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

Abhishek Kumar Thakur, Prakriti Raj Kandel

ABSTRACT

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.

1. Consultant Orthopedic Surgeon, Sumeru City hospital, Lalitpur
2. Associate Professor, Department of Orthopedics, Universal College of Medical Sciences, Bhairahawa

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For Correspondence
Dr. Abhishek Kumar Thakur
Consultant Orthopedic surgeon,
Sumeru City hospital, Lalitpur
Email: abhishekthakur176@gmail.com
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). 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, 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 should be missed. Steiil 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). 

![Figure 1. The Ottawa Ankle Rules for ankle and foot radiography](image)

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 and have been widely applied in many countries. 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 Steiil et al. 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**                                      |
| OARs+       | OARs-   | Total |
| Fracture    | 6       | 0     | 6     | 2     | 0     | 2    |
| No fracture | 10      | 9     | 19    | 3     | 6     | 9    |
| **Midfoot group**                                   |
| 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.2,4,14-19 OARs were developed and validated by its Canadian inventors2,4 and used in various clinical settings. OARs are easy to memorize and simple to apply, in addition, these rules have been successfully and favorably validated in various countries.2,4,6,13-24 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.23 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.1,3,4,6,13,14,19,22,23,28 Result of present study is similar to those of Stiell et al14 and various other studies13,16,19,21. 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 heath 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.

REFERENCES

1. Cockshott WP, Jenkin JK, Pui M. Limiting the use of routine radiography for acute ankle injuries. Can Med Assoc J. 1983;129:129–131.
2. Heyworth J. Ottawa ankle rules for the injured ankle. Br J Sports Med. 37:194.
3. Stiell IG, Greenberg GH, McKnight RD, Nair RC, McDowell I, Worthington JR. A study to develop clinical decision rules for the use of radiography in acute ankle injuries. Ann Emerg Med 1992;21:3849.
4. Stiell IG, Greenberg GH, McKnight RD, Nair RC, McDowell I, Reardon M et al. Decision rules for the use of radiography in acute ankle injuries: refinement and prospective validation. JAMA 1993;269:112732.
5. Stiell IG, Wells G, Laupacis A, Brison R, Verbeek R, et al. Multicentre trial to introduce the Ottawa ankle rules for use of radiography in acute ankle injuries. Br Med J 1995;311: 594–597.
6. Auley GR, Ravaud P, Giraudie B, Kerboul L, Nizard R, et al. Implementation of the Ottawa ankle rules in France: a Multicenter randomized controlled trial. JAMA, 1917;277:1935–1939.
7. Yuen MC, Sim SW, Lam HS, Tung WK. Validation of the Ottawa Ankle Rules in a Hong Kong ED. Am J Emerg Med 2001;19:429–432.
8. Knudsen R, Vijdrea R, Damborg F. Validation of the Ottawa Ankle Rules in a Danish emergency department. Dan Med Bull. 2010;57:A4142.
9. Can U, Ruckert R, Held U, Buchmann P, Platz A, et al. Safety and efficiency of the Ottawa Ankle Rules in a Swiss population with ankle sprains. Swiss Med Wkly, 138: 292–296.
10. Stiell IG, Bennett C. Implementation of clinical decision rules in the emergency department. Acad Emerg Med, 14:955–959.
11. Pigman EC, Klug RK, Sanford S, Jolly BT. Evaluation of the Ottawa clinical decision rules for the use of radiography in acute ankle and midfoot injuries in the emergency department: An independent site assessment. Ann Emerg Med, 1994;24:41–45.
12. Bessen T, Clark R, Shabih S, Hughes G. A multifaceted strategy for implementation of the Ottawa Ankle Rules in two emergency departments. BMJ 2002;339:b3056.
13. Leder JJ, Kesari A, Smolinski RJ. Implementation of the Ottawa ankle rule in a university sports medicine center. Med Sci Sports Exerc, 34:57–62. (PMID: 11782648)
14. Sujitkumar P, Hadfield JM, Yates TW. Sprain or fracture? An analysis of 2000 ankle injuries. Arch Emerg Med 1986; 3:1016.
15. Brooks SC, Potter BT, Rainey JB. Inversion injuries of the ankle: clinical assessment and radiographic review. BMJ 1981; 282:6078.
16. Vargish T, Clarke WR. The ankle injury: indications for the selective use of x-rays. Injury 1983;14:50712.
17. Gleadhill DNS, Thomson JY, Simms P. Can more efficient use be made of x-ray examinations in the accident and emergency department? BMJ 1987; 294:9437.
18. Brand DA, Frazier WH, Kohlhepp WC, Shea KM, Hoefer AM, Ecker MD et al. A protocol for selecting patients with injured extremities who need x-rays. N Engl J Med 1982; 306:3339.

19. Svenson J. Need for radiographs in acutely injured ankle. Lancet 1988;1:2445.

20. Szczesny G, Sypniewski M, Deszczynski J. Application of the Ottawa ankle rules in the ankle and midfoot injuries: verification of the method on the basis of own material. Chirurgia Narzadow Ruchu I Ortopedia Polska. 1999; 64:433-439.

21. Yduen MC, SIm SW, Lam HS, Tung WK. Validation of the Ottawa ankle rules in a Hong Kong ED. Am J Emerg Med. 2001; 19:429-432.

22. Wynn-Thomas S, Love T, McLeod D, Vernall S, Kljakovic M, Dowell A et al. The Ottawa ankle rules for the use of the diagnostic x-ray in the after hours medical centre in New Zealand. New Zealand Med. J. 2002;115:184.

23. Shahram Yazdani, Hesam Jahandideh, Hossein Ghofrani. Validation of the Ottawa Ankle Rules in Iran: A prospective survey. BMC Emergency Medicine 2006, 6:3 (doi: http://dx.doi.org/10.1186/1471-227X-6-3, PMID:16480520, PMCID:PMC1386702)

24. M. Marinelli, A.Di Giullio, M. Macini. Validation of the Ottawa ankle rules in a second-level trauma center in Italy. J Orthopaed Traumatol. 2007; 8:1620.

25. Kelly AM, Richards D, Kerr L, Grant J, O'Donovan P, Basire K et al. Failed validation of a clinical decision rule for the use of radiography in acute ankle injury. NZ Med J. 1994;107:294-5.