WBCT Can Effectively Diagnose Syndesmotic Instability Among Patients with Weber B Ankle Fractures

Rohan Bhimani, MD, MBA; Soheil Ashkani-Esfahani, MD; Bart Lubberts, MD, PhD; Philip Kaiser, MD; Lorena Bejarano-Pineda, MD; Gino Kerkhoffs, MD; Gregory R. Waryasz, MD; Christopher W. DiGiovanni, MD; Daniel Guss, MD, MBA

Category: Ankle; Trauma

Keywords: Alignment Weight Bearing CT; Syndesmotic Stability; Weber B Ankle Fractures

Introduction/Purpose: Diagnosing and treating syndesmotic instability that occurs in some Weber B ankle fractures is essential to restore normal ankle joint kinematics and optimize clinical outcomes however subtle instability can be difficult to identify. WBCT evaluates the syndesmotic joint under physiologic load. We compared the diagnostic sensitivities of one-dimensional (1D) distance, two-dimensional (2D) area, and three-dimensional (3D) volumetric measurement of the injured syndesmotic joint on WBCT, in patients with unilateral Weber B ankle fractures with surgically-confirmed syndesmotic instability, to the contralateral uninjured side.

Methods: Patients with unilateral surgically confirmed syndesmotic instability accompanying a Weber B type lateral malleolar ankle fracture (n = 23) who underwent preoperative bilateral foot and ankle WBCT were included. A separate group of patients with unilateral Weber B ankle fractures without syndesmotic instability and who underwent bilateral WBCT were included as a control group (n = 18). With the uninjured side serving as an internal control, measurements on bilateral WBCT images included: 1) syndesmotic area, 2) tibiofibular distance measured at the anterior, middle, and posterior aspect of the distal tibiofibular articulation, 3) fibular rotation, 4) distance from fibular tip to plafond, 4) fibular fracture displacement and 5) medial clear space distance. In addition, 3D volumetric measurements: 1) syndesmotic joint volume from the tibial plafond extending to 3cm and 5cm proximally, respectively 2) medial clear space volume, and 3) lateral clear space volume were calculated, and their sensitivities were compared to the aforementioned measurements.

Results: Among patients with unilateral syndesmotic instability with Weber B ankle fractures, all WBCT measurements except medial clear space distance, syndesmotic area, and anterior and posterior tibiofibular distance were significantly greater on the injured compared to the uninjured side (p-values ranging from <0.001 to 0.004). Of these measurements, 3D syndesmosis volumetric measurements spanning from the tibial plafond to a level 3cm and 5cm proximally had the highest relative volumetric ratio between the injured and uninjured side, suggesting high sensitivity to distinguish between stable and unstable syndesmotic injuries (p-values ranging from 0.001 to 0.036). In the control group without syndesmotic instability, all evaluated WBCT parameters except for MCS volume, and distal fibular tip to tibial plafond showed no significant side-to-side difference.

Conclusion: Bilateral WBCT can effectively diagnose syndesmotic instability among patients with Weber B ankle fractures. While middle incisura distance, fibular rotation, and 3D volumetric measurements can all be used to identify such instability, 3D syndesmotic volume measurements are the most sensitive and thus strongly recommended for future application in scenarios of clinical dilemma of syndesmotic injury-particularly when injuries are subtle. When performing these 3D volume measurements, it appears that syndesmosis volume extending from the tibial plafond to a height of 5cm proximally is best suited to evaluate such instability given the larger absolute side to side difference of 3.5 cm³.
Figure 1. Weightbearing computed tomography syndesmotic joint volumetric measurements in a patient having Weber B fracture with right sided syndesmotic instability. Anterior view. Image (A) Syndesmotic joint volume up to 3cm above the joint line. (B) Syndesmotic joint volume up to 5cm above the joint line. Abbreviations: L, left; R, right.

Figure 2. Weightbearing computed tomography syndesmotic joint measurements in a patient having Weber B fracture with right sided syndesmotic instability. Axial view images. Image (A) Syndesmotic joint area (shaded area). (B) Anterior tibiofibular distance. (C) Middle tibiofibular distance. (D) Posterior tibiofibular distance. Abbreviations: L, left; R, right.