Comparison of Ottawa Ankle Rules and Bernese Ankle Rules in Acute Ankle and Midfoot Injuries

Ayak ve ayak bileği yaralanmalarında Ottawa ayak bileği kuralları ve Bernese ayak bileği kurallarının karşılaştırılması

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Ozkan KOSE,[1] Servan GOKHAN,[2] Ayhan OZHASENEKLER,[2]
Mustafa CELIKTAS,[3] Seyhmus YIGIT,[3] Serkan GURCAN[4]

[1]Antalya Training and Research Hospital, Department of Orthopedics and Traumatology, Antalya

[2]Diyarbakır Training and Research Hospital, Department of Emergency Medicine, Diyarbakır

[3]Diyarbakır State Hospital, Department of Orthopedics and Traumatology, Diyarbakır

[4]Diyarbakır Training and Research Hospital, Department of Orthopedics and Traumatology, Diyarbakır

SUMMARY

Objective: The purpose of this study was to compare the sensitivity and specificity of Ottawa Ankle Rules (OAR) and Bernese Ankle Rules (BAR) in acute ankle and midfoot injuries in the emergency department.

Methods: 100 consecutive patients presented to our emergency department with acute ankle and/or midfoot injuries following a blunt trauma were included. Patients were physically examined and evaluated regarding the BAR and OAR respectively by the same emergency medicine physician. All patients were referred for standard radiography of the ankle or foot or both according to the presence of pain or tenderness in one or both of these zones. Radiography results were interpreted by a consultant orthopedic surgeon who had not examined the patients. Sensitivity, specificity, positive and negative predictive values of each test were calculated.

Results: Radiographic examinations showed 19 fractures out of 100 investigated patients. Sensitivity and specificity of OAR were 100% and 77% respectively. Sensitivity and specificity of BAR were 94% and 95% respectively. Positive and negative predictive values of OAR were 51% and 100% respectively while positive and negative predictive value of BAR found to be 81% and 98% respectively.

Conclusions: This study showed that OAR has better sensitivity than BAR. However, BAR has better specificity than OAR. Although BAR has better specificity, we still suggest use of OAR due to its 100% sensitivity.

Key words: Ankle; Bernese Ankle Rules; foot; fracture; Ottawa Ankle Rules.

ÖZET

Amaç: *Bu çalışmada, acil servise ayak ve ayak bileği yaralanması nedeniyle başvuran hastalarda, Ottawa ayak bileği kuralları (OAK) ve Bernese ayak bileği kurallarınının (BAK) sensitivite ve spesifitesini karşılaştırmayı amaçladık.*

Gereç ve Yöntem: *Künt ayak ve ayak bileği yaralanması sonrası acil servise başvuran 100 ardışık hasta çalışmaya dahil edildi. Hastaların muayeneleri yapıldı, OAK ve BAK aynı acil hekimi tarafından sırayla değerlendirildi. Tüm hastalara, ağrı ve hassasiyetin tek bir bölge veya iki bölgeyi içermesine göre standart ayak veya ayak bileği radyografileri istendi. Radyografi sonuçları, hastaları muayene etmeden bir ortopedi uzmanı tarafından yorumlandı. Her test için sensitivite, spesifite, pozitif ve negatif prediktif değer hesaplandı.*

Bulgular: *Radyografik değerlendirmeler, incelenen 100 hastanın 19'unda kırıkları göstermiştir. OAK'nın sensitivite ve spesifitesi sırasıyla %100 ve %77 idi. BAK'nın sensitivite ve spesifitesi sırasıyla %94 ve %95 idi. OAK'nın pozitif ve negatif prediktif değerleri sırasıyla %51 ve %100 idi. BAK'nın pozitif ve negatif prediktif değerleri sırasıyla %81 ve %98 idi.*

Sonuç: *Bu çalışma OAK'nın BAK'dan daha sensitif olduğunu göstermiştir. Bunun yanında, BAK, OAK'dan daha spesifiktir. Biz, BAK daha spesifik olmasına rağmen, %100 sensitiviteye sahip olduğu için OAK'nın kullanımını öneriyoruz.*

Anahtar sözcükler: *Ayak bileği; Bernese ayak bileği kuralları; ayak; kırık; Ottawa ayak bileği kuralları.*

Correspondence

Ozkan KOSE, M.D.

Antalya Training and Research Hospital, Department of Orthopedics and Traumatology, Antalya, Turkey.

Tel: +90 - 242 - 249 44 00
E-mail: drozkankose@hotmail.com

Introduction

Acute ankle and midfoot injuries are one of the most common reasons for presenting to A&E departments.[1] Radiography is performed on almost all patients to rule out a fracture. However, only 15-20% of patients have a clinically significant fracture.[2-4] In other words, radiography is not necessary for most of these patients.

Various clinical decision rules have been introduced to pick up the patients with fracture, therefore to reduce the number of unnecessary radiographic examination in this segment of patients up to date.[2,5,6] Ottawa Ankle Rules (OAR) is the most popular and widely accepted clinical guideline to help the physician as to decision making regarding need for x-ray examination after ankle and mid-foot injury. It was first developed in 1992 by Steill et al.[2] Since its introduction, several studies all around the world validated the OAR.[3,4,7,8] The use of the rules has been shown to have nearly 100% sensitivity for ankle and mid-foot fractures and has reduced the need for radiographic examinations. The most important problem with this guideline, however, is its low specify.[9,10] Concerns about increasing the specificity enforced the innovation of modifications of OAR or new guidelines.[11]

Recently, Eggli et al. described a new indirect examination test called Bernese Ankle Rules (BAR) that is proposed to have better specificity than OAR.[5] Although, several studies which investigate a single decision rule are present in the relevant literature, a few study compares two different clinical guidelines.[6,12,13]

The purpose of this study is to compare the sensitivity and specificity of OAR and BAR in acute ankle and midfoot injuries in the emergency department.

Material and Methods

This prospective study was performed in a 3-month period on 100 consecutive patients presenting to our emergency department with acute ankle and/or midfoot injuries following a blunt trauma. The research was carried out according to the Declaration of Helsinki principles. Patients who were less than 18 years of age, those admitted later than 48 hours, those referring for re-evaluation, pregnant patients, and those with multiple traumas or decreased level of consciousness that may preclude the rating were excluded from study. Patients were physically examined and evaluated regarding the BAR and OAR respectively by the same emergency medicine physician (Fig. 1, and Fig. 2). Each patient's data was recorded. All patients were referred for standard radiography of the ankle or foot or both according to the presence of pain or tenderness in one or both of these zones. Radiography results were interpreted by a consultant orthopedic surgeon who had not examined the patients. Sensitivity, specificity, positive and negative predictive value of each test was calculated.

Results

100 patients were included to the study. There were 32 female and 68 male patients. The mean age was 30.7±10.3. The most common mechanism of injury was inversion injury to the ankle (79 patients, 74%). 64 patients sustained the injury during sports, 21 patients sustained the

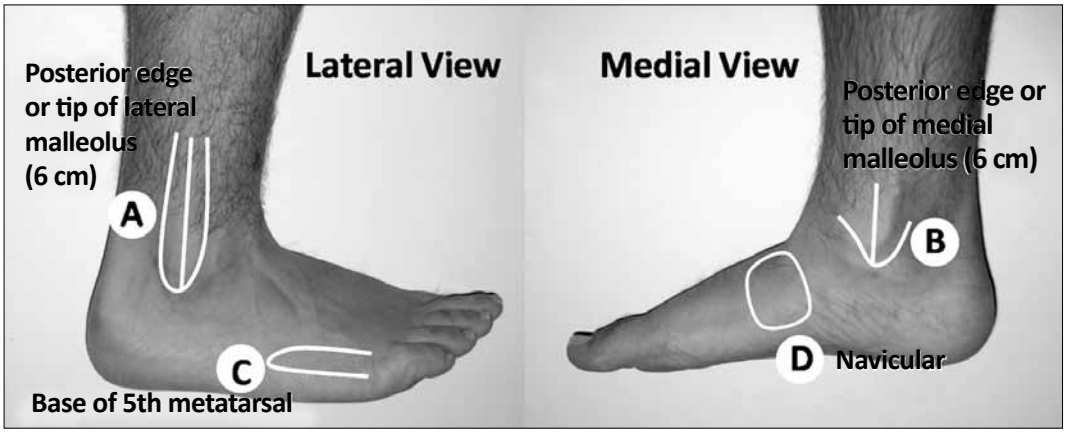

Fig. 1. *Ottawa Ankle Rules. Ankle radiographs are required if; (1) There is bone tenderness at A, or; (2) There is bone tenderness at B, or; (3) Inability to bear weight both immediately and in ED Foot radiographs are required if; (1) There is bone tenderness at C, or; (2) There is bone tenderness at D, or; (3) Inability to bear weight both immediately and in ED.*

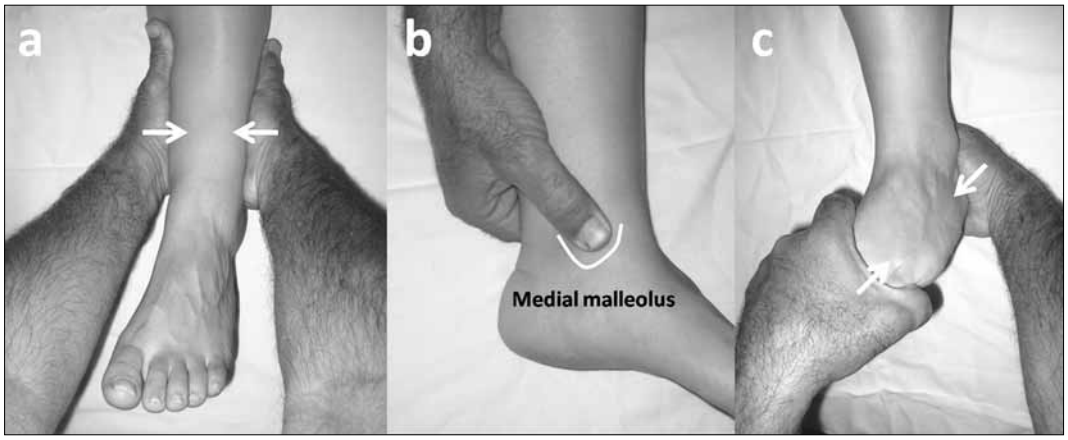

Fig. 2. *Bernese Ankle Rules. If any of these clinical examination causes pain, the diagnosis is acute fracture and radiographic examination is required (Ankle radiographs for a and b, foot radiographs for c.)* **(a)** *Indirect fibular stress. The malleolar fork is compressed approximately 10 cm proximally to the fibular tip, avoiding direct palpation of the injured region.* **(b)** *Direct medial malleolar stress. The thumb is pressed flatly on the medial malleolus.* **(c)** *Compression Stress of the midfoot and hindfoot. One hand fixes the calcaneus in neutral position and the other hand applies a sagittal load on the forefoot, so that the midfoot and hindfoot are compressed.*

injury during daily walking, and the remaining reported other reasons. Radiographic examinations showed 19 fractures out of 100 investigated patients (Table 1). Sensitivity and specificity of OAR were 100% and 77% respectively. Sensitivity and specificity of BAR were 94% and 95% respectively. Positive and negative predictive values of OAR were 51% and 100% respectively. Positive and negative predictive value of BAR were 81% and 98% respectively (Table 2). Further analysis of data revealed that BAR failed to pick up the fracture in one patient who had a non-displaced fifth metatarsal base fracture. OAR was rated as positive in 18 patients who had no fracture. 12 out of these 18 patients were rated as positive due to inability to bear weight both immediately and in ED.

Discussion

This study showed that OAR has better sensitivity than BAR. However, BAR has better specificity than OAR. Examination in BAR depends on applying indirect forces to the injured region without direct compression on the bone when we exclude medial malleolar stress test. Therefore, it is postulated that false-positive results were prevented by not producing pain with direct palpation of the bone.[5] However, majority of false-positive results of OAR in this study (12 out of 18) were due to inability to bear weight both immediately and in ED. Therefore, we suggest that '*inability to bear weight both immediately and in ED*' should be questioned in OAR. This may be the reason that reduces the specificity. When we exclude these cases, the specificity would be 92% which is quite similar to BAR.

Table 1. *Distribution of fractures*

	Number of cases
Lateral malleolar fracture	9
Bimalleolar fracture	1
Medial malleolar fracture	1
Fifth metatarsal base fracture	8
Total	19

OAR is an instrument that is calibrated towards high sensitivity to minimize the number of missed fractures, at the expense of specificity. In a recent systematic review, sensitivity of OAR ranged from 98.2% to 100%, and specificities ranged from 47.9% to 26.3% in 27 included studies.[14] In our study, similarly the sensitivity of was found 100%, on the contrary, specificity was found 77% which is higher than reported in the previous studies. There may be various reasons for this gross discrepancy between our results and other studies. It has been shown that pain perception may vary greatly according to previous pain experience, sex, ethnicity, cultural background and personal traits.[15] Vivid expression of pain leads more false-negative results, as the test depends on subjective patient rating. It also depends on how the examination is performed.

Table 2. *Summary of all data showing the rate of injuries and conformity of the OAR and BAR results with diagnostic feature*

	Fracture	No Fracture	Total	
OAR positive	19	18	37	Positive predictive value 51%
OAR negative	0	63	63	Negative predictive value 100%
Total	19 Sensitivity 100%	81 Specificity 77%	100	
	Fracture	**No Fracture**	**Total**	
BAR positive	18	4	22	Positive predictive value 81%
BAR negative	1	77	78	Negative predictive value 98%
Total	19 Sensitivity 94%	81 Specificity 95%	100	

In his original study, Eggli et al. reported that sensitivity and specificity of BAR was 100% and 91%. They postulated that BAR increased the specificity without loss in the sensitivity. However, our results were different from this study. BAR failed to pick up a patient with a fifth metatarsal base fracture where OAR easily detected this fracture. BAR uses '*Compression stress of the mid- and hind foot*' test to identify the midfoot injuries.[5] In our opinion, distraction instead of compression should be performed which seems more logical because distraction of the fracture ends would produce much more pain due to periosteal irritation. On the other hand, specificity was even higher than their original study supporting their hypothesis.

BAR prevented excess X-ray examination in six patients (6%) which may be underestimated. Although BAR has better specificity we still suggest use of OAR due to its 100% sensitivity. In emergency department, to pick up a fracture is more important than to rule out a fracture due to medico legal problems.

Limitations: Our study has some strengths and limitations. All patients were assesed by the same investigator and all patients had radiographic control. However, the number of patients was low, which may decrease the strength of our results. Further investigations on large number of patients may increase the reliability.

Conclusions

This study showed that OAR has better sensitivity than BAR. However, BAR has better specificity than OAR. Although BAR has better specificity we still suggest use of OAR due to its 100% sensitivity. Development of specific and sensitive guidelines may solve these problems in the near future. Combination of examination methods seems to be a possible solution.

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