ORIGINAL ARTICLE

The role of Ottawa ankle rules in geriatric emergency department visits

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ABSTRACT

BACKGROUND: Ankle injuries are a common reason for visits to the emergency department (ED). An effective diagnosis and treatment process is crucial for the swift recovery of patients and for alleviating congestion in EDs. This study aims to evaluate the adequacy and effectiveness of the Ottawa Ankle Rules (OAR) in geriatric patients presenting to the emergency department (ED).

METHODS: Between February 2022 and November 2022, 160 patients aged 65 and older (118 women, 42 men) who presented to the ED with isolated ankle injuries were included in the study. We calculated the sensitivity, specificity, positive predictive value, and negative predictive value of the OAR.

RESULTS: The study found fractures in 37.5% of patients. The sensitivity of the OAR was 98.33%, the specificity was 86%, the negative predictive value was 98.85%, and the positive predictive value was 80.82%.

CONCLUSION: This study demonstrates that the OAR is highly sensitive in the geriatric population but shows some limitations in terms of specificity and positive predictive value. These results support the effectiveness of using the OAR in evaluating ankle injuries in the geriatric population but also highlight the need for cautious application due to the potential for false-positive outcomes.

Keywords: Ankle fracture; geriatric; Ottawa ankle rules.

INTRODUCTION

Ankle injuries are a significant concern in emergency department (ED) visits. These injuries frequently occur during sports activities, falls, or daily routines, affecting individuals across all age groups.[1-3] The prevalence of ankle injuries is critical for the effective management of emergency service resources. A proficient diagnosis and treatment process is essential for the rapid recovery of patients and for reducing congestion in EDs. In this context, determining the correct diagnostic approaches while assessing the severity of the injury is critically important for both patient health and the efficient use of health system resources.

In elderly patients, ankle injuries may present different clinical characteristics compared to younger individuals. In this age group, factors such as decreased bone density, imbalance, chronic illnesses, and medication use can increase the risk of injury.[4,5] Ankle injuries can have particularly severe consequences for elderly patients, as they can elevate the risk of falls and significantly reduce quality of life. Additionally, the healing process after injury in the elderly typically takes longer, and the risk of complications is higher.[6-8] Therefore, the necessity of adopting age-specific approaches in the diagnosis and treatment of ankle injuries in elderly patients becomes evident.

The Ottawa Ankle Rules (OAR) are a set of guidelines utilized in EDs to evaluate ankle injuries.[9] These rules were developed to identify which patients require radiography (X-ray). Based on specific clinical findings and palpation points, the rules aim to reduce the unnecessary use of radiography, thereby minimizing radiation exposure.[10] When used to efficiently

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and rapidly assess the severity of an injury, the OAR not only accelerates the diagnosis process but also contributes to the more efficient use of ED resources.

This study specifically aims to evaluate the adequacy of the OAR in patients aged 65 and above presenting to the ED. Our research will explore the accuracy rate of the OAR in this age group, the reduction in radiography usage, and consequently, its contribution to the more efficient use of ED resources. Our hypothesis is that the OAR will demonstrate a high accuracy rate in patients aged 65 and over, and the implementation of these rules will significantly reduce unnecessary radiography usage.

MATERIALS AND METHODS

This prospective observational study was conducted in the emergency department of Kartal Dr. Lütfi Kırdar City Hospital between February 2022 and November 2022. Approval was obtained from the hospital's ethics committee (ethics committee ruling number: 2022/514/228/1, date: June 30, 2022).

The study included patients who presented to the ED with isolated ankle injuries and were aged 65 and above. The exclusion criteria were chronic injuries (lasting more than 10 days), solely skin-specific injuries (e.g., lacerations, abrasions), and being under the age of 65.

The OAR are a set of clinical criteria used to determine the need for radiographic imaging in ankle injuries, based on ankle palpation tenderness and specific walking abilities. According to the OAR, an ankle X-ray is needed if there is bone tenderness within the posterior 6 cm of the lower tibia or near the inside ankle bone, if there is tenderness within the posterior 6 cm of the lower fibula or near the outer ankle bone, or if the patient cannot walk four steps either at the site of the incident or during the examination. Similarly, a foot X-ray is recommended if there is tenderness at the navicular bone or the base of the fifth metatarsal, or if the patient is unable to walk four steps either at the scene or during the exam (Fig. 1).[9]

Patients were examined by researchers trained specifically in the OAR and data collection techniques before being referred to another physician. Follow-up and treatment data of the patients were retrospectively obtained from a hospital-based electronic dataset and independently reviewed by at least two researchers to minimize potential biases.

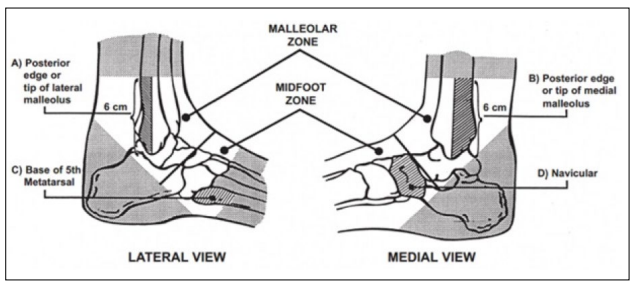

Figure 1. Locations for palpation within the malleolar and midfoot zones.

Statistical Analysis

Descriptive statistical methods were utilized for data analysis. These methods calculated the means, frequencies, and percentage distributions of variables in the dataset. The analysis of relationships between categorical variables was conducted using the Chi-square Independence Test and Fisher's Exact

Table 1. Participant characteristics

Variables	n (%)
Number of participants	160
Age, years	73.6±6.9; 95% CI (72.57; 74.74)
Gender	
Female	118 (73.8)
Male	42 (26.2)
Trauma side	
Right	96 (60.0)
Left	64 (40.0)
Mechanism of injury	
Inversion	39 (24.3)
Eversion	43 (26.9)
Plantar flexion	5 (3.1)
Direct trauma/other	73 (45.7)
Treatment	
Medical	153 (95.6)
Surgery	7 (4.4)
Ottawa	
(-)	87 (54.4)
(+)	73 (45.6)
Fracture (radiology)	
(-)	100 (62.5)
(+)	60 (47.5)
Fracture type*	
Tibia distal	2 (3.3)
Lateral malleolus	15 (25.0)
Medial malleolus	11 (18.3)
Bimalleolar	8 (13.3)
5th metatarsal	17 (28.3)
Navicular	2 (3.3)
Cuboid	2 (3.3)
Talus	3 (5.0)

CI: Confidence intervals. *Percentages in this section are calculated for the 60 patients with fractures.

Table 2. Accuracy of the OAR in the evaluation of ankle and foot injuries

	Fracture (+) n (%)	Fracture (-) n (%)	
Ottawa (+)	59 (98.3)	14 (14.0)	Positive Predictive Value: 80.8%
Ottawa (-)	1 (1.7)	86 (86.0)	Negative Predictive Value: 98.8%
	Sensitivity: 98.3%	Specificity: 86.0%	

Test. Statistical analyses were performed with the Statistical Package for the Social Sciences (SPSS) software (version 23.0; SPSS Inc., Chicago, IL, USA). The potential reduction in ankle radiographs is expressed as a percentage decrease, comparing the actual number of radiographs taken to the number that would have been ordered based solely on the clinical decision rule. This reduction is calculated using the following formula: [(Total number of radiographs actually performed - Number of radiographs that would have been ordered based on the clinical decision rule) / Total number of radiographs actually performed] x 100. A power analysis conducted with G*Power software determined that, to achieve a power of 0.90 with a Type I error (alpha) of 0.05, and considering the calculated effect size, a total of 128 patients is required.

RESULTS

The study included 160 geriatric patients. The average age was 73.6±6.9 years, with 73.8% (n=118) female and 26.2% (n=42) male participants. The mechanisms of injury were inversion (24.3%, n=39), eversion (26.9%, n=43), plantar flexion (3.1%, n=5), and direct trauma or other causes (45.7%, n=73) (Table 1). Regarding treatment, 95.6% (n=153) of the patients received medical treatment, while 4.4% (n=7) underwent surgical intervention. Radiological examinations detected fractures in 37.5% (n=60) of the patients, with types of fractures including lateral malleolus (25.0%, n=15), medial malleolus (18.3%, n=11), bimalleolar (13.3%, n=8), 5th metatarsal (28.3%, n=17), distal tibia (3.3%, n=2), navicular (3.3%, n=2), cuboid (3.3%, n=2), and talus (5.0%, n=3) fractures (Table 1).

The sensitivity of the OAR was found to be 98.3%, specificity 86.0%, positive predictive value 80.8%, and negative predictive value 98.8% (Table 2).

These results indicate that strict adherence to the OAR could lead to a 54.3% decrease in the number of unnecessary ankle radiographs. However, this approach could miss one case of a fourth metatarsal fracture, representing 1.7% of the cases, as this particular fracture would not have been detected if the decision to conduct an X-ray had been based solely on the OAR outcome.

DISCUSSION

This study aimed to evaluate the effectiveness of the OAR in geriatric patients. The results demonstrate that the OAR has high sensitivity and specificity rates, yet there remains a risk of missing certain types of fractures. This underscores that while the OAR is a valuable tool for assessing ankle injuries, its limitations must be taken into consideration.

The evaluation of ankle injuries in the geriatric population necessitates special attention due to age-related factors. Decreased bone density and balance issues in this age group can not only increase the risk of injury but also prolong the healing process.[11,12] Additionally, the heightened sensitivity of elderly patients to injuries, coupled with a higher risk of complications, underscores the clinical significance of ankle injuries in this demographic. Thus, it is critical to factor in age-specific characteristics and needs when diagnosing and treating ankle injuries in geriatric patients.

The OAR offers significant advantages to clinicians in the assessment of ankle injuries. By minimizing unnecessary radiography, this clinical tool streamlines the diagnostic process and facilitates more efficient use of emergency department resources.[13,14] However, the limitations of the OAR must be recognized. Specifically, given the risk of overlooking certain fracture types, a holistic approach that incorporates clinical evaluation and patient history is essential. This approach is vital for accurate diagnosis and effective treatment planning.

Our study's findings highlight that the OAR provides high sensitivity and reasonable specificity in the geriatric population, aligning with the results of similar previous studies. The literature suggests that the OAR exhibits high sensitivity (approximately 96.4% - 99.6%) but lower specificity (26.3% - 47.9%).[15-18] This indicates that while the OAR is an effective tool for identifying ankle injuries, care must be taken to mitigate the risk of false-positive results. Consistent with this literature, our study endorses the use of the OAR as an efficient diagnostic tool in the geriatric population.

The effectiveness of the OAR in geriatric patients underscores the importance of their careful application, especially considering the age-related physiological changes that may affect diagnostic outcomes. Although the OAR's high sensitivity and specificity rates are commendable, the potential to overlook certain fracture types underscores the need for clinicians to incorporate comprehensive clinical assessments and patient history into their evaluation processes. This integrated approach ensures more accurate diagnoses and effective treatment plans, highlighting the nuanced application of the OAR in the geriatric population.

Moreover, our study underscores the significance of further research to explore the OAR's applicability across different subgroups within the elderly population. Considering the variations in bone density, balance, and comorbidity profiles among older adults, future studies could offer valuable insights into optimizing the OAR's use. Addressing these gaps would not only enhance diagnostic accuracy but also contribute to developing more tailored strategies for managing ankle injuries in geriatric patients, ultimately improving patient outcomes and ED resource utilization.

This study has some limitations. Firstly, the limited number of geriatric patients and the study's single-center design may restrict the generalizability of the results. Secondly, its retrospective nature could lead to missing or biased clinical data. Additionally, variations in clinicians' interpretation and experience with applying the OAR can influence outcomes, complicating efforts toward standardization. We acknowledge that the study did not differentiate the effectiveness of the OAR across specific age groups beyond 65, nor did it examine the direct impacts of diabetes mellitus (DM) and neuropathic pain, which are significant considerations in this demographic. Additionally, our inability to collect detailed information on patients' osteoporosis status and Body Mass Index (BMI) restricted our capacity to conduct regression analyses to further explore these factors. Identifying these considerations highlights valuable directions for future research to refine the application of the OAR and understand the influence of comorbidities such as DM on injury assessment.

CONCLUSION

In conclusion, this study demonstrates that the OAR offers high sensitivity and reasonable specificity in the evaluation of ankle injuries in geriatric patients. These results suggest that the OAR can be an effective tool in minimizing unnecessary radiography and expediting diagnostic processes. However, the study also underscores some limitations of the OAR, particularly the risk of overlooking rare fracture types. These findings highlight the necessity of careful evaluation and adopting individualized approaches when utilizing the OAR in the geriatric population.

Ethics Committee Approval: This study was approved by the Kartal Dr. Lütfi Kırdar City Hospital Ethics Committee (Date: 30.06.2022, Decision No: 2022/514/228/1).

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ORİJİNAL ÇALIŞMA - *ÖZ*

Geriatrik acil servis başvurularında Ottawa ayak bileği kurallarının rolü

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AMAÇ: Acil servis (AS) başvurularında ayak bileği yaralanmaları önemli bir yer tutmaktadır. Etkin bir tanı ve tedavi süreci, hastaların hızla iyileşmesi ve acil servislerdeki tıkanıklığın azaltılması için hayati öneme sahiptir. Bu çalışmanın amacı, acil servise başvuran geriatrik hastalarda Ottawa ayak bileği kurallarının (OAR) yeterliliğini ve etkinliğini değerlendirmektir.

GEREÇ VE YÖNTEM: Şubat 2022-Kasım 2022 tarihleri arasında, izole ayak bileği yaralanması şikayetiyle acil servise başvuran 65 yaş ve üzeri 160 hasta (118 kadın, 42 erkek) çalışmaya dahil edilmiştir. OAR'nin sensitivitesi, spesifitesi, pozitif prediktif değeri ve negatif prediktif değeri hesaplandı.

BULGULAR: Çalışmada, hastaların %37.5'inde fraktür tespit edilmiştir. OAR'nin sensitivitesi %98.33, spesifitesi %86, negatif prediktif değeri %98.85 ve pozitif prediktif değeri %80.82 olarak bulunmuştur.

SONUÇ: Çalışma, OAR'nin geriatrik popülasyonda yüksek sensitiviteye sahip olduğunu, ancak spesifite ve pozitif prediktif değer açısından bazı sınırlılıklar gösterdiğini ortaya koymaktadır. Bu sonuçlar, geriatrik popülasyonda ayak bileği yaralanmalarının değerlendirilmesinde OAR'nin kullanımının etkinliğini desteklemekte, ancak aynı zamanda yanlış pozitif sonuçlar açısından dikkatli kullanılması gerektiğini göstermektedir.

Anahtar sözcükler: Ayak bileği kırığı; geriatrik; Ottawa ayak bileği kuralları.

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