray ordered [†]	13	116
X-ray not ordered	0	67

* Excludes clinically insignificant fractures; [†] Ordering X-rays was used as a measure of usual practice

X-rays A total of 133 (67%) patients received X-rays, 74 (73%) in Christchurch and 59 (60%) in Wellington.

Fractures Seventeen fractures were diagnosed; nine (9%) in Christchurch and eight (8%) in Wellington. Three fractures from Christchurch and one from Wellington were clinically insignificant; three were flake avulsions and one was a bone fragment.

Sensitivity and specificity of the Ottawa ankle rules There were 11 cases of disagreement between the reviewing practitioners when surveying the data sheets for Ottawa status that were resolved by a third practitioner. In total, 113 patients were assessed as Ottawa positive, and 16 of these patients had fractures. The four patients with clinically insignificant fractures were excluded when the sensitivity and specificity of the OAR was assessed. Of these four, three were Ottawa positive and one was Ottawa negative.

The overall sensitivity of the Ottawa Rules was 100% (95% CI: 75.3 – 100) and the specificity 47% (95% CI: 40.5 – 54.5). In Christchurch the sensitivity was 100% (95% CI: 75.3 – 100) and the specificity 39% (95% CI: 28.8 – 49.4); and in Wellington the sensitivity was 100% (95% CI: 75.3 – 100) and the specificity 56% (95% CI: 44.7 – 66.0). The positive predictive value of the OAR was 12% overall (95% CI: 6.5 – 19.4); 10% (95% CI: 3.6 – 19.6) in Christchurch, and 15% (95% CI: 6.2 – 28.3) in Wellington.

Sensitivity and specificity of usual practice The sensitivity and specificity of usual practice was determined by assessing whether an X-ray was ordered or not by the GP at the time of the consultation. In total, 129 X-rays were ordered, of which 13 revealed a fracture. The overall sensitivity of usual practice was 100% (95% CI: 75.3 – 100) and the specificity 37% (95% CI: 30.2 – 44.2). In Christchurch the sensitivity was 100% (95% CI: 75.3 – 100) and the specificity 30% (95% CI: 21.03 – 40.5); and in Wellington the sensitivity was 100% (95% CI: 75.3 – 100) and the specificity 43% (95% CI: 32.9 – 54.2). The positive predictive value of usual practice was 10% (95% CI: 5.3 – 16.1) overall; 9% (95% CI: 3.2 – 17.5) in Christchurch; and 12% (95% CI 5.0 – 23.3) in Wellington.

What difference would implementing the Ottawa ankle rules make? General practitioners ordered X-rays for 101 of the 110 (92%) Ottawa positive cases and for all four patients with clinically insignificant fractures. X-rays were ordered for 28 of 86 (33%) Ottawa negative patients. In the setting we studied, use of the Ottawa rules would reduce the total number of X-rays ordered from 129 to 110. Implementing the OAR would therefore reduce X-ray utilisation by 16% (95% CI: approx 10.8 – 21.3). However, strict application of the OAR would mean that one of the four patients with clinically insignificant fractures would not have been X-rayed.

Discussion

Strict application of the OAR to the patients in this study would not have resulted in GPs missing any clinically significant ankle fractures. The sensitivity and specificity of usual practice was comparable to the sensitivity and specificity of the OAR. Strict application of the OAR would have saved only 19 X-rays in the sample studied. It was therefore decided that the benefits of further implementation of the OAR did not warrant a specific implementation programme.

The study has validated the OAR in a New Zealand primary care setting. The difference between this result and that found in the earlier attempt to validate the OAR in New Zealand could be explained by the exclusion criteria that were used in this study, but were absent from the earlier research. If we had not applied exclusion criteria, the OAR would have appeared to miss three fractures. Upon close examination, however, these were clinically insignificant flake avulsions to which the OAR could not be applied. The original validation of the refined OAR excluded fractures with bone fragments less than 3 mm in breadth on the empirical grounds that such fractures were not treated with plaster immobilisation.³ However, in a setting in which the clinical norm is to treat avulsion fractures, the appropriateness of the OAR for these events is open to debate. This emphasises the point that while the OAR are valid in a New Zealand setting, they must be applied appropriately.

Use of the OAR would have reduced the number of X-rays ordered by 16% in the sample that we studied. Even though awareness of the OAR among GPs was low, the outcome of usual practice of ordering X-rays is similar to the outcome that would have been obtained using the OAR. This suggests that clinically experienced practitioners may be able to apply the important elements of guidelines without acknowledging that they are using a guideline in any formal sense.

The potential for 16% reduction in X-rays was less than we expected on the basis of previous research,^{3,12-16} and it is therefore questionable whether good results could be achieved with an education campaign. Resources for an education campaign are probably justified only where there is prima facie cause to suspect that an unduly high proportion of ankles are being X-rayed.

We have validated the OAR in a New Zealand primary care setting, however we have identified some limitations to them as a tool in clinical practice. The Rules do not make as much of a difference to normal practice in ordering X-rays as might be expected from previous studies, and the definition of clinically insignificant fractures to which the OAR do not apply is a grey area that deserves careful consideration in practice.

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