

Changes in Morphology of Metacarpal Bone Shaft in Patients with Rheumatoid Arthritis: A Prospective Longitudinal Peripheral Quantitative Computed Tomography Study over 5 Years

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ABSTRACT

Objective: Data on longitudinal changes in the geometry and density of the inflammation prone metacarpal bone are scarce. This study aimed to quantify the effect of rheumatoid arthritis (RA) on metacarpal bone shaft morphology.

Methods: This prospective study included consecutive postmenopausal RA patients who met the American College of Rheumatology Criteria (n=39) and consecutive postmenopausal healthy controls (HC) (n=42) (mean follow-up duration: 63 months). Peripheral quantitative computed tomography scans at 50% of the total metacarpal shaft (third metacarpal bone) were obtained at baseline and follow-up. Use of bisphosphonates (BP), glucocorticoids (GC), biologics, and disease-modifying anti-rheumatic drugs (DMARD) was monitored (baseline to follow-up). Total cross-sectional area (CSA), cortical-transitional zone and compact zone CSA, cortical volumetric bone mineral density, and compact cortex porosity were measured. A linear mixed-effects model was used to determine significant differences in the rate of change in the RA and control groups and in RA patient subgroups.

Results: Compared with HC, RA patients had lower handgrip strength (P=0.01). RA patients showed increased medullary CSA (P=0.004), higher cortical porosity (P=0.026), cortical transitional CSA (0.005), and higher total CSA (P=0.013) at baseline. RA status was correlated with a significantly higher loss of cortical bone mineral density (P=0.014). GC use >5 mg/day was positively correlated with a fourfold increase of medullary CSA (P=0.009) and resulted in a three- to fourfold loss of cortical density (P=0.002) and cortical CSA (P=0.004).

Conclusion: This study aimed to quantify the effect of rheumatoid arthritis (RA) on metacarpal bone shaft morphology. Compared to healthy controls, RA patients had increased cortical BMD loss. Prednisone dose correlated with increase in medullary CSA, loss of cortical area, and loss of cortical BMD. Patients with ACPA/ RF positivity had higher compact cortex porosity and higher transitional zone CSA. This study helps to understand how RA status, disease duration, and activity and glucocorticoid use may affect metacarpal bone shaft geometry and density over time.