Validation of Ottawa ankle rules protocol in Greek athletes: study in the emergency departments of a district general hospital and a sports injuries clinic

E Papacostas, N Malliaropoulos, A Papadopoulos, C Liouliakis

Abstract

Objective—To validate the Ottawa ankle rules protocol for predicting ankle and midfoot fractures in Greek athletes.

Method—A prospective survey in the emergency departments of a district general hospital and a sports injury clinic in Greece over nine months. A clinical evaluation was made of 122 patients with acute ankle and/or midfoot injury, and then radiographs were taken.

Results—Nine ankle and eight midfoot fractures were detected. The sensitivity of the Ottawa ankle rules protocol in predicting fractures in both the malleolar and midfoot zones was 100%. The negative predictive value for each of these areas was also 1.0. Specificity was estimated to be 0.3 for ankle fractures and 0.4 for midfoot fractures. Positive predictive values were 0.16 and 0.28 respectively. A possible reduction of up to 28.7% was found in the need for radiography.

Conclusions—Use of the Ottawa ankle rules protocol in evaluating injured Greek athletes resulted in 100% sensitivity when performed by orthopaedic residents or sports medicine doctors, and had the potential to reduce the use of radiography.

Keywords: ankle sprains; radiographs; injuries

Acute ankle and midfoot injuries are among the most common complaints to present to emergency departments and the most common injuries in sport.1–7 The low fracture rate in these injuries (15%)3,8 has prompted much effort to produce rules for deciding when radiographic examination is necessary.

Stiell et al.7 developed the Ottawa ankle rules (OAR) protocol for the above injuries to rationalise the use of ankle and midfoot radiography. They suggest radiographic examination of the ankle if there is pain in the malleolar zone and either (a) inability to bear weight both immediately and in the emergency department (four steps) and/or (b) bone tenderness at the posterior edge or tip of either malleolus. They also recommend midfoot radiographs only if there is pain in the midfoot zone and either (a) inability to bear weight both immediately and in the emergency department (four steps) and/or (b) bone tenderness at the navicular or the fifth metatarsal.

There is considerable controversy over the performance of the OAR protocol.2,9 Sensitivities of 93–100% have been shown and a potential reduction in use of radiography of 10–34%.7,9

Our aim was to validate the OAR protocol in athletes, taking into consideration the differences between athletes and the general population.

Methods

This prospective survey was conducted in the emergency departments of a district general hospital and a sports injuries clinic in Greece over the nine months from May 1999 to January 2000. We included athletes and people who did sports activities at least three times a week, who had sustained acute ankle and/or midfoot injury during sports activity. All patients were clinically examined by a sports medicine doctor or an orthopaedic resident, and classified according to the definition of Stiell et al.7,9 We excluded patients younger than 18 years old, pregnant women, patients with multiple trauma, and those with a Glasgow Coma Scale score of less than 15/15. We used preprinted data collection forms designed so that the examining doctor could mark the area of bone tenderness and determine the patient’s ability to bear weight, while also recording the findings of the physical examination (fig 1). In this way, the injury could easily be characterised as OAR positive or negative with regard to the need for radiographs. We also collected data about age, sex, and injury mechanism.

Radiography was performed after the clinical evaluation and completion of the data collection form for each patient. Standard ankle series were obtained if there was pain or tenderness in the malleolar zone, and standard foot series if there was pain or tenderness in the midfoot zone. Malleolar and midfoot zones were defined as described by Stiell et al.7 The examining doctor interpreted the radiographs at the time of the visit. Later, a consultant in radiology also interpreted them, not knowing the doctor’s findings. Bone fragments larger than 3 mm in breadth were considered to be clinically significant fractures.7 The performance of the OAR was assessed using the qualified radiologist’s interpretation.

All the patients underwent a second clinical examination, two or three days after the injury, after application of the RICE (rest, ice, compression, elevation) protocol, in order to classify ankle sprains and start the rehabilitation programme.
To assess the performance of the OAR protocol in predicting clinically significant or avulsion fractures, we estimated sensitivity, specificity, and predictive values. The appropriate procedures in Statistics for Windows (version 5.1) software were run. \( p<0.05 \) was considered significant.

**Results**

We studied 122 patients, mean (SD) age 29 (9.62) years, who sustained an ankle or midfoot injury during sports activity from May 1999 to January 2000. All were athletes or people with consistent sports activity regimens (more than three times a week). Patients were examined by an orthopaedic resident (71%) or a sports medicine doctor (29%). Seventy-nine injuries occurred to the malleolar zone, and we diagnosed nine (11%) significant or avulsion fractures. We also examined 43 midfoot injuries, and found eight (19%) fractures.

The OAR protocol was used to assess all 122 patients, and we found that only 87 of them (71%) met the criteria for use of radiography, suggesting that there could have been a possible reduction in radiography use of up to 29%.

The sensitivity of the OAR protocol in predicting fractures in both the malleolar and midfoot zones was 100%. The negative predictive value was also 1.0. We estimated that specificity was 0.3 for the ankle fractures and 0.4 for the midfoot fractures. We found that positive predictive values were 0.16 and 0.28 respectively. Tables 1–4 show the results.

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**OTTAWA ANKLE RULES**

<table>
<thead>
<tr>
<th>Name:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address:</td>
<td>Sex: Male Female</td>
</tr>
<tr>
<td>Age:</td>
<td>Sports activity:</td>
</tr>
<tr>
<td>Time from the accident:</td>
<td></td>
</tr>
</tbody>
</table>

**Injury mechanism:**
- Torsional
- Fall
- Traffic accident

**ANKLE**
- Pain: Yes No
- AND
- Weight bearing (4 steps): Yes No

**MIDFOOT**
- Pain: Yes No
- AND
- Weight bearing (4 steps): Yes No

**Ottawa Ankle Rules**
- Clinical diagnosis
- X-ray diagnosis (orthopaedist)
- X-ray diagnosis (radiologist)

**Figure 1** Data collection form.
Table 1 Outcome of ankle and midfoot injuries

<table>
<thead>
<tr>
<th>Radiography</th>
<th>Fracture</th>
<th>No fracture</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Met criteria</td>
<td>17</td>
<td>70</td>
<td>87</td>
</tr>
<tr>
<td>Did not meet criteria</td>
<td>0</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
<td>105</td>
<td>122</td>
</tr>
</tbody>
</table>

Table 2 Outcome of ankle injuries

<table>
<thead>
<tr>
<th>Radiography</th>
<th>Fracture</th>
<th>No fracture</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Met criteria</td>
<td>9</td>
<td>49</td>
<td>58</td>
</tr>
<tr>
<td>Did not meet criteria</td>
<td>0</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>Total</td>
<td>9</td>
<td>70</td>
<td>79</td>
</tr>
</tbody>
</table>

Table 3 Outcome of midfoot injuries

<table>
<thead>
<tr>
<th>Radiography</th>
<th>Fracture</th>
<th>No fracture</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Met criteria</td>
<td>8</td>
<td>21</td>
<td>29</td>
</tr>
<tr>
<td>Did not meet criteria</td>
<td>0</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>35</td>
<td>43</td>
</tr>
</tbody>
</table>

Table 4 Performance of the Ottawa ankle rules protocol in identifying ankle and midfoot fractures in Greek athletes when used by orthopaedic residents or sports medicine doctors

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Ankle</th>
<th>Midfoot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Specificity</td>
<td>0.3</td>
<td>0.4</td>
</tr>
<tr>
<td>Positive predictive value</td>
<td>0.16</td>
<td>0.28</td>
</tr>
<tr>
<td>Negative predictive value</td>
<td>1.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Discussion

Since 1981, several studies have been conducted to establish predictive rules for the use of radiography in ankle injuries. As we felt that the OAR protocol is the best recommended and validated, we decided to test it in Greece, particularly for athletic injuries, to see if the differences in populations and national health systems had any influence. In the Greek national health system, there are no independent accident and emergency departments—every medical specialty has its own. As a result, a musculoskeletal injury may be examined and assessed by orthopaedic residents or consultants. This makes the use of the OAR protocol particularly easy and efficient because the examining doctors are all experienced. Discrepancies observed in other studies arise mainly because of differences in level of clinical training and experience.

We found 100% sensitivity in the malleolar and midfoot zone, and a possible 29% reduction in use of radiographs. Our results are similar to those of Stiell et al. We used the OAR protocol for all ankle and midfoot injuries, regardless of the athletic activity. Our preliminary results show similarities to those of Stiell et al, but we chose to deal with athletes because of the special characteristics of this group. It is well established that athletes seek more accurate diagnosis and better treatment, as rapid rehabilitation is their primary goal. This makes them more difficult to examine, because they often demand that radiography be performed, thinking that a radiograph is the only way to exclude a fracture. However, it is our duty as doctors to emphasise the importance of clinical examination.

The great increase in the use of imaging examination has made orthopaedic surgeons and sports medicine doctors more like radiologists than clinical doctors. We feel that the OAR protocol provides the best documented guidelines for the use of radiography, and that radiologists should use it more than clinical doctors. We feel that the OAR protocol will allow doctors to spend more time examining their patients than ordering radiographs, keeping the latter only for cases that fulfil the indications.


Commentary

This study was well set up. It confirms the usefulness of the Ottawa ankle rules in predicting a fracture in the ankle and midfoot following an injury. For a repair in any emergency department, it would be useful for the junior medical officers to learn and use the Ottawa ankle rules, as there is potential for reducing the need for radiography.

SIMON BELL
31 Normanby Street, Brighton, Victoria 3186, Australia
snbell@skynet.net.au