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Utility of Ottawa ankle rules in excluding ankle fractures in Indian scenario

Malay K. Mandal, Anirban Paul*, Abhijit Sen, S. Sariful Rahaman, Bimalendu Bikash Hazra

Department of Orthopedics, KPCMCH, Jadavpur, Kolkata, West Bengal, India

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***Correspondence:**
Dr. Anirban Paul,
E-mail: anirban.mmch@gmail.com

ABSTRACT

Background: Patients with acute ankle injuries form a major bulk in outdoor and emergency room, and many of them get radiographs done to rule out fractures. Ottawa ankle rules (OAR) may reduce the need for unnecessary radiographs by detecting fractures only with help of simple clinical findings. We conducted this study to see the extent of usefulness of these rules in our day-to-day practice.
Methods: Our study is observational in nature. A total of 107 patients who visited the clinic of the chief investigator between the time period from 1st January 2019 to 31st December 2020, fulfilling inclusion criteria and willing to participate, were enrolled. The patients were examined clinically, and the assessor recorded the findings on a previously prepared assessment form. Data analysis was done from the master chart.
Results: Among the 107 patients, 46 patients were 'suspicion positive' by OAR. After the radiographic assessment, we found 11 fractures, all of which belonged to the 'suspicion positive' group. Statistical analysis showed that OAR had a sensitivity of 100% for ankle fractures, whereas specificity for the same was 63.54%. We found the positive predictive value to be 23.91% and negative predictive value to be 100%, positive likelihood ratio of 2.74, and negative likelihood ratio of 0.
Conclusions: OAR is an easy and reliable tool to screen ankle fractures. In a country with as massive a health care burden as ours, it can reduce the number of unnecessary radiographs and thus reduce exposure, cost, and time of medical professionals.

Keywords: OAR, Utility of OAR, Excluding ankle fractures, Application of OAR in Indian scenarios

INTRODUCTION

Acute ankle injuries form a large bulk of patients daily in the emergency room as well as in the outpatient department. Not only in orthopaedics OPD, but this subset of patients also presents to general and family physicians also[1]. Most patients undergo radiographic evaluation till date despite the availability of various clinical criteria to exclude significant ankle fractures, such as OAR and Bernese ankle rules.[2] This increases health care costs significantly, also causes undue radiation exposure, and prolongs emergency room waiting time. So, health care system in a developing country like ours gets burdened unnecessarily as only less than 15% of these patients have actual ankle or midfoot fractures.[3,4] OAR were developed in 1992, which includes a 4-step approach to exclude ankle fracture. The ankle assessment includes the ability to walk four steps (immediately after the injury or at the emergency department) and presence of localised tenderness of the posterior edge or tip of either malleolus (four spots). We conducted this study to see the extent of usefulness of these rules in our day-to-day practice in the need for radiographs in some ankle injuries.

Objectives

The objectives of the study were to assess reliability of OAR as the screening test to rule out ankle fractures, to see its utility in Indian scenarios and to see if it can be used in walk-in clinics of India alongside emergency room.

METHODS

Our study was observational in nature and the study setting includes the personal clinic of the chief investigator.

Our study sample consisted of all patients who presented with acute ankle injury in the personal clinic of the chief investigator between 1st January 2019 to 31st December 2020 fulfilling inclusion criteria and were willing to participate.

Inclusion criteria were patients with acute twisting injury of ankle and adult patients within 18-50 years age group.

Patients who were not eligible for the study were excluded like; age <18 years and >50 years, pregnant women, open injury, with isolated superficial lesions i.e., laceration or burns, polytrauma, grave sensory and awareness disturbance (GCS <15), trauma > 1 week old, re-evaluation of previously assessed injury and referred from other hospitals with a radiograph.

The patients were examined clinically, and the assessor recorded the findings on a previously prepared assessment form. The assessor noted the following points: 1) inability to bear weight for 4 steps immediately after injury and at the time of evaluation 2) tenderness over four points, i.e., posterior edge (6 cm) or tip of both malleoli, 3) tenderness over base of 5th metatarsal, cuboid or navicular.

Patients were defined as 'suspicion negative' if no positive observation among the abovementioned examination findings was present, and as 'suspicion positive' if any one of the positive findings was present.

Anteroposterior and lateral view radiographs of the ankle and anteroposterior and oblique view radiographs of foot were taken in every case. Radiographic presence of fractures was noted. Radiography results were interpreted by two different orthopaedic surgeons conducting this study, other than the chief investigator, who had not visited or examined the patient.

All data were collected in a prepared assessment sheet and put into excel to prepare a master chart. Data was then analysed from the chart using SPSS 25.

Due approval from ethical committee was obtained.

RESULTS

Between our study period a total of 107 patients were enrolled in our study. Age distribution of our study population was such: 65.42% of our patients were in the age group of 18-30 years; 25.23% were in the age group of 31-40 years, and 9.34% were between 41-50 years age (Table 1).

Table 1: Age distribution of study population.

Variables	Populations		
Age group (years)	18-30	31-40	41-50
Percent of study population (%)	65.42	25.23	9.34

The 81.8% of the patients who suffered from fractures, belonged to the age group of 18-30 years, and only 18.2% belonged to the subset of 31-40 years aged patients.

The 64 patients (59.8%) were male and 43 of our patients (40.18%) were female (Figure 1).

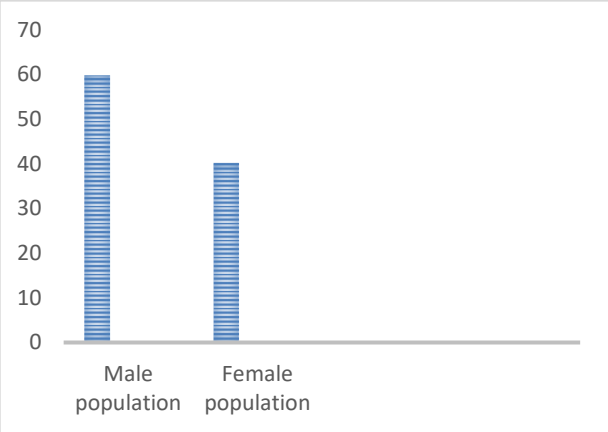

Figure 1: Gender distribution.

The average duration of symptoms was 2.42 days. Among the patients, 58 patients (54.20%) suffered an ankle injury during any sports activity (i.e., running, jumping, contact sports, etc.), 28 patients (26.16%) due to fall from stairs, 16 patients (14.95%) had an injury during outdoor walking and only 5 patients (4.67%) had an injury due to household fall (Table 2).

Table 2: Mechanism of injury.

Mechanism of injury	Sports activity	Fall from stairs	During outdoor waking	Household fall
Percent of study population (%)	54.20	26.16	14.95	4.67

Among the 107 patients, 46 patients were 'suspicion positive' by OAR, and 61 patients were 'suspicion negative'. After the radiographic assessment we found only 11 fractures, all of which belonged to the 'suspicion positive' group (Table 3).

Table 3: Clinical suspicion/radiological diagnosis.

Variables	Presence of fractures in radiographs	No fracture in radiographs	Total
Suspicion positive	11	35	46
Suspicion negative	0	61	61
Total	11	96	107

Five of the patients (45.4%) among those who had a fracture, had a fracture of the lateral malleolus, 3 of them (27.3%) had medial malleolus fracture, 1 had (9.9%) bimalleolar fracture and 2 had (18.2%) fracture in the base of 5th metatarsal. No fractures were found in the navicular or cuboid (Figure 2).

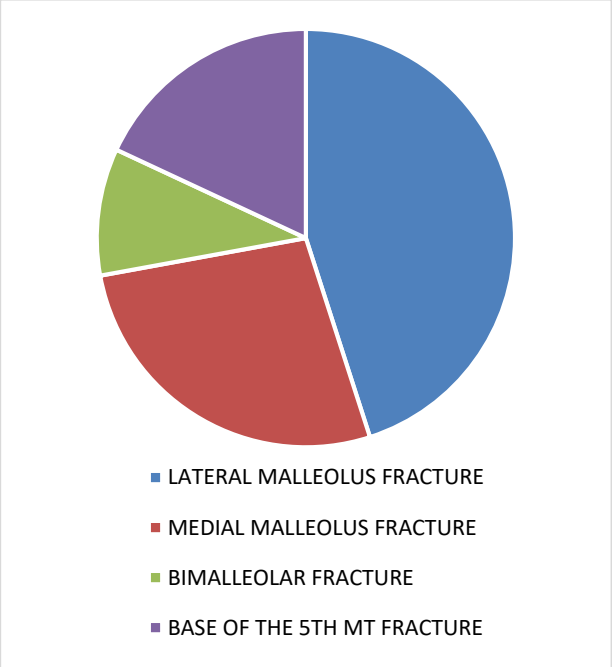

Figure 2: Distribution of ankle fractures in our study population.

Table 4: Statistical results of the study.

Variables	Percentage (%)
Sensitivity	100
Specificity	63.54
PPV	23.91
NPV	100
Positive likelihood ratio	2.74
Negative likelihood ratio	0

Statistical analysis of data from our study depicts that, OAR had a sensitivity of 100% for ankle fractures in our study setup, whereas specificity for the same was 63.54%. We found the positive predictive value to be 23.91% and the negative predictive value to be 100%. Likelihood ratios are as follows: positive likelihood ratio of 2.74 and negative likelihood ratio of 0. Our study also showed that proper implementation of OAR to rule out fractures can cause a potential reduction of radiographs in these patients by 57% (Table 4).

DISCUSSION

A large bulk of ankle injuries in the emergency room and clinics (6-12%of emergency room visits) but significantly less amount (<15% of ankle injury) of actual fractures, produced the urgent need of screening tests that can minimise the burden of cost, long waiting time and unnecessary exposure to x-ray.[5] Among the various screening methods, OAR emerged as the promising one. Though various studies, systematic reviews validated OAR, it's not being used widely. In India, there is a lack of large-scale studies to validate OAR. There is no study about validating its use outside the emergency room, in walk-in clinics of India, though a large no of patients here doesn't come for prompt treatment, rather take a day or two and attend walk-in clinics. We attempted to address this problem through our study, though the pandemic outbreak slowed us down.

The average age in our study population was 28.4 years (18-50 years). Maximum no of patients belonged to the younger age group of 18-30 years (65.42%). Similar tendencies in age distribution were also seen in the study conducted by Singh et al (42%) and Brooks et al.[4,6] We found that 81.8% of the patients who suffered from fractures, belonged to the age group of 18-30 years, and sports injury being the commonest (54.20%) mode of injury. Brooks et al found that it can be due to more engagement in sports activity in the younger population.[4] But results differ from the findings by Meena et al where most of injuries were due to fall, which can be explained by the liberal age limit in their study population (8-76 years).[7]

The 59.8% of our study subjects were male, which was similar to the gender distribution in the study by Meena et al (60% male).[7]

The most common fracture in our study was lateral malleolus fracture (45.4%), followed by medial malleolus fracture, which was also the case seen in the study of Wang et al.[8]

Meena et al found 100% sensitivity, 68.7% specificity, and 100% negative predictive value, in their study.[7] Our study also revealed similar statistical results, i.e., 100% sensitivity, 63.5% specificity, and 100% negative predictive value. The specificity of OAR in our study was quite high than most of the other studies. It may be due to the fact, that in our study only the chief investigator examined all the patients clinically and his experience with OAR was nothing new. Singh et al found 100% sensitivity and 30.30% positive predictive value of OAR, which is also similar to our study (positive predictive value of 23.91%).[6] In a systematic review of 27 studies, Bachmann

et al found the sensitivity of OAR to be in the range of 99.6%-100%, though huge variability in specificity was found (10%-79%).[9]

In the matter of avoiding x-ray, results of our study (57% potential chance of avoiding x-ray) were also comparable to others (51% x-ray avoidance in the study by Meena et al and 30-40% avoidance depicted by Bachmann et al.[7,9]

All of these findings in our study corroborate with others, which validates the reliability of OAR to be used as a screening test of ankle injuries in India, and outside the ER also. We feel that medicolegal aspects of missing a fracture may be one of the factors which remains a hindrance to use OAR.

Limitations

Sample size was small and observer bias may be present

CONCLUSION

OAR is an easy and reliable tool to screen ankle fractures. It can be used in both the outpatient departments and emergency rooms. In a country with as massive a health care burden as ours, it can reduce the number of unnecessary radiographs and thus reduce exposure, cost, and time of medical professionals.

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Ethical approval: The study was approved by the institutional ethics committee

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