

# Age-Related Changes in Proximal Humerus Bone Health in White Males

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## Abstract

The proximal humerus is a common site for osteoporotic fracture during aging, accounting for up to 5% of fractures to the appendicular skeleton. While falls onto an outstretched hand are usually physically responsible for proximal humerus fractures, the ability of the underlying bone to resist applied loads must also play a role. Few studies have assessed proximal humerus bone health with aging. The aim of the current study was to explore age-related bone changes at the proximal humerus in men. A cross-sectional study design was used to assess peripheral quantitative computed tomography (pQCT)-derived bone properties of the proximal humerus in a cohort of 112 white males (age range = 30-85 yrs). A tomographic slice of the non-dominant upper extremity was acquired at 80% of humeral length proximal from its distal end—a location corresponding to the surgical neck of the humerus. Images were assessed for cortical (Ct.BMC) and trabecular (Tb.BMC) BMC, total (Tt.Ar), cortical (Ct.Ar) and medullary (Me.Ar) area, periosteal (Ps.Pm) and endosteal (Es.Pm) perimeter, cortical thickness (Ct.Th), and bone strength index for compression (BSI<sub>c</sub>). BSI<sub>c</sub> was calculated as the product of Tt.Ar and the square of total volumetric BMD. Data were plotted against age and linear regression lines assessed for their slope. Slopes were subsequently converted to percent change in the bone property per year. During aging, the proximal humerus expanded with Tt.Ar and Ps.Pm increasing at rates of 0.40%/yr and 0.19%/yr, respectively. However, Me.Ar (0.62%/yr) and Es.Pm (0.34%/yr) expanded at faster rates such that there was net loss of both Ct.BMC (-0.23%/yr) and Tb.BMC (-1.08%/yr). Also, the more rapid expansion of Me.Ar relative to Tt.Ar meant that Ct.Ar (-0.15%/yr) and Ct.Th (-0.34%/yr) both decreased with age. The net result of these mass and structural changes was progressive loss of bone strength with age, as indicated by a 0.44%/yr decline in BSI<sub>c</sub>. These data provide a picture of bone changes at the proximal humerus during aging. They suggest that between age 30 and 80 yrs, approximately 54% and 11% of Tb.BMC and Ct.BMC at the proximal humerus is lost, respectively. They also suggest that compressive strength of the proximal humerus declines by 22% between age 30 and 80 years. These declines in proximal humerus bone health have implications for fracture risk at this location during aging.