

Hounsfield Unit Values of the Lumbar Spine Serve as an Effective Tool for Preoperative Osteoporosis Screening in Patients With Osteoarthritis Undergoing Total Hip Arthroplasty

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INTRODUCTION: Hip osteoarthritis (OA) and osteoporosis often coexist, complicating bone mineral density (BMD) assessment owing to its degenerative changes. Additionally, coexisting spinal disorders complicate the evaluation of the lumbar spine BMD. Osteoporosis in total hip arthroplasty (THA) patients can affect intraoperative periprosthetic fractures, stem subsidence, aseptic loosening, higher revision rates, and even patient satisfaction with the surgery. Therefore, it is crucial for surgeons to evaluate BMD preoperatively, as the osteoporotic condition influences the choice of implants used, contributing to the success of the surgery. Hounsfield unit (HU) values of the lumbar spine is a useful method for assessing bone density, especially in cases of significant degenerative diseases, and may offer more reliable measurements. Therefore, this study aimed to investigate the correlation between lumbar spine HU values and BMD of the femur, lumbar spine, and distal radius in preoperative patients with THA with hip osteoarthritis. Additionally, we aimed to establish a cut-off value for lumbar HU to diagnose osteoporosis and osteopenia.

METHODS: In this retrospective analysis, 218 hips from consecutive patients with radiographically and clinically confirmed hip OA who underwent primary THA were included. All patients received preoperative DXA measurements at the total hip (TH), femoral neck (FN), lumbar spine (L2–L4), and distal radius within three months before surgery. Preoperative CT scans for 3D surgical planning were used to measure mean HU values within elliptical regions of interest in the cancellous bone of the mid-height L4 and L5 vertebral bodies. Pearson's correlation coefficients assessed associations between HU values and DXA T-scores at each site. Receiver operating characteristic (ROC) analysis determined area under the curve (AUC) and optimal HU cutoffs for diagnosing osteoporosis (T-score < -2.5) and osteopenia (T-score between -2.5 and -1.0).

RESULTS: The cohort (mean age 68.3 ± 11.0 years; 88% female) exhibited mean L4 and L5 HU values of 115.8 ± 47.0 and 120.0 ± 47.5 , respectively. Moderate positive correlations were observed between HU values and T-scores at all DXA sites, strongest for L5 HU versus non-arthritic TH T-scores ($\rho = 0.64$, $p < 0.01$) and L4 HU versus FN T-scores ($\rho = 0.62$, $p < 0.01$). For osteoporosis detection, ROC analysis yielded AUCs of 0.82 (L4) and 0.83 (L5) on the arthritic side, with cutoffs of 118.9 HU and 100.8 HU, respectively, and AUCs of 0.76 (L4) and 0.77 (L5) on the non-arthritic side (cutoffs 96.6 HU and 92.6 HU). For osteopenia, AUCs ranged from 0.78–0.84 across levels, with optimal HU thresholds between 112.6 and 128.7.

DISCUSSION AND CONCLUSION: Lumbar spine HU values measured on routine preoperative hip CT scans show moderate correlation with DXA-derived BMD across hip, spine, and radial sites in patients with hip OA. These opportunistic HU assessments can serve as a practical, cost-effective screening tool for identifying patients at risk of osteoporosis or osteopenia when DXA is unavailable or unreliable due to degenerative changes. Incorporation of HU-based screening into preoperative protocols may enhance perioperative planning and implant selection to improve THA outcomes.