

Sagittal Femoral Bow Is Dependent on Bone Density

John Lee, MD, MS¹; Samuel Rosenbaum, MD²; Manuel Schubert, MD²;

Stewart Wang, MD, PhD²; James Goulet, MD²;

¹Harborview Medical Center, Seattle, Washington, USA;

²University of Michigan, Ann Arbor, Michigan, USA

Background/Purpose: Despite implant modifications to better match the sagittal bow of the femur, anterior cortical perforation and abutment remain prevalent with intramedullary nail fixation of proximal femur fractures. Prior femoral bow analyses have demonstrated an association between femoral bow, gender, age, and length but none with bone density. We tested the hypothesis that femoral bow is dependent on bone density.

Methods: 167 patients with a positron emission CT scan and a DXA (dual xray absorptiometry) scan within 1 year of each other were analyzed. The sagittal radii of curvature (ROCs) of the outer and inner anterior cortical boundaries of the femur were determined with a novel custom MATLAB script. Associations between age, gender, femoral length, World Health Organization (WHO) T-score class, and femoral ROC were determined with regression analyses.

Results: Study included 138 females and 29 males, mean age 59 years (standard deviation [SD] = 15). Mean femur length was 42.7 cm (SD = 27.0). Average time between CT and DXA was 174 days (SD = 108). Mean outer and inner anterior ROCs were 149.5 cm (SD = 56.7) and 147.5 cm (SD = 54.4), respectively. 68, 81, and 18 patients had normal, osteopenic or osteoporotic hips, respectively, while 79, 60, and 23 had normal, osteopenic or osteoporotic lumbar spines, respectively. Five lumbar spines were too degenerative for bone density assessment. The ROC of the outer, but not the inner, anterior cortical boundary of the femur depended on WHO bone density classification at the hip ($P = 0.034$ for outer, $P = 0.114$ for inner). Femoral ROC was not dependent on lumbar spine bone density. In addition to bone density, femoral length was associated with ROC ($P = 0.015$ for outer, $P = 0.049$ for inner) while age and gender were not.

Conclusion: The sagittal bow of the femur depends on bone density. Caution should be taken during guide wire introduction, reaming, and intramedullary nail insertion in low radii of curvature femurs due to their low bone density, or alternative treatment options should be considered.