Implementation of the Ottawa Ankle Rules by Resident Orthopaedic Surgeons in an Emergency Department

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Abstract

Background: Routinely in an emergency department, radiographs are ordered for almost every patient with ankle injury, despite there are decision rules such as Ottawa Ankle Rules (OAR) to distinguish the patients who need them. The use of these rules is limited due to imperfect sensitivity and subjectivity of the method.

Objectives: To validate the accuracy of the OAR implemented by resident orthopaedic surgeons to rule out clinical significant ankle fractures in patients with acute ankle injuries.

Design: Prospective cohort study.

Method: One hundred and twenty three patients presented with ankle injury in our emergency department during a two-month period (January 2012 to February 2012). One hundred and nineteen patients fulfilled the inclusion criteria for this study. Resident orthopaedic surgeons examined the patients and filled the data forms. All patients underwent blinded radiographic assessment by an orthopaedic surgeon and a radiologist.

Main outcome measures: Sensitivity, specificity, potential reduction in radiographs needed.

Results: An ankle fracture was observed in thirty-four (28.6%) patients. In this group of patients, the OAR failed to predict two fractures (sensitivity 94.12%) and showed a relative low specificity (37.65%). The possible reduction in the radiographs needed was 28.6%.

Conclusions: This validation study of the OAR implemented by resident orthopaedic surgeons in a Greek setting produced similar results than those published previously in various other settings. The OAR for ankle injuries seem to be an accurate, objective, cost-effective method to rule out ankle fractures.

Keywords: Ankle injuries; Ottawa ankle rules; Sensitivity; Specificity; Clinical decision rules

Introduction

Fractures and dislocations of the ankle and foot are among the most common injuries in the musculoskeletal system. Five to ten million ankle injuries occur each year in the United States [1], accounting for 36% of all lower limb injuries [2] and representing 10% of emergency room visits [3]. The prevalence and severity of ankle injuries have been increasing since the 1950s, and this has been attributed to the increase in recreational activity [1]. Ankle sprains are considered to be one of the most common injuries experienced during sports [4-6]. Lesions of the ankle and foot can alter the mechanics of gait and as a result cause stress on other lower limb joints. The disability and time away from occupation resulting from these injuries warrant close attention to diagnosis and management [7-11].

It is imperative to rule out a fracture after an acute ankle trauma. X-ray including anteroposterior and lateral views should be performed in situations where acute bony tenderness is present on the malleoli or the medial or lateral dome of the talus. X-rays of the ankle joint should include the base of the 5th metatarsal to exclude associated fracture.

Currently, radiographs are routinely ordered almost in every patient with ankle trauma, although clinical significant fractures account for only 15% of the injuries [12]. The main reasons are mostly patients’ expectations and secondarily the doctors’ fear of overlooking a fracture. This defensive approach may lead to unnecessary radiographical examinations, resulting in increased radiation exposure and health care expenditure, as well as longer waiting times in the emergency department [13, 14]. Ankle films account for about 2% of all radiographic examinations and about 10% of emergency radiographs [1]. An estimated $500 million is spent annually in Canada and the United States on ankle radiographs alone [15].

In order to reduce the need for radiography in patients with acute ankle trauma, prediction rules have been developed. These rules aim to reduce the amount of radiographs without the risk of missing clinical significant fractures. Clinical significant fractures are considered those that need treatment either surgical or conservative. The Ottawa Ankle Rules (OAR) were developed in Canada and state that ankle radiographs are needed only if there is pain on palpation on the posterior edge of either malleolus or inability to walk four steps [16, 17].

Literature Review

The Ottawa ankle rules are decision rules that help to determine which patients with ankle injuries should undergo radiography. The OAR have been derived (N=750) [16], refined, and prospectively validated (N=1,485) [17] previously by two implementation trials; a local (N=2,342) [12] and a multicenter one (N=12,777) [18].
It has been shown that these rules have high sensitivity (almost 100%) in detecting fractures with a reduction in radiographies of approximately 40%. The same systematic review assessing the diagnostic value of the OAR revealed substantial heterogeneity of specificity ranging from 22.3% to 46.1% [19].

Unfortunately the Ottawa rules have been proved as being unsuccessful in a few populations [20-23]. A possible explanation for this problem might be more or less severe ankle injury in different populations because of various thresholds for seeking medical assistance [24].

Studies have suggested that poor knowledge of the Ottawa Ankle Rules (OAR) limits its clinical impact [25].

Brehaut et al. reported a survey performed among Canadian emergency physicians to evaluate barriers to the implementation of clinical decision rules. While 99.2% of the respondents reported to be familiar with the OAR, only 30.9% were able to correctly remember all its components. Errors in remembering rule components were more common among part-time (beta=0.18, p=0.009) and older (beta=0.18, p=0.04) physicians, and those who do not apply the rule consistently (beta=0.14, p=0.04). Most physicians (89.6%) reported using the OAR always or most of the time in appropriate circumstances, while only 42.2% reported basing their decisions to order radiography primarily on the rule. Physicians reported considering non-rule factors that are not related to the presence of a fracture (e.g., swelling: 54%), and factors that add more predictive value over and above the rule (e.g., age>55 years: 55.2%) [26].

The reason for disagreement between clinical studies and real-life situations may be related to the fact that physicians do not adequately remember the OAR [25] or because ordering unnecessary radiographs had no negative consequences [27] or even because physicians are hesitant to rely on the results of their physical examination [28].

Graham et al. evaluated the international diffusion of the Ottawa Ankle Rules and determined emergency physicians’ (EPs) attitudes toward clinical decision rules. The results indicated that a majority of Canadian (89%) and U.K. (73%) EPs use the rules. However, less than one third of Spanish, French, and U.S. physicians reported frequent use of the rules [29].

Materials and Methods

This is a prospective study performed at a medium-sized hospital in Thessaloniki (Greece). Consecutive patients presenting to the emergency department with an acute ankle injury from January 2012 to February 2012 were eligible. Acute ankle injury was defined as any painful ankle resulting from trauma. Ankle was defined as the malleolar area and the midfoot area, both of which are commonly involved in twisting injuries.

All the patients were examined by resident orthopaedic surgeons. The examiners had to fulfill a predetermined form which contained a set of patients’ characteristics and contextual information, such as age, gender, height, weight, injury mechanism and the time passed between the injury and examination. They also recorded the result of the OAR always or most of the time in appropriate circumstances, while only 42.2% reported basing their decisions to order radiography primarily on the rule. Physicians reported considering non-rule factors that are not related to the presence of a fracture (e.g., swelling: 54%), and factors that add more predictive value over and above the rule (e.g., age>55 years: 55.2%) [26].

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Results

During the study 1268 patients were referred to the orthopaedic emergency department of our hospital out of which 123 with an acute ankle trauma. Four out of these patients met the exclusion criteria or refused to participate and had to be excluded from the study. The mean age of the patients included in the study was 38.46 years and the mean body mass index (BMI) was 26.11. Fifty-seven patients were males (47.9%) and sixty-two were females.

The mechanism of the injury was mostly a simple fall. Almost one fourth of the injuries happened during sport activities.

Thirty-four clinical significant fractures were observed on the radiographs, sixteen in males (47.1%) and eighteen in females (52.9%). Patients who sustained a fracture were older than patients without a fracture and that difference was statistically significant (U=964.000, p=0.005, two-tailed).

The time between the injury and the evaluation at the emergency department did not play any important role in tenderness at the malleoli area. On the contrary there is important difference between those who are able to make four steps and those not, in correlation with the time passed between injury and examination.

The Ottawa Ankle Rules identified 32 of the 34 clinical significant fractures (sensitivity 94.12% and specificity 37.65%).

The OAR recommended radiography in 71.4% of the cases. The corresponding potential savings in radiographs were 28.6%.
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Discussion

Until recently, many decisions to perform investigations have been based more on personal experience than on evidence-based medicine. Under the current socio-economic conditions, doctors have to deal with rising pressure to provide proper health care at less cost. Clinical decision rules (CDRs) are tools that help clinicians to take diagnostic and therapeutic decisions at the bedside. By standardizing the collection and interpretation of clinical data, CDRs attempt to reduce uncertainty in medical decision-making [30]. It is important to ensure that the sensitivity and specificity of the rule are accurate and that there are few missed diagnoses.

Since the early 1980s, several studies have been conducted to establish predictive rules for the use of radiography in ankle injuries. The best established and validated protocol seemed to be the OAR. Our study proved that the OAR protocol could be used in the Greek population.

Our results showed sensitivity of 94.12%, specificity of 37.65%, and possible reduction of 28.57% in use of radiographs. Our results are similar to those found in literature [5].

In the Greek national health system every patient with a musculoskeletal injury is examined and assessed by either orthopaedic residents or consultants so there are no discrepancies observed in other studies, which arise mainly because of differences in level of clinical training and experience. Greek patients’ mentality involves asking for an x-ray examination for any musculoskeletal injury, having in mind that x-rays is the only way to rule out a fracture. Many of them are also reluctant to be examined and to provide the proper information. Doctor’s fear of a bad professional reputation or litigation by missing a fracture leads him to overestimate patients’ complaints and therefore maximizes sensitivity while on the same time minimizes specificity. Soft-tissue tenderness and swelling make bone tenderness difficult to assess. It also appears plausible that the subtlety of palpation technique might impact on the false-positive rates, that is, the percentages of patients who apparently indicated pain or inability to walk four steps, but had no fracture [28]. We think that the main disadvantage of the OAR protocol is that it is influenced by subjective factors.

The OAR protocol is calibrated towards high sensitivity at optimal specificity. High sensitivity minimizes false negative results. On the other hand specificity correlates with the uselessness of the rule in helping avoid unnecessary x-rays and associated costs.

It is obvious that in times of increased legal pressure and the growing obligation to document and prove clinical findings for social and health insurance purposes it is likely that the performance of the decision rules measured in a study cannot be reached in clinical practice. In our study as in almost every other earlier validation study all patients underwent radiography irrespective of the decision rule result. So the capacity of the rule to reduce the number of unnecessary x-rays remains somewhat theoretical.

Conclusions

This validation study of the OAR implemented by resident orthopedic surgeons in a Greek setting produced similar results than those published previously in various other settings.

Emergency physicians around the world should adopt the use of clinical decision rules for ankle injuries. With relatively simple implementation strategies, care can be standardized and costs reduced while providing excellent clinical care. Cost-effective decision rules that do not compromise the acute or chronic medical situation of a patient are generally of great acceptance. The OAR protocol for ankle injuries seems to be an accurate, objective, cost effective method to rule out ankle fractures.

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