

APPLICABILITY OF OTTAWA ANKLE RULES IN PREDICTING THE NEED FOR RADIOGRAPHY IN ANKLE AND MIDFOOT INJURIES IN RWANDA

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ABSTRACT

Objective: To assess the applicability of Ottawa Ankle Rules in predicting the need for the radiography in ankle and midfoot injuries in Rwanda.

Design: This was a prospective multicenter cross-sectional study carried over a 6 month duration, from May 2018 to October 2018.

Setting: University Teaching Hospital of Kigali (UTH-Kigali), Rwanda Military Hospital (RMH) and King Faisal Hospital, Kigali, Rwanda (KFH-K).

Patients and methods: Adult patients presenting with acute ankle and midfoot injuries at the emergencies of three referral hospitals in Kigali. Patients were examined using OARs and underwent radiography to rule out the presence or absence of the fracture.

Results: A total of 196 patients from three referral hospitals in Kigali were enrolled in the study. The sensitivity and specificity of the OARs were 97.9% and 35.8% respectively.

Conclusion: In this study, Ottawa Ankle Rules have high sensitivity and low specificity; however, it showed high false positive values due to high sensitivity of the test. When properly applied, Ottawa Ankle Rules can decrease the number of unnecessary ankle or midfoot radiographs and limiting the waiting time in acute settings in Rwanda.

Key words: Ottawa ankle rules, Radiography, Applicability, Validation

INTRODUCTION

Acute injuries of the ankle are among the most common injuries of the musculoskeletal system. They account for 25% of all injuries of the musculoskeletal system and for 36% of all lower extremity injuries (1). In the USA, five to ten million ankle injuries occur each year. It is estimated that about one ankle sprain occurs per 10,000 people each day in Western countries (2). In the United States and the UK, about 23,000 and 5,000 injuries of the ankle, occur respectively each day (3). Kannus *et al.* (4) found, a relative increase of 319% of ankle fractures in elderly Finnish population from 1970 to 2000. In a Nigerian study, 46.3% of all fractures due to road traffic accidents had ankle fractures, while 88.6% of ankle fractures were due to road accidents in a Ghanaian experience (5,6). In Rwanda, Twizere (7) found the ankle (38.5%) as the most injured body part in soccer injuries. Hakizimana (8) also found ankle (79.2%) as the most injured body part in basketball related injuries in Rwanda.

Almost all patients with foot and ankle injuries undergo radiographic examination to exclude presence of a fracture; however, fewer than 15% of these

patients actually have fractures (9). This routine is also done in Rwanda, where patients with ankle injuries are radiographed even without a proper physical examination. The main reasons are mostly patients' expectations and doctors' fear of missing the fracture. This defensive approach may lead to unnecessary radiographic examinations, resulting in increased radiation exposure and health care expenditure, as well as longer waiting times in the emergency department (10,11).

Prediction rules have been developed in order to reduce the need for radiography in patients with acute ankle trauma. These rules aim to reduce the amount of radiographs without the risk of missing clinically significant fractures (12). To reduce unnecessary radiography for acute ankle injuries, Stiell *et al* (13,14), developed the clinical decision rules known as "Ottawa Ankle Rules", used in assessing and predicting the possibility of fractures of the ankle and foot. The rules 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. Researches done for the validation of Ottawa Ankle Rules showed high sensitivity and modest specificity for the detection

of ankle fractures and it has been shown to reduce the unnecessary X-rays, costs and long stay at emergency (10,15-17). The purpose of this study was to determine the applicability of Ottawa Ankle Rules in predicting the need for radiography to rule out ankle and midfoot fractures in acute settings in Rwanda.

MATERIALS AND METHODS

This was a prospective multicenter cross-sectional study carried over a 6 month duration, from May 2018 to October 2018 for adult patients presenting with acute ankle and midfoot injuries at the Accident & Emergency Departments of three referral hospitals in Kigali (University Teaching Hospital of Kigali, Rwanda Military Hospital and King Faisal Hospital, Kigali, Rwanda). We included patients who sustained closed ankle and midfoot injuries within 7 days of injury and who were older than 18 years of age and above. We excluded patients whose ankle or midfoot X-rays were already done, pregnant women, patients with major distracting injuries and patients with altered mental status (GCS <15). Every patient presenting at Accident & Emergency Department with ankle or mid-foot injury fulfilling the inclusion criteria was recruited, examined by a resident using OARs and antero-posterior and lateral radiography of the ankle or mid-foot were requested to rule out the presence or absence of the fractures. The X-ray was interpreted by the same resident who examined the patient. Results were recorded in the form containing the demographic data such as age, sex, the referring health facility or home, province of residency and clinical data such as mechanism of injury, time from injury to presentation at Accident & Emergency Department, findings of Ottawa Ankle Rules and results of radiography. Data analysis was done using SPSS and accuracy was calculated using sensitivity, specificity, positive and negative predictive values. The study was approved by the Institutional Review Board and an informed consent was signed by the patients before being enrolled in the study.

RESULTS

During the study, 196 patients met the inclusion criteria and were enrolled in the study; 104 (53%) were male and 92 (47%) were female with the mean age of 35.7 years and range of 69 with minimum age being 18 years and maximum being 87 years. Ankle twisting during casual walk was the most common mechanism of injury with 70 (35.7%) patients. Road traffic

accident was the second most common mechanism of injury with motor vehicle and motorcycle accidents seen in 25 and 30 patients respectively. In this study, there were 143 (73%) fractures, the lateral malleolar fracture was the most commonly seen ankle fracture accounting for 29.9% of cases and was commonly seen in patients (36 patients) who presented with inability to bear weight and lateral malleolar tenderness.

As shown in Table 1, the sensitivity and specificity of the Ottawa Ankle Rules were 97.9% and 35.8% respectively with false positives accounting for 64.2% of cases which are related to the high sensitivity of the test. The positive predictive value was 80.45%, whereas the negative predictive value was 86.3%. The positive likelihood ratio was 1.52 and negative likelihood ratio was 1.73. Only 3 (1.53%) cases have been missed and 19 (9.7%) cases of the unnecessary X-rays would have been reduced by the test (Ottawa Ankle Rules).

Table 1
Outcome of ankle and midfoot injuries

Radiography	Ottawa Ankle Rules		Total
	Positive for fracture	Negative for fracture	
Presence of the fracture	140	3	143
Absence of the fracture	34	19	53
Total	174	22	196

DISCUSSION

In this study we found high sensitivity of 97.9% and low specificity of 35.8% of Ottawa Ankle Rules. Ottawa ankle rules have shown high sensitivity and low specificity in many different systematic reviews analyzing its accuracy. In his systematic review analyzing 21 primary studies, Jonckheer *et al.* (18), found sensitivity and specificity of the OAR range from 92–100% and from 16–51%, respectively. In their systematic review including 66 studies, Beckenkamp *et al.* (19) found a high sensitivity and a poor specificity of 99.4%, (97.9% to 99.8%) and 35.3%, (28.8% to 42.3%) respectively. In a systematic review by Bachmann *et al.* (20), they found high sensitivities of the OAR ranging from 99.6% in studies on application of the rules within 48 hours of injury to 96.4% in studies of combined assessment, while the specificities ranged from 47.9% in studies with a prevalence of fracture below the 25th centile of all studies to 26.3% in studies of combined assessment; and the pooled negative likelihood ratios for the ankle

and midfoot were 0.08 (95% CI 0.03 to 0.18) and 0.08 (0.03 to 0.20) respectively. Ottawa Ankle Rules have also shown high sensitivity in non-physician providers where MacLellan *et al.* (21) found a sensitivity of 100% and a specificity of 19%.

In view of its high sensitivity, OAR has been validated in many countries (10,15,17,22); however it has not been validated in some countries, Tay *et al.* (23) in Asia, Singapore, found a sensitivity of 90% and a specificity of 34%, and he concluded that the OAR cannot be used to screen for the need for X-ray studies in Asian patients who have sustained twisting ankle injuries because of a high false-negative rate. Perry *et al.* (24) in UK found a sensitivity of 93.6%, and specificity of 46%. The positive predictive value was 17.98% and negative predictive value 98.39%. He concluded that decision rules should be used with care and not replace clinical judgment and experience.

In our study, we would have reduced of the unnecessary X-rays, this is different from other 19 (9.7%) cases; Stiell *et al.* (25) found a reduction of 28% in the proportion of patients referred for ankle radiographs. Daş (26) in Turkey found 38.02% reduction in radiography when OAR is implemented in Emergency Department and used by general practitioners. In his systematic review, Jonckheer *et al.* (18) found an estimate on the reduction of radiographs ranging from 13% to more than 40%. We would have reduced fewer fractures compared to others because the majority of ankle sprains are managed at district hospital level and only fractures are referred for better management in referral hospitals.

CONCLUSION

In this study, Ottawa Ankle Rules have high sensitivity and low specificity; however, it showed high false positive values due to high sensitivity of the test. Applicability of Ottawa Ankle Rules is possible and when properly applied, can decrease the number of unnecessary ankle or midfoot radiographs and reducing the costs and waiting time in acute settings in Rwanda.

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