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Opportunistic Artificial Intelligence-based Detection Of Osteoporosis And Osteopenia Using Thoracic Vertebral Bone Mineral Density Measurements In Coronary Artery Calcium Scans

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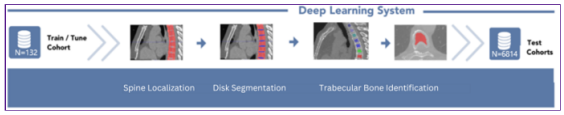
Abstract:
Introduction: Previously we reported a manual method of measuring thoracic vertebral bone mineral density (BMD) using quantitative computed tomography (QCT) in non-contrast cardiac CT scans used for coronary artery calcium (CAC) scoring. In this report, we present validation studies of an artificial intelligence (AI) based automated bone mineral density (AutoBMD) measurement that recently received FDA approval as an opportunistic add-on to CAC scans.
Methods: A deep learning model was trained to detect vertebral bodies. Subsequently signal processing techniques were developed to detect discs and trabecular components of the vertebral body. The model was trained using 132 CAC scans comprising 7649 slices. To validate AutoBMD, we used all 6814 cases of manual BMD measurements previously reported from CAC scans in the Multi-Ethnic Study of Atherosclerosis (MESA).
Results: Mean±SD for AutoBMD and manual BMD were 177.3 ± 53.1 g/cm^3 and 174.4 ± 56.1 g/cm^3 respectively (p= 0.23). MESA cases were 47% male and 53% female with age 60 ± 9.1. Human experts vs. AutoBMD reported 23% vs. 21% for osteoporosis, and 32% vs. 34% for osteopenia (p=0.7). A strong correlation was found between AutoBMD and manual measurements (R = 0.97, p<0001). AutoBMD averaged 15 seconds per report vs. 5.5 minutes for manual measurements (p<0.0001).
Conclusions: AutoBMD is an FDA approved AI-enabled opportunistic tool that reports BMD with Z-score and T-score, and accurately detects osteoporosis and osteopenia in CAC scans. No extra cost of scanning and no extra radiation to patients, plus the high prevalence of asymptomatic osteoporosis, make AutoBMD a valuable add-on to CAC scans.



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