Evaluation of Lauge-Hansen Designation of Weber C Fractures

Richard M. Hinds, MD [1], Patrick C. Schottel, MD [2], Marschall B. Berkes, MD [3], Milton T.M. Little, MD [4], David L. Helfet, MD [5], Dean G. Lorich, MD [6]

[1] Research Fellow, Orthopaedic Trauma Service, Hospital for Special Surgery, New York, NY
[2] Orthopaedic Resident, Department of Orthopaedic Surgery, Hospital for Special Surgery, New York, NY
[3] Orthopaedic Surgeon, United States Air Force, Landstuhl Regional Medical Center, Landstuhl, Germany
[4] Orthopaedic Trauma Fellow, Harborview Medical Center, Seattle, WA
[5] Director, Orthopaedic Trauma Service, Hospital for Special Surgery, New York, NY
[6] Associate Director, Orthopaedic Trauma Service, Hospital for Special Surgery and New York Presbyterian Hospital, New York, NY

ARTICLE INFO

ABSTRACT

Associations between Weber C ankle fractures and pronation external rotation (PER) injuries of the Lauge-Hansen classification have often been incorrectly correlated. The purpose of the present study was to evaluate the Lauge-Hansen designation of Weber C fractures by establishing the proportion of Weber C fractures that are supination external rotation (SER), supination adduction (SA), pronation abduction (PA), PER, and hyperplantarflexion variant fractures. A clinical database of operative ankle fractures treated by the senior author (D.G.L.) was reviewed. The inclusion criteria were patient age older than 16 years, preoperative ankle radiographs, and Weber C fracture designation. A total of 132 patients met the inclusion criteria, and the proportion of PA, PER, SER, SA, and variant fractures among the Weber C fractures was analyzed. PA fractures accounted for 0.8% (n = 1), PER fractures 56.8% (n = 75), SER fractures 35.6% (n = 47), and hyperplantarflexion variant fractures 6.8% (n = 9) of the 132 Weber C fractures. Patients with Weber C-PER fractures were more commonly male ($p = .005$) and younger ($p = .003$) and demonstrated a greater fibular fracture height ($p < .001$) than those with Weber C-SER and Weber C-variant fractures. Our study quantitatively demonstrated that not all Weber C fractures occur secondary to pronation injuries. This distinction is important, because all pronation injuries will demonstrate medial ankle injury, but SER and variant fractures might not. We therefore recommend careful evaluation of the fibular fracture characteristics, including the direction of fracture propagation and the distance from the tibial plafond, when classifying Weber C fractures using the Lauge-Hansen system, because correct classification is vital in preparation for appropriate operative treatment.

© 2014 by the American College of Foot and Ankle Surgeons. All rights reserved.

Weber C fractures are widely encountered in clinical practice and have been reported to account for 14% to 47% of all ankle fractures (1,2). This fracture pattern has been defined as a fibular fracture superior to the level of the syndesmosis (2–4). Despite its prevalence, Weber C fractures have often been incorrectly correlated with the Lauge-Hansen classification system. A common inaccurate association has been found between Weber C ankle fractures and pronation external rotation (PER) injuries of the Lauge-Hansen classification system (2,5,6). Although a distinct correlation is present between the 2 injury patterns, they are not synonymous. One

should not indiscriminately categorize a Weber C ankle fracture as a PER injury without closely evaluating the characteristics of the fracture pattern, including fibular comminution, direction of the fibula fracture, and distance from the tibial plafond to the fibula fracture.

Proper identification of the Lauge-Hansen fracture pattern is important, because the classification system predicts osseoligamentous ankle injury. Although pronation ankle injuries, including PER and pronation abduction (PA) ankle fractures, and supination external rotation (SER) IV fractures indicate injury to medial ankle structures, injury-free medial structures in lower grade SER fractures (i.e., SER II and SER III) are often seen. Ankle fractures without a medial malleolar fracture or deltoid ligament injury do not necessitate medial ankle exploration. The misdiagnosis of Weber C-SER II or Weber C-SER III fractures as pronation ankle injuries may lead to the formulation of an inappropriate surgical treatment plan involving both medial and lateral structures. Thus, accurate designation of the

Lauge-Hansen fracture pattern is needed to formulate and implement an effective surgical treatment plan.

The purpose of the present study was to evaluate the Lauge-Hansen designation of Weber C fractures by establishing the proportion of Weber C fractures that are SER, supination adduction (SA), PA, PER, and hyperplantarflexion variant fractures. We hypothesized that SER fractures would account for a proportion of Weber C fractures.

Patients and Methods

The institutional review board approved the present study, and our clinical database of operative ankle fractures treated by the senior author (D.G.L.) from January 1, 2005 to May 31, 2013 was retrospectively reviewed. All 161 Weber C fractures were initially evaluated. The inclusion criteria were patient age older than 16 years, preoperative ankle radiographs, and Weber C fracture designation. Of the 161 patients, 29 were excluded because of inadequate imaging studies.

Patient gender and age were evaluated as the demographic data. The ankle injury profile included fracture side (left versus right), Lauge-Hansen classification, fibula fracture height (distance from tibial plafond to inferior most portion of the fibula fracture), geriatric fracture (age 65 years or older), and tibiotalar dislocation. The osseoligamentous injury pattern was determined by a fellowship-trained orthopedic trauma attending physician (D.G.L.) at data entry into the prospective database after examination of the preoperative radiographs, magnetic resonance imaging and/or computed tomography studies, and intraoperative assessment. Any unclassified ankle fractures were re-evaluated by 2 of the authors (R.M.H. and P.C.S.), and a consensus designation was determined. Weber C fractures were defined as suprasyndesmotic fibular fractures. Fracture categorization using the Lauge-Hansen classification system was performed according to the fibular fracture direction and ligamentous injury pattern (3,7–10). PER injuries were noted to have a fibula fracture in an anterosuperior to posteroinferior direction, PA injuries a transverse or oblique fibula fracture with or without comminution, and SER injuries a fibula fracture in an anteroinferior to posterosuperior direction. SA injuries were not expected in our cohort of Weber C fractures, because SA injuries result in either a distal fibular avulsion fracture or lateral collateral ligament injury (3,4,11). Hyperplantarflexion variant ankle fractures were defined as fractures with a double vertical fracture pattern of the posterior tibial plafond with posterolateral and posteromedial fragments separated by a sagittal fracture line in posterior ankle fractures with posteromedial extension or additional posterior fragments (9,12). The proportion of PA, PER, SER, SA, and hyperplantarflexion variant fractures among the Weber C fractures was analyzed.

Statistical Analysis

Descriptive statistics are presented as frequencies and percentages for categorical variables and the mean $\pm$ standard deviation for continuous variables. Associations between the categorical variables and the Lauge-Hansen classification were assessed using the chi-square test or Fisher's exact test. Relationships between the continuous variables and the Lauge-Hansen classification were assessed using Kruskal-Wallis tests with Bonferroni-corrected pairwise Mann-Whitney U tests. The level of significance for all tests was $p \leq .05$. Statistical analyses were performed using Statistical Analysis Systems, version 9.3 (SAS Institute, Cary, NC).

Results

A total of 132 Weber C ankle fractures were included in the present study. Males had incurred 75 of the 132 Weber C fractures (56.8%), and the overall mean age was 47 (range 17 to 91) years. Of the 132 fractures, 1 was PA III, 75 were PER (1 PER III and 74 PER IV), 47 were SER (1 SER II, 2 SER III, and 44 SER IV), and 9 were hyperplantarflexion variant ankle fractures (Figs. 1 to 4). PA fractures accounted for 0.8%, PER fractures for 56.8%, SER fractures for 35.6%, and variant fractures for 6.8% of the Weber C fractures (Fig. 5). No SA injuries were noted among the Weber C fractures. Geriatric fractures accounted for 31 of

Fig. 1. (*A*) Anteroposterior, (*B*) mortise, and (*C*) lateral radiographs of a pronation abduction injury–Weber C fracture.