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Shetty Test Challenges Ottawa Ankle Rules in Detecting Foot and Ankle Fractures: A Prospective Comparative Study

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ABSTRACT

Objectives: Ankle joint injuries are among the most common orthopedic injuries and are associated with significant healthcare costs. To reduce unnecessary radiographic screening, diagnostic tools such as the widely accepted Ottawa Ankle Rules (OARs) have been developed. However, the accuracy of OARs in excluding fractures remains uncertain. Recently, a new diagnostic test, the Shetty Test (ST), has been introduced. This prospective comparative study aimed to evaluate the diagnostic accuracy of the "ST" in comparison to the "OARs" for detecting ankle and foot fractures.

Methods: A total of 112 consecutive adult patients (>18 years old) were included in the study. They were presented to the Emergency Department of a University Hospital in Alexandroupolis due to an ankle or foot injury. Data were collected over 6 months, from November 2022 to May 2023.

Results: The sensitivity of the ST was 68.4%, specificity was 76.3%, positive predictive value (PPV) was 37.1%, and negative predictive value (NPV) was 92.2%. For the OARs, sensitivity was 94.7%, specificity was 15%, PPV was 18.5%, and NPV was 93.3%. When at least one of the tests was positive, the sensitivity and NPV increased to 100%.

Conclusion: The ST was found to be reliable; however, it did not outperform the OARs in this study. Nevertheless, when used in conjunction, the two tests significantly improved sensitivity and the NPV. Due to its simplicity and reproducibility, the ST could be a valuable tool in daily clinical practice, particularly for non-orthopedic emergency department personnel.

Keywords: Ottawa ankle rules, Shetty test, Foot and ankle, Fracture, Screening.

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Introduction

Orthopedic injuries involving the ankle joint are among the most frequently encountered injuries in clinical practice [1]. In the United States, approximately 10% of patients seeking medical attention in the Emergency Department (ED) annually present with ankle joint injuries, resulting in an estimated annual cost of $2 billion for the treatment of such injuries [2]. Radiographic imaging is commonly used alongside clinical examination to evaluate potential fractures in these patients. To reduce the unnecessary use of radiographic screening, several diagnostic tools and criteria have been developed to identify patients with a high likelihood of fracture [3, 4]. The Ottawa Ankle Rules (OAR) are the most widely accepted and extensively studied screening tool for identifying patients with a high probability of fracture. However, their accuracy in terms of excluding fractures remains uncertain [5, 6]. Moreover, the OAR requires patients with potential foot or ankle fractures to bear weight, which can be impractical during the acute phase of trauma due to significant pain. Furthermore, the rules require the evaluation of specific anatomical landmarks, which may prolong the physical examination. Nursing and non-orthopedic staff may also encounter difficulties in recognizing these anatomical landmarks, implementing OARS challenging in some settings.

Recently, a new diagnostic test, the "Shetty Test" (ST), has been introduced for the exclusion of ankle fractures. This test is simpler to perform and does not require specialized expertise. Preliminary studies suggested that the ST demonstrated promising outcomes in identifying ankle fractures; however, further research is required to validate its reliability and effectiveness in broader clinical settings [7-11]. This study aimed to evaluate the reliability of the "Shetty test" as a screening tool for fractures around the foot and ankle and to compare its performance with the Ottawa Ankle Rules.

Patients and Methods

This prospective comparative study included 112 consecutive adult patients (>18 years old) who presented to the Emergency Department (ED) of a University Hospital with ankle or foot injuries. Patients were examined by either a trainee or a specialized Orthopaedic surgeon. Data were collected over 6 months, from November 2022 to May 2023. A clinical examination was conducted, which included the ST and Ottawa Ankle Rules, alongside plain radiographs to rule out fractures. Patients with open fractures, dislocations, or those who were pregnant were excluded from the study, as the performance of the test was either not feasible or irrelevant. Demographical data, such as age and sex, mechanism of injury, ability to bear weight, and Visual Analog Scale (VAS) scores for pain assessment, were collected to document and report the perceived pain associated with ankle injuries. The present study was approved by the Local Ethical Committee of the University General Hospital (registration number 47440/19-10-2022). All participants provided written informed consent before inclusion in the study. Test results were prospectively collected, and statistical analysis was performed using SPSS version 23.0 software (SPSS Inc., Chicago, IL, USA). The categorical variables were presented as frequencies and percentages, and continuous variables were expressed as mean±SD. The OAR and ST were compared between fracture and non-fracture groups, using crosstabs and Pearson's Chi-squared test. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated for both tests.

Ottawa Ankle Rules (OAR)

According to the OAR guidelines, an ankle radiograph is required if there is bony tenderness at the medial malleolus or along its posterior edge, bony tenderness at the lateral malleolus or along its posterior edge, or if the patient is unable to take four steps during the examination. Similarly, a foot radiograph is required if there is bony tenderness upon palpation of the navicular bone or the fifth metatarsal base, or if the patient is unable to take four steps during the examination [12].

Shetty Test (ST)

To perform the ST, the patient was positioned in a sitting position on the examination bed with their lower limbs suspended. The examiner supported the patient's sole in their palm and asked the patient to exert pressure as if walking. If the patient experienced an increase in pain during this maneuver, the test was considered positive, strongly suggesting the presence of a fracture. In such cases, additional radiographic testing was recommended to confirm the diagnosis (Figure 1) [9].

Fig. 1. "The Shetty test". The whole foot is supported and the patient is asked to exert pressure simulating weight bear. If the pain worsens the test is considered positive.

Results

A total of 112 consecutive patients, with a mean age of 39.6±15.8 years, were included in the study. Females comprised 57% of the cohort (n=64), and 82% of the patients sustained inversion injuries of the foot and ankle. The mean VAS score for pain was 5.9±2.3, and almost 85% of the patients were able to bear weight after the injury. Plain radiographs confirmed the presence of foot or ankle fractures in 17% of the patients (Table 1). The Shetty test was positive in only 31.3% of the patients, while OAR was positive in 86.6% of the patients. The sensitivity of the ST was 68.4%, and the specificity was 76.3%. The PPV was 37.1%, and the NPV was 92.2%. For the OAR, the sensitivity was 94.7%, and the specificity was 15%. The PPV was 18.5%, and the NPV was 93.3%. The inability to bear weight had a sensitivity of 52.6% and the specificity was 92.5% for detecting fractures. The PPV was 58.8%, and the NPV was 90.5%. When both tests (ST and OAR) were positive, the sensitivity was 63.1%, and the specificity was 79.5%. The PPV was 38.7%, and the NPV was 91.3% (Table 2). When at least one of the tests (ST or OAR) was positive, the sensitivity increased to 100%, and the specificity decreased to 11.8%. The PPV was 18.8% and the NPV was 100%.

Discussion

The main finding of this study was that OAR demonstrated higher sensitivity (94.7% vs 68.4%) but lower specificity (15% vs 76.3%) than ST. Despite the higher sensitivity of the OAR, both tests showed only a slight difference in NPV (93.3% for OAR vs 92.2% for ST), while the PPV of the ST was significantly higher, nearly double that of the OAR (37.1% vs 18.5%). Importantly, this study indicated that ST could complement the OAR in screening for foot and ankle fractures. When at least one of the two tests was positive, sensitivity reached 100%, with an NPV of 100%.

Although the ST appeared to outperform the OAR in terms of specificity, the present results did not

Table 1. Demographic information of the included patients in this study

	N	Age (years)	Sex (%)		VAS	Inversion Injury (%)	Fracture (%)	Ability to weight-bear (%)	Positive ST (%)	Positive OAR (%)
			Male	Female						
Population	112	39.6±15.8	43	57	5.9±2.3	82	17	85	31.3	86.6

VAS: Visual Analog Scale; ST: Shetty test; OAR: Ottawa ankle rules

Table 2. Comparing sensitivity, specificity, and predictive values of the Shetty Test and Ottawa Ankle Rules for screening foot and ankle fractures

Variable	Shetty Test	Ottawa Ankle Rules	Inability to weight bear	At least one test positive
Sensitivity (%)	68.4	94.7	52.6	100
Specificity (%)	76.3	15	92.5	11.8
NPV (%)	92.2	93.3	90.5	100
PPV (%)	37.1	18.5	58.8	18.8

NPV: Negative Predictive Value; PPV: Positive Predictive Value

Table 3. Available studies evaluating the "Shetty Test"

A/A	Year	Author	Type of Study	Patients	Results	
1.	2012	Shetty *et al.,* (9)	Prospective Cohort	50	Sensitivity: 100%, Specificity: 91.49% NPV: 100%, PPV: 43%	
2.	2018	Ojeda-Jimenez *et al.,* (8)	Prospective Cohort	100	Sensitivity: 100% Specificity: 95.56% NPV: 100%, PPV: 71.40%	
3.	2020	Jovic *et al.,* (7)	Prospective Comparative ST vs OAR	54	OAR Sensitivity: 92% Specificity: 10%	ST Sensitivity: 92% Specificity: 40%
4.	2022	Ak *et al.,* (11)	Prospective Comparative ST vs OAR	207	OAR Sensitivity: 97.22% Specificity: 48.89% NPV:97.06%, PPV: 50.36%	ST Sensitivity: 51.39% Specificity: 85.93% NPV:76.82% PPV: 66.07%
5.	2023	Avinca *et al.,* (10)	Prospective Comparative ST vs OAR	150	OAR Sensitivity: 85.71% Specificity: 82.61% NPV:95.00% PPV: 60.00%	ST Sensitivity: 82.86% Specificity: 77.39% NPV:93.6% PPV: 52.73%

OAR: Ottawa Ankle Rules; ST: Shetty Test; NPV: Negative Predictive Value; PPV: Positive Predictive Value

conclusively establish the superiority of the ST over the OAR. The evidence in the literature on this topic is still scarce, as ST is a relatively new diagnostic tool, and only 5 studies examining its performance are available. The results of these studies, which are summarized in Table 3, are somewhat controversial [7-11]. Specifically, two cohort studies reported that the ST had a sensitivity of 100% and a specificity of over 90% [8, 9]. However, in subsequent studies, the ST didn't perform as well, though, in two out of the three comparative studies, it was at least equal to OAR, a finding that aligned with the results of this study [7, 10, 11]. One possible explanation for these discrepancies was the subjective nature of the ST, as it relied solely on the patient's perception of pain. Despite these inconsistencies, the ST remains a simple, quick, and easy-to-perform test, particularly for non-orthopedic professionals working in the ED, as it does not require the identification of specific anatomical landmarks, unlike the OAR. Furthermore, as indicated by previous studies as well as the present findings, the ST is not only straightforward but also reliable, with a fair ability to detect or exclude ankle fractures.

The potential synergistic effect of combining the OAR and ST during clinical examination has not been previously explored. This study suggested that such a combination could yield promising results, as both sensitivity and NPV reached 100% when at least one of the two tests was positive. However, further research is warranted to further investigate this possibility and its potential clinical utility.

This study is not without limitations. First, although it is a prospective comparative study with specific inclusion and exclusion criteria, the sample size remained relatively small, making it unwise to generalize these findings. Second, all tests in this study were performed by orthopedic residents or consultants, and it was unclear whether the same results could be replicated by other ED professionals. However, the findings of a previous study, involving both nursing staff and physicians, found no significant differences in test performance between the two groups [7]. Finally, the low specificity of the OAR (15%) in this study was notable, though it was consistent with findings from other published studies, as the OAR was generally considered a nonspecific test [5, 6, 13].

Even though ST didn't outperform OAR in this study, it was proven to be a reliable diagnostic tool. The literature on its performance remained controversial, but its simplicity and reproducibility made it a valuable addition to clinical practice, particularly for non-orthopedic ED personnel. Future research is essential not only to accurately define the sensitivity and specificity of the ST but also to determine whether its synergistic use with the OAR, as demonstrated in this study, could improve the screening of foot and ankle fractures.

Declaration

Ethics Approval and Consent to Participate: The present study was approved by the Local Ethical Committee of the University General Hospital with registration number 47440/19-10-2022. To participate in the study, participants were asked to sign an informed consent form.

Consent for Publication: All authors consent to the publication of this manuscript.

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References

1. Amendola A, Williams G, Foster D. Evidence-based approach to treatment of acute traumatic syndesmosis (high ankle) sprains. Sports Med Arthrosc Rev. 2006; **14**(4):232–6.
2. Herman L. A 20-year perspective on the Ottawa Ankle Rules: Are we still on solid footing? JAAPA. 2021; **34**(7):15–20.
3. Pijnenburg ACM, Glas AS, De Roos MAJ, Bogaard K, Lijmer JG, Bossuyt PMM, et al. Radiography in acute ankle injuries: The Ottawa Ankle Rules versus local diagnostic decision rules. Ann Emerg Med. 2002; **39**(6):599–604.
4. Sujitkumar P, Hadfield JM, Yates DW. Sprain or fracture? An analysis of 2000 ankle injuries. Arch Emerg Med. 1986;**3**(2):101-6.
5. Pires R, Pereira A, Abreu-e-Silva G, Labronici P, Figueiredo L, Godoy-Santos A, et al. Ottawa ankle rules and subjective surgeon perception to evaluate radiograph necessity following foot and ankle sprain. Ann Med Health Sci Res. 2014; **4**(3):432-5.
6. Gomes YE, Chau M, Banwell HA, Causby RS. Diagnostic accuracy of the Ottawa ankle rule to exclude fractures in acute ankle injuries in adults: a systematic review and meta-analysis. BMC Musculoskelet Disord. 2022; **23**(1):885.
7. Jovic D, Johnson D, Tolmie L, Stanier P, Hutchins R. Shetty test in ankle and foot trauma: An emergency department pilot study assessing specificity and sensitivity. Emerg Med Australas. 2020; **32**(4):683–6.
8. Ojeda-Jiménez J, Méndez-Ojeda MM, Martín-Vélez P, Tejero-García

S, Pais-Brito JL, Herrera-Pérez M. Experience using the 'Shetty test' for initial foot and ankle fracture screening in the Emergency Department. Rev Esp Cir Ortop Traumatol (Engl Ed). 2018; **62**(5):343–7.

9. Shetty V, Wasnik S, Hegde C, Shetty V, Kasture S, Thakur H. The "shetty test" in ankle injuries: Validation of a novel test to rule out ankle fractures. Eur J Orthop Surg Traumatol. 2013; **23**(7):831–3.
10. Avinca, Taş M. Comparison of Shetty ankle test and Ottawa ankle rules in ankle injuries. Eur Rev Med Pharmacol Sci. 2023; **27**(5):1852–5.
11. Ak R, Kurt E, Bahadırlı S, Semih Çakır M, Bilgü AS, Kurt ŞZE. The Comparison of Ottawa Ankle Rules and Shetty test performances in foot-ankle trauma patients visited to the emergency department. Injury. 2022; **53**(6):2287–91.
12. Stiell IG, Mcknight RD, Greenberg GH, Mcdowell I, Nair RC, Wells GA, et al. Implementation of the Ottawa Ankle Rules. JAMA. 1994; **271**(11):827–32.
13. 13. Morais B, Branquinho A, Barreira M, Correia J, Machado M, Marques N, et al. Validation of the Ottawa ankle rules: Strategies for increasing specificity. Injury. 2021; **52**(4):1017–22.