Weightbearing CT Analysis of Hindfoot Alignment in Chronic Lateral Ankle Instability: A Multivariate Analysis of 124 Feet

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Introduction/Purpose: Varus hindfoot deformity may increase the risk of chronic ankle instability (CAI). Weightbearing CT (WBCT) semi-automated measurements and built-in databases may contribute to investigate the relationship between clinical and radiographic data. The objective of this study was to analyze hindfoot alignment (HA) in relation with CAI in a series of patients using these new tools. We hypothesized that there would be a positive correlation between a varus morphotype and a history of CAI.

Methods: This is a Level 3 retrospective comparative study of a continuous series of 124 feet (63 patients) referred from July to December 2016 and subsequently assessed by WBCT (PedCAT®, CurveBeam LLC). The measurement software (Talas®, Curvebeam LLC), gave HA as a value of Foot and Ankle Offset (FAO). This measures the offset between the center of the ankle joint and the median line of the foot joining the centers of the calcaneus and forefoot weight bearing surfaces. Data was prospectively saved in a database (CubeView®, CurveBeam, PA, USA). The definition of CAI was a history of at least 3 ankle sprains during a 6 months period. Exclusion criteria were medial instability and syndesmotic injuries (2 cases). A univariate analysis was conducted to study CAI against the following variables: gender (Fisher), BMI and FAO (Kruskal-Wallis). The significant variables were subsequently included in a multivariate logistic model.

Results: Nineteen feet had CAI, in 12 patients. Gender (p=0.0467 – the proportion of women for patients with CAI was 72.3%, compared to 33.3% without CAI) and FAO (p=0.0002) were significant in the univariate analysis. The mean FAO was respectively -1.40 (SD: 5.50) and 3.56 (SD: 5.31) with and without a history of CAI. No significant difference of age or BMI was shown. After verification of log-linearity between odds of CAI and FAO, the multivariate logistic regression adjusted for gender demonstrated a 15% increase of odds of CAI per unit increase of varus (adjusted Odds Ratio (CI95%): 0.858 (0.771-0.943) p=0.003), and no more significant effect of gender after adjustment on FAO (Odds ratio (CI95%) Female versus Male: 0.548 (0.185-1.669) p=0.277).

Conclusion: A positive linear relationship was found between Varus Hindfoot Alignment measured using a semi-automatic tool in WBCT and the odds ratio for Chronic Ankle Instability, thus confirming and quantifying previous findings. The recent development of semi-automatic measurements and prospective databases opens future perspectives for big data and multivariate analysis in foot and ankle pathology.