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Original Article

Reproducibility of the Lauge-Hansen, Danis-Weber, and AO classifications for ankle fractures☆

Lucas Lopes da Fonseca[a], *Icaro Gusmão Nunes*[a], *Rodrigo Reis Nogueira*[a], *Gustavo Eduardo Vieira Martins*[a], *Antônio Cesar Mesencio*[b], *Sílvia Iovine Kobata*[c,*]

[a] *Departamento de Ortopedia e Traumatologia, Hospital Municipal Odilon Behrens, Belo Horizonte, MG, Brazil*

[b] *Serviço de Ortopedia, Instituto de Previdência dos Servidores do Estado de Minas Gerais, Hospital da Previdência, Belo Horizonte, MG, Brazil*

[c] *Departamento de Ortopedia e Traumatologia, Hospital das Clínicas, Universidade Federal de Minas Gerais, Belo Horizonte, MG, Brazil*

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ABSTRACT

Objective: This study evaluated the reproducibility of the three main classifications of ankle fractures most commonly used in emergency clinical practice: Lauge-Hansen, Danis-Weber, and AO-OTA. The secondary objective was to assess whether the level of professional experience influenced the interobserver agreement for the classification of this pathology.

Methods: The study included 83 digitized preoperative radiographic images of ankle fractures, in anteroposterior and lateral views, of different adults that had occurred between January and December 2013. For sample calculation, the estimated accuracy was approximately 15%, with a sampling error of 5% and a sampling power of 80%. The images were analyzed and classified by six different observers: two foot and ankle surgeons, two general orthopedic surgeons, and two second-year residents in orthopedics and traumatology. The Kappa statistical method of multiple variances was used to assess the variations.

Results: The Danis-Weber classification indicated that 40% of the agreements among all observers were good or excellent, whereas only 20% of good and excellent agreements were obtained using the AO and Lauge Hansen classifications. The Kappa index was 0.49 for the Danis-Weber classification, 0.32 for Lauge Hansen, and 0.38 for AO.

Conclusion: The Hansen-Lauge classification presented the poorest interobserver agreement among the three systems. The AO classification demonstrated a moderate agreement and the Danis-Weber classification presented an excellent interobserver agreement index, regardless of professional experience.

☆ Study conducted at the Departamento de Ortopedia e Traumatologia, Hospital Municipal Odilon Behrens (HMOB), Belo Horizonte, MG, Brazil.

* *Corresponding author.*
E-mail: silviakobata@yahoo.com.br (S.I. Kobata).

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Análise da reprodutibilidade das classificações de Lauge-Hansen, Danis-Weber e AO para as fraturas de tornozelo

Palavras-chave:
Traumatismos do tornozelo
Variações dependentes do observador
Fraturas do tornozelo/classificação

RESUMO

Objetivo: Avaliar a reprodutibilidade e comparatividade das três principais classificações usadas para fraturas do tornozelo mais comumente empregadas nos servicos de emergência: Lauge-Hansen, Danis-Weber e AO-OTA. Observar secundariamente se existe influência da experiência profissional sobre a concordância entre observadores para a classificação dessa patologia.

Métodos: Foram usadas 83 imagens digitalizadas de radiografias pré-operatórias, em incidências anteroposterior e perfil, de fraturas do tornozelo de adultos diferentes, ocorridas entre janeiro e dezembro de 2013. No cálculo amostral assumiu-se precisão da estimativa de 15%, com erro amostral de 5% e com poder de amostragem de 80%. A leitura e a classificação das fraturas foram feitas por seis observadores, dois cirurgiões de pé e tornozelo, dois ortopedistas generalistas e dois residentes do segundo ano de ortopedia e traumatologia. A análise das variações foi feita pelo método estatístico de Kappa de múltiplas variâncias.

Resultados: Com o uso da classificação de Danis-Weber, 40% das concordâncias foram consideradas boas ou excelentes entre todos os observadores, enquanto nas classificações de Lauge Hansen e AO apenas 20% se apresentaram boas ou excelentes. O índice Kappa acumulado para cada classificação foi de 0,49 para a classificação de Danis-Weber, 0,32 para Lauge Hansen e 0,38 para a classificação AO.

Conclusão: A classificação de Lauge Hansen apresenta a pior concordância interobservador dentre as três classificações. A classificação da AO demonstrou concordância intermediária e a de Danis-Weber apresentou o maior índice de concordância interobservador, independentemente da experiência do profissional.

Introduction

Ankle injuries account for 5 million emergency department visits in the United States, 85% of which are sprains and the remaining 15%, fractures. Ankle fractures are among the most common injuries treated by orthopedic surgeons; they account for 9% of all fractures and 36% of all lower limb fractures, generating an annual cost of US$ 10 billion per year in that country. These injuries tend to have a bimodal distribution, peaking in young men and elderly women. Incidence in elderly women has tripled in the last 30 years, due to population aging.[1] The treatment of these fractures depends on the careful identification of the extent of bone lesions, as well as the damage to the soft tissues and ligaments. The assessment of a suspected ankle fracture includes detailed medical history, physical examination, appropriate radiographic examination, and initial treatment options. Once the fracture has been well defined, the key to a successful outcome lies in the anatomical restoration of the structures involved for tibiotalar joint reconstruction.[2]

The first classification methodology for ankle fractures was developed by Percival Pott *apud* Budny and Young,[1] which described the number of fractured malleoli, stratifying the lesions as unimalleolar, bimalleolar, or trimalleolar. Although this classification is intuitive and easy to reproduce, it does not distinguish stable and unstable injuries, nor does it guide treatment.[3]

Lauge-Hansen,[4] through cadaveric experiments, proposed a classification system that correlates the lines of ankle fractures with certain trauma mechanisms. The fractures are classified into four groups: supination-adduction, supination-eversion, pronation-eversion, and pronation-abduction. The first term indicates the position of the foot at the time of injury and the second refers to the direction of the force applied to the foot at the time of the trauma.[4–6] According to this classification, the supine-eversion pattern is the most frequent in emergency departments, with a prevalence ranging from 40% to 75%.[7]

Danis[8] and Weber[9] proposed another classification system based on the localization of the main fibular fracture line, dividing the fractures into three groups: type A (below the syndesmosis level), type B (at the syndesmosis level), and type C (above the syndesmosis). Despite its simplicity and ease-of-reproduction, this classification does not consistently predict the extent of the injury in the tibiofibular syndesmosis, as several studies have already demonstrated, since type B and C fractures can be treated in a similar way regardless of the location, according to the presence or absence of ligament instability at the site. This classification also disregards the state of the structures on the medial side, a vital osteoligament structure, and it is not possible to compare prognosis,