

## RELIABILITY OF 'OTTAWA ANKLE RULES' IN ACUTE ANKLE AND MIDFOOT INJURIES

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### ABSTRACT

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#### INTRODUCTION

The Ottawa ankle rules (OARs) are clinical decision guidelines used to identify whether patients with ankle injuries need to undergo radiography. The OARs have been proven that their application reduces unnecessary radiography.

#### MATERIAL AND METHODS

This prospective study was conducted at Sumeru City Hospital, Lalitpur in the Department of Emergency and Outpatient Department of Orthopaedics. Thirty-six patients were included in the study. Twenty-five patients were in ankle group and 11 patients were in midfoot group. All patients were sent for X-rays after evaluating them according to OARs.

#### RESULTS

Among 36 cases, 8 clinically significant fractures were found. Sensitivity of OARs for detecting fractures was 100 % for both ankle and midfoot group. Specificity of OARs for detecting fractures were 47.36 % for ankle group and 66.67 % for midfoot group. Negative predictive value of OARs was 100 %.

#### CONCLUSION

OARs are very accurate and highly sensitive tools for detecting fractures in acute ankle and midfoot injuries. Implementation of these rules would lead to significant reduction in the number of radiographs and thereby reduce the cost of the treatment, radiation exposure and waiting time of patients at hospital.

#### KEYWORDS

Ankle injury, Midfoot injury, Ottawa ankle rules.

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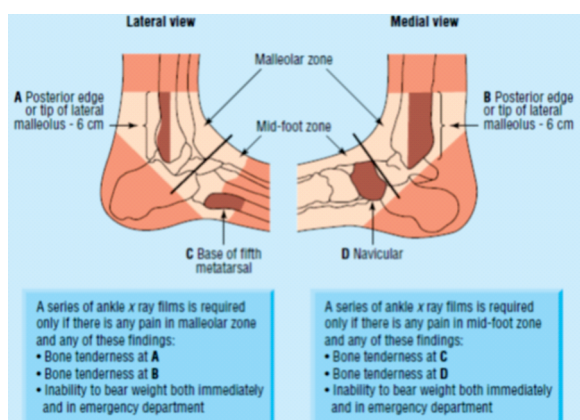
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## INTRODUCTION

Foot and ankle injuries are common clinical conditions treated by emergency physicians; these injuries account for 6–12% of the patients seen in emergency departments (ED).<sup>1</sup> Currently, almost all patients with foot and ankle injuries undergo radiographic examination to exclude fracture; however, fewer than 15% of these patients actually have fractures<sup>2</sup>, thus most of these radiographs are unnecessary. So, there was a need for clinical tests that can reduce the unnecessary X-rays ordered for such injuries, while at the same time, these tests should have ability to include all clinically significant fractures and no fracture<sup>3, 4</sup> should be missed. Stiell et al developed and validated such tests and named them Ottawa ankle rules (OARs). These rules are based on pain, bony tenderness and weight bearing ability (Fig. 1).<sup>4</sup>



**Figure 1.** The Ottawa Ankle Rules for ankle and foot radiography<sup>4</sup>

According to OARs, X-rays of the ankle is done, if there is pain in the malleolar zone and either (a) inability to bear weight immediately and in the ED (four steps) and/or (b) bone tenderness at the posterior edge or tip of either malleolus. They recommend midfoot X-ray only if there is pain in the midfoot zone and either (a) inability to bear weight immediately and in the emergency department (four steps) and/or (b) bone tenderness at the navicular or the base of fifth metatarsal.

Since their introduction in 1992, the OARs have been validated as highly sensitive and modestly specific for the detection of ankle fractures in multiple clinical settings<sup>5</sup> and have been widely applied in many countries.<sup>6-13</sup> Since ankle and foot injuries are also common in our hospital and all cases are sent for X-rays, we evaluated the accuracy of the OARs in our set-up.

## MATERIAL AND METHODS

This prospective study was conducted at Sumeru City hospital, Lalitpur in the Department of Emergency and Outpatient Department of Orthopaedics from July 2020 to April 2021, over a period of 9 months. All adult patients presenting to the hospital with complaints of ankle and

midfoot pain secondary to closed traumatic injuries were included in this study. Exclusion criteria were patients less than 18 years of age, patients with open injuries, patients referred from outside hospital with radiography, patients with pre-existing neurovascular compromise and patients with obvious ankle and foot deformities. A written informed consent was obtained from each patient for inclusion in the study.

Cases were evaluated according to OARs (Fig.1). Malleolar and midfoot zones were defined as described by Stiell et al.<sup>3,4</sup> Tenderness was evaluated first followed by assessment of weight bearing abilities. Weight bearing was described as the ability to transfer weight twice onto each leg (a total of four steps) regardless of limping or discomfort. Clinical diagnosis was reached and recorded. X-rays were sent for both OAR negative and positive cases. X-rays ordered for ankle was Antero-Posterior (AP), Lateral (Lat.) and mortise view. For foot, AP, Lateral and oblique views were ordered. The X-rays were evaluated and fracture fragment displacement more than 3 mm breadth was considered as clinically significant fracture. OARs were evaluated by calculating sensitivity, specificity and predictive values.

## RESULTS

We studied a total of 36 patients, out of which 25 were in ankle group and 11 were in midfoot group. All patients underwent x-ray evaluation, giving 100% radiography rate. Twisting injury was the commonest mechanism of injury in both ankle and midfoot group followed by RTA. Out of 25 patients in ankle group, 16 (64%) were diagnosed as OARs positive. Out of 16 OARs positive cases, 6 (37.5%) had clinically significant fracture. Out of 11 patients in midfoot group, 5 (45.4%) were diagnosed as OARs positive. Out of 5 OARs positive cases, 2 (40%) had clinically significant fracture. None of the patients in OARs negative group had clinically significant fracture. The outcome and performance of Ottawa ankle rules are shown in detail in table 1 and 2 respectively.

**Table 1.** Outcome of OARs for ankle and midfoot groups

	Ankle group			Midfoot group		
	OARs+	OARs-	Total	OARs+	OARs-	Total
Fracture	6	0	6	2	0	2
No fracture	10	9	19	3	6	9
Total	16	9	25	5	6	11

**Table 2.** Performance of OARs for ankle and midfoot groups

	Sensitivity	Specificity	Positive Predictive value	Negative Predictive value	X-Ray that could be saved
Ankle group	100 %	47.36 %	37.5 %	100 %	36 %
Midfoot group	100 %	66.67 %	40 %	100 %	54.55 %

## DISCUSSION

Several studies have been performed since 1981 to develop clinical rules for evaluation of acute ankle and midfoot injuries regarding need of X-rays in such injuries.<sup>3,4,14-19</sup> OARs were developed and validated by its Canadian inventors<sup>3,4</sup> and used in various clinical settings. OARs are easy to memorize and simple to apply, in addition, these rules have been<sup>6-13</sup> successfully and favorably validated in various countries.<sup>3,4,6,20-24</sup> However, without evaluation, even well-defined decision making rules are not suitable for application in all clinical settings due to differences in patients' characteristics, different clinical settings and behavior of treating physicians. Moreover, some study results have rejected the generalization of the OARs.<sup>25</sup> Therefore, evaluation of the OARs was considered in this study.

In present study, twisting injury was the most common mechanism of injury. This result was similar to several other studies worldwide.<sup>3,4,6,20-24</sup> Result of present study is similar to those of Stiell et al<sup>3,4</sup> and various other studies.<sup>6,20-24</sup> In this study, sensitivity of OARs was calculated to be 100%. That means all patients with clinically significant fracture were picked up by OARs and none of the clinically significant fractures were missed. Specificity was calculated to be 47.36% for ankle group and 66.67% for midfoot group. Specificity of OARs appears to be moderate. Negative predictive value (NPV) was calculated 100% for ankle and midfoot groups. That means chances of getting clinically significant fractures in those patients who were diagnosed as OARs negative was zero. With application of OARs, the amount of X-rays that could be saved was calculated as 36 % for ankle group and 54.55 % for midfoot group. This figure shows that nearly half of the X-rays could be avoided with application of OARs. Though X-ray is a low cost investigation, it is done in high volume and is not free of hazards. Therefore, reduction in X-rays even by half can lead to significant impact on our health care cost along with reduction in radiation hazards.

## CONCLUSION

The OARs has proven to be a highly sensitive and moderately specific test for detecting fractures associated with ankle and midfoot injuries. Widespread application of the OARs by the medical community can decrease unnecessary ankle radiography and waiting time for patients.

## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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