

## Osteopenia Screening Utilizing a Novel CT-Based DEXA Equivalent Algorithm

**BACKGROUND CONTEXT:** Vertebral compression fractures (VCF) are the most common type of osteoporotic fracture, accounting for as many fractures as hip and distal radius fractures combined. The prevalence is staggering, with VCFs affecting 25% of postmenopausal women older than 50 years of age, and 40% by 80 years of age. In the USA, costs attributable to VCFs alone have been appraised at more than \$1.07 billion with indirect costs due to patients and caregiver loss of productivity estimated at \$6 billion annually. Despite its prevalence, economic burden, and clinical symptoms, diagnostic testing for osteoporosis such as the DEXA scan is not routine. Fewer than 50% of eligible Medicare recipients undergo bone mineral density screening. In contrast, CT scanning for other conditions is readily utilized, with over 80 million scans performed annually in the US alone. At the authors' institution, a computerized CT-based algorithm has been introduced as a novel analytic program to be utilized as a mass osteoporosis screening tool through the analysis of CT-based data.

**PURPOSE:** The purpose of this study was to determine if the novel CT- based algorithm served as an accurate, DEXA equivalent screening tool for identifying osteoporosis in patients older than 55 years old.

**STUDY DESIGN/SETTING:** This study was a randomized, retrospective review performed at a large, academic, Level 1 trauma center of patients with both CT and corresponding DEXA scans performed with IRB approval from January 2014 to January 2015.

**PATIENT SAMPLE:** One hundred fifty-seven patients older than 55 years of age with CT studies of the chest, abdomen and lumbar spine (T12-L5) and corresponding DEXA scans performed within 12 months of one another were evaluated.

**OUTCOME MEASURES:** DEXA scan derived T-Scores, and CT-based algorithm derived T-Scores.

**METHODS:** Patients with CT studies of the chest, abdomen and lumbar spine (T12-L5) and corresponding DEXA scans performed within 12 months of one another were evaluated. CT slice thickness was no greater than 3 mm. All studies were stripped from identifying information for review. An in- dependent reviewer was blinded to DEXA scores of patients. Outcomes measured were DEXA-derived T-Score and CT-based algorithm derived T-Score. Association between patient DEXA and CT-based algorithm derived T-Scores were analyzed by a paired t-test and chi-square test via intraclass correlation coefficient data.

**RESULTS:** There were 157 patients with scores collected on both the CT based and DEXA screening methods. In the CT-based group, 37 patients were identified as osteoporotic (T-Score<-2.5), 76 osteopenic (T-Score<-1 to -2.5), 59 normal (T-Score>-1.0). In the DEXA group, 25 identified as osteoporotic, 48 osteopenic, and 84 normal. Paired t-test revealed that there was a statistical difference between screening types, such that, on average, Lumbar DEXA scores were higher than CT-based scores,  $p<.001$ . The Intraclass Correlation Coefficient (ICC) was 0.55 with a confidence interval of (0.43, 0.65). This ICC value represents moderate agreement (Landis & Koch, 1977). Using a cutoff of less than -1 as osteopenic, 73 patients were flagged as being osteopenic via the Lumbar DEXA screening method, while 113 patients were flagged as being osteopenic using the CT-based screening method. Furthermore, 68 patients were categorized as osteopenic using both lumbar DEXA and CT-based algorithm screening methods. Based on a chi-square test, there was a significant association between being identified as osteopenic with the lumbar DEXA screening method and via the CT based screening method,  $p<.001$ . The CT based screening method showed a sensitivity of 0.93, and a specificity of 0.46.

**CONCLUSIONS:** This retrospective review identified the association between Lumbar DEXA and CT based screening methods for osteopenia. The CT- based algorithm proved to be highly sensitive for the detection of osteoporosis, accurately deriving a T-Score utilizing CT volumetric information of both trabecular and cortical bone of the lumbar vertebrae. This CT based screening tool offers compelling advantages. This method provides a cost-effective, mass-screening tool for osteoporosis, and has broad future applications, such as identifying patients at risk for vertebral compression fractures.

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*Disclosures:* The algorithm tested was developed by and supplied by Zebra Medical Vision, LTD. Orna Amitai-Bregman and Eldad Elnekave, MD are employees of Zebra Medical Vision, LTD.