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Lateral Talar Subluxation Measurements in Nonoperatively Managed Weber B Ankle Fractures

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Abstract

Background: Lateral talar subluxation (LTS) was introduced as a measurement tool for evaluating isolated Weber B ankle fractures, with LTS >4 mm on gravity stress (GS) radiographs possibly indicating need for surgery. This study reviews LTS measurements in nonoperatively managed isolated Weber B fibula fractures to further investigate the validity of this previously stated cutoff.

Methods: The senior authors previously reported outcomes of a novel algorithm for nonoperative management of isolated Weber B ankle fractures. Outcome scores reported include American Orthopaedic Foot & Ankle Society (AOFAS) hindfoot, Olerud-Molander (OMA), Foot and Ankle Ability Measure for activities of daily living (FAAM/ADL), and visual analog scale (VAS) scores. All patients achieved union of their fracture. LTS was measured on GS radiographs of both injured and contralateral uninjured extremities.

Results: Forty-two patients were included with minimum 1-year follow-up. Average age was 49 years (range 19-72). Mean measurements on injury GS radiographs were as follows: medial clear space (MCS) 4.45 mm (SD = 0.93), superior clear space (SCS) 3.46 mm (SD = 0.70), and LTS 2.33 mm (SD = 1.57, range 0-4.7 mm), with 35 (83.3%) patients having injury LTS ≤4 mm. Mean measurements on contralateral (uninjured) GS radiographs were as follows: MCS 3.39 mm (SD = 0.63), SCS 3.15 mm (SD = 0.50), and LTS 1.30 mm (SD = 1.28, range 0-4.8 mm). There was no statistically significant difference in all outcome measures based on amount of LTS (<2 mm, 2-4 mm, >4 mm).

Conclusion: Most patients had injury LTS ≤4 mm, although those with LTS >4 mm had excellent outcome scores. LTS measurements on normal ankles reveal a large range. LTS may be a useful adjunct in evaluating isolated Weber B ankle fractures but the 4-mm cutoff may not be entirely reliable. Further studies are required to validate LTS as a decision-making tool.

Level of Evidence: Level IV, case series.

Keywords: lateral talar subluxation, LTS, Weber B, ankle fracture, outcome scores

Introduction

Supination-external rotation (SER)–type ankle fractures are one of the most common orthopaedic injuries, yet indications for surgical management of isolated fibular fractures remains controversial. Stable patterns (Weber B, Lauge-Hansen SER-II) with no deltoid ligament disruption are managed nonoperatively, whereas unstable patterns (SER-IV) with medial-sided injury are treated surgically. It can be difficult to discern the difference between these 2 patterns when the medial-sided injury is through the deltoid complex, especially when there is no medial clear

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space (MCS) widening on standard radiographs. As such, manual and gravity stress radiographs have been used to evaluate the competence of the deltoid ligament.[1,11,17]

Many studies have suggested MCS measurements >4 or >5 mm on stress radiographs may be used to determine need for operative intervention.[3,5,14,18] However, some data have shown that the deltoid complex may still be intact even when MCS is >6 mm.[19,20] The senior authors previously described a novel algorithm for nonoperative management of Weber B ankle fractures with the following inclusion criteria: no MCS widening on weightbearing radiographs, gravity stress MCS <7 mm, within 2 mm of ipsilateral superior clear space (SCS), and within 2 mm of contralateral gravity stress MCS.[10] Outcomes were excellent, and this was maintained at midterm follow-up.[16] Haupt et al[8,9] recently described lateral talar subluxation (LTS) as a measurement tool for evaluating SER-variant ankle fractures, and the authors suggest that it may be superior to MCS to analyze medial ankle structure stability. LTS >4 mm was noted to be a potential cutoff used to determine need for surgical intervention.

To date, there has not been further clinical studies evaluating LTS as a measurement tool. In this study, we review LTS measurements in a cohort of nonoperatively treated isolated Weber B fibula fractures as well as their uninjured contralateral side. By doing so, we aim to better understand the value of LTS measurements as a tool for guiding treatment decisions and to investigate whether there is any correlation between the extent of LTS and patient outcomes.

Methods

This is a retrospective single-institution case series. We previously presented a novel protocol for nonoperative management of Weber B ankle fractures with gravity stress MCS widening <7 mm and within 2 mm of ipsilateral SCS and contralateral gravity stress MCS.[10] This cohort included patients aged 18 and older presenting to our Foot & Ankle Clinic with a Weber B lateral malleolus fracture with normal mortise on non-stress radiographs. As part of the original study, bilateral ankle radiographs were obtained including AP, lateral, and gravity stress mortise views. At any point during follow-up if the mortise on weightbearing radiographs were abnormal, surgical treatment was recommended. All patients enrolled into this nonoperative protocol achieved union of their fracture. Outcomes were excellent including American Orthopaedic Foot & Ankle Society (AOFAS) hindfoot, Olerud-Molander (OMA), Foot and Ankle Ability Measure for activities of daily living (FAAM/ADL), and visual analog scale (VAS) scores.[10] These outcome measures have all been previously validated.[2,4,6,7,12,13,15,21]

In this study, we utilize the same cohort of nonoperatively treated patients and existing radiographs. We report patient demographics and gravity stress radiographic measurements of the injured ankle as well as the uninjured contralateral ankle. These measurements include MCS, SCS, and LTS. The LTS measurements were done as described by Haupt et al,[9] utilizing the vertical line denoting the anterolateral rim of the ankle syndesmosis as well as the lateral edge of the talar dome. These 2 lines were extended and the horizontal distance between them was measured. Patients were excluded if they had radiographs with inadequate visualization of the anterolateral rim of the ankle syndesmosis or a poorly defined lateral edge of the talar dome that resulted in an inability to accurately measure LTS. We also reviewed the original cohort's outcome scores.

Table 1. Demographics and Outcomes of Nonoperative Cohort (N = 42).

Characteristic	Value
Age, y, mean (range)	49 (19-72)
Sex	
Male	16 (38)
Female	26 (62)
Outcome scores at 1-y follow-up, mean (SD)	
AOFAS	94.2 (7.5)
OMA	92.8 (12.3)
FAAM/ADL	94.0 (12.3)

Abbreviations: AOFAS, American Orthopaedic Foot & Ankle Society (hindfoot); FAAM/ADL, Foot and Ankle Ability Measure for activities of daily living; OMA, Olerud-Molander ankle score.

Basic descriptive statistics were used on all data sets derived from demographics, radiographic measurements, and outcome scores. To determine if there was any association between extent of LTS and the various outcome measures, we divided the cohort into those with LTS <2 mm, 2 to 4 mm, or >4 mm and performed a Kruskal-Wallis nonparametric test for each outcome measure. Significance was set at a P value of less than .05.

Results

Forty-two patients were included in this study and had minimum 1-year follow-up. Demographics and outcome scores are reported in Table 1. The average age of the cohort was 49 years (range 19-72) at the time of injury. Twenty-six (61.9%) were female. The mean MCS on injury gravity stress radiographs was 4.45 mm (SD 0.93), SCS was 3.46 mm (SD 0.70), and LTS was 2.33 mm (SD 1.57, range 0-4.7 mm), with 35 (83.3%) patients having injury LTS ≤4 mm (Table 2). Each patient also had contralateral gravity stress radiographs of their uninjured ankle. Contralateral mean MCS was 3.39 mm (SD 0.63), SCS 3.15 mm (SD 0.50), and LTS measured 1.30 mm (SD 1.28, range 0-4.8, mode 0), with 5 measurements higher than 3.0 mm. The mean difference between the injured and contralateral LTS was 1.04 mm.

Table 2. Gravity Stress View Radiographic Parameters.

	Injured Ankle (n = 42)	Uninjured Contralateral (n = 42)
MCS, mm, mean (SD)	4.45 (0.93)	3.39 (0.63)
SCS, mm, mean (SD)	3.46 (0.70)	3.15 (0.50)
LTS, mm, mean (SD)	2.33 (1.57)	1.30 (1.28)
Extent of LTS, n (%)		
<2 mm	16 (38)	28 (67)
2 to 4 mm	19 (45)	13 (31)
>4 mm	7 (17)	1 (2)

Abbreviations: LTS, lateral talar subluxation; MCS, medial clear space; SCS, superior clear space.

All patients achieved union of their fracture. At least 1 year after injury, the mean AOFAS Hindfoot score was 94.2 (range 66-100, SD = 7.5), the mean OMA score was 92.8 (range 50-100, SD = 12.3), and the mean FAAM/ADL was 94.0 (range 43-100, SD = 12.3). The mean VAS score for pain at 1 year was 0.49. There was no significant difference in outcome measures based on amount of lateral talar subluxation (<2 mm, 2-4 mm, >4 mm): AOFAS ($P = .41$), OMA ($P = .40$), FAAM/ADL ($P = .41$), pain VAS ($P = .16$).

Discussion

There remains no gold standard treatment algorithm for many SER-variant isolated Weber B distal fibula fractures. Historically, MCS has been the main radiographic parameter to help identify unstable SER-variant ankle fractures that require operative treatment. Recently, LTS has been proposed as an additional measurement tool.[9] The authors suggest that LTS measurements >4 mm may potentially indicate instability requiring operative intervention.[9]

In our series of nonoperatively treated isolated Weber B ankle fractures, all patients achieved union and had excellent outcomes. Most patients in our cohort had injury LTS ≤4 mm. However, 16.7% of patients had LTS >4 mm, with the highest measurement being 4.7 mm, reflecting successful nonoperative treatment even in those with LTS slightly greater than the previously stated 4-mm cutoff. In addition, there was no correlation between degree of LTS measurement and outcomes, although our study was not powered to evaluate this.

We also measured LTS in uninjured ankles, which to our knowledge is the first study to do so, with a mean of 1.30 mm, SD of 1.28 mm, and upper range of 4.8 mm. In theory, all uninjured ankles should have no lateral talar subluxation. However, we found that only 38% of normal ankles had 0 mm of subluxation (ie, continuous line from syndesmotic line to lateral side of talus). The remaining ankles with some amount of LTS may be explained by anatomic variables as previously reported, including valgus bend of the distal fibula at the lateral ankle gutter or increased talar width.[9] It appears that LTS measurements are more sensitive to ankle rotation on radiographs compared to the other established radiographic parameters such as MCS or SCS.

Based on the study design, some limitations should be addressed. The current study is a retrospective case series conducted at a single institution, which may limit the generalizability of the results. Our cohort of nonoperatively treated isolated Weber B ankle fractures used a novel protocol that may not reflect the clinical or radiographic parameters and cutoffs that are used by other surgeons. Our study is not designed to establish treatment guidelines using LTS, and our series of reported measurements in normal ankles is insufficient to establish normative values of LTS. Despite these limitations, the current study provides valuable insights into the use of LTS as a radiographic tool to evaluate ankle stability in isolated Weber B ankle fractures. This is important as no other published study has reported on this parameter since its original description.

In conclusion, LTS is a novel measurement tool to evaluate ankle stability in SER-variant ankle fractures. In our cohort of nonoperatively managed isolated Weber B ankle fractures with excellent outcomes, most patients had LTS ≤ 4 mm and all were ≤4.7 mm, and extent of LTS did not correlate with outcomes. However, with 16.7% of our patients having LTS > 4 mm, further investigation is required to assess the validity of the previously stated 4 mm cutoff for surgical intervention.[9] We also found that in normal uninjured ankles, the LTS was not consistently 0 mm as initially anticipated, indicating that this measurement may not be reliable and should not be used on its own when evaluating isolated Weber B ankle fractures. Other established radiographic parameters should still be used when evaluating the stability of certain SER-variant ankle fractures. Further studies are required to identify normative values and to validate LTS as a useful decision-making tool.

Ethical Approval

Ethical approval for this study was obtained from University of Michigan Institutional Review Board (HUM00145778)

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article. ICMJE forms for all authors are available online.

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