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Midfoot Charcot neuroarthropathy: a comparison of radiographs in patients with and without foot ulcers.

Katherine M. Raspovic, MedStar Georgetown University Hospital Washington, District of Columbia USA, Dane K. Wukich, Orthopaedic Surgery University of Pittsburgh Medical Center Pittsburgh, Pennsylvania USA

The **aim** of this study is to evaluate weightbearing radiographs in patients with midfoot Charcot neuroarthropathy (CN) secondary to diabetes and to compare the radiographic findings of CN patients with and without foot ulcers. **Materials:** 114 patients (50 with foot ulcers and 64 without ulcers) were identified and included in this study. None of the patients had previously undergone ankle, hindfoot or midfoot surgery. Nine radiographic measurements were made using digital technology (7 in the sagittal plane and 2 in the transverse plane). **Results:** There were no significant differences between the groups with regard to age, gender, duration of diabetes, prevalence of peripheral artery disease, body mass index or obesity. CN patients with foot ulcers had significantly greater deformity ($p<0.05$) when assessing the lateral talar first metatarsal angle, calcaneal pitch, cuboid height, calcaneal fifth metatarsal angle, talar declination and lateral tibiotalar angle. Medial column height and the two measurements in the transverse plane (hindfoot forefoot angle and AP talar first metatarsal angle) were not significantly different between the two groups. The results also indicated a strong correlation between calcaneal pitch and lateral calcaneal 5^{th} metatarsal angle (r=0.76, $p<0.0001$),calcaneal pitch and cuboid height (r=0.65, $p < 0.0001$) and lateral calcaneal 5^{th} metatarsal and cuboid height (r=0.63, $p<0.0001$).
Discussion: Sagittal plane deformities are more likely to be associated with foot ulceration in patients with CN than transverse plane deformities. A previous study by Bevan and Tomlinson reported that ulcers did not occur when the lateral talar first metatarsal angle was less than 27 degrees. Contrary to that study, we identified 11 of 46 patients (24%) with foot ulcers who had a lateral talar first metatarsal angle of < 27 degrees. The goal of CN treatment is to prevent foot ulceration, and heightened awareness should be entertained in patients with progressive deformity in the sagittal plane. Lateral column involvement is associated with a worse prognosis than medial column involvement, and progressive deformity of the lateral column may warrant surgical intervention to prevent ulceration. Lateral column involvement can be identified by a decrease in the cuboid height, decreased calcaneal pitch and decreased lateral calcaneal fifth metatarsal angle. As the deformity progresses, the insensate plantar skin is subjected to increased pressure from plantar bony prominences that may result in foot ulceration. Once ulceration develops the risk of infection and amputation rises dramatically, and has been reported to be 12 times higher in patients with CN and foot ulcers compared to CN patients without foot ulcers. This study can assist physicians in stratifying the risk for both ulceration and need for surgery in patients with CN based on reproducible radiographic measurements.