Utility of Femoral Radiographic Indices for Preoperative Osteoporosis Screening in Postmenopausal Female Patients Undergoing Total Hip Arthroplasty for Osteoarthritis of the Hip

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INTRODUCTION:
Osteoporosis is common in postmenopausal women and may adversely affect outcomes of total hip arthroplasty (THA), including periprosthetic fracture, implant subsidence, and loosening. Dual-energy X-ray absorptiometry (DXA) is the gold standard for preoperative bone mineral density (BMD) assessment, but access and cost may limit its routine use. We aimed to determine whether simple femoral morphological indices measured on preoperative anteroposterior (AP) hip radiographs correlate with DXA-assessed BMD in postmenopausal women undergoing primary THA for hip osteoarthritis (HOA), and to establish diagnostic cutoffs for osteoporosis.
METHODS:
In this single-center retrospective study, we reviewed 181 hips in postmenopausal women (age ≥50 years) undergoing primary THA for Tönnis grade 3 HOA. Exclusion criteria included prior hip surgery, infection, metabolic bone disease, inadequate imaging, or DXA performed >3 months preoperatively. All patients underwent DXA of the total hip (TH), femoral neck (FN), lumbar spine (L2–4), and distal radius; T-scores were defined per World Health Organization criteria. Preoperative AP radiographs (internally rotated 15°) were used to measure five femoral indices: canal-to-calcar ratio (CCR), canal flare index (CFI), cortical thickness index (CTI), canal diaphysis ratio (CDR), and canal bone area ratio (CBAR). Pearson correlation assessed relationships between each index and T-scores, and receiver operating characteristic (ROC) analysis determined area under the curve (AUC) and optimal cutoff values for osteoporosis (T-score < -2.5).
RESULTS:
Among 95 osteoarthritic hips (surgical side) and 86 contralateral non-arthritic hips, mean age was 70 years (range 50–89) and mean body mass index 23.7 kg/m². T-scores for TH were –1.4 (surgical) and –1.1 (non-surgical), and for FN –1.9 and –0.6, respectively. Moderate negative correlations were observed between TH BMD and several indices; CBAR showed the strongest correlation on both surgical ($\rho = -0.61$, $p < 0.01$) and non-surgical sides ($\rho = -0.62$, $p < 0.01$). ROC analysis yielded AUCs of 0.75 (cutoff 0.47) on the surgical side and 0.74 (cutoff 0.49) on the non-surgical side for CBAR (both $p < 0.01$). CDR and CTI also demonstrated AUCs ≥0.70 with optimal cutoffs of 0.53 and 0.48 (surgical) and 0.51 and 0.47 (non-surgical), respectively.
DISCUSSION AND CONCLUSION:
Femoral radiographic indices, particularly CBAR, correlate moderately with DXA-assessed TH BMD even in advanced HOA and remain valid despite degenerative changes. In settings where preoperative DXA is unavailable or impractical, measurement of CBAR, CDR, or CTI on routine AP hip radiographs can serve as a simple, cost-effective screening tool to identify osteoporosis in postmenopausal women undergoing THA. Incorporation of these indices into preoperative assessment protocols may help inform implant selection and perioperative management to optimize long-term outcomes.