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AI-enabled Detection Of Low Bone Mineral Density In Coronary Artery Calcium Scans Associated Osteoporosis With High Calcium Score Independently Of Age, Gender, And Conventional Risk Factors: Multi-ethnic Study Of Atherosclerosis (MESA)

Author Block: Venkat S. Manubolu, MD[1], Song Shou Mao, MD[1], Anthony P. Reeves, PhD[2], Dong Li, PhD[3], Kyle Atlas, BS[4], Chenyu Zhang, MS[4], Edward Callahan, MD[1], Matthew Budoff, MD[1], Morteza Naghavi, MD[4].

[1]The Lundquist Institute, Torrance, CA, USA, [2]Cornell University, Ithaca, CA, USA, [3]Emory University, Atlanta, GA, USA, [4]HeartLung Technologies, Torrance, CA, USA.
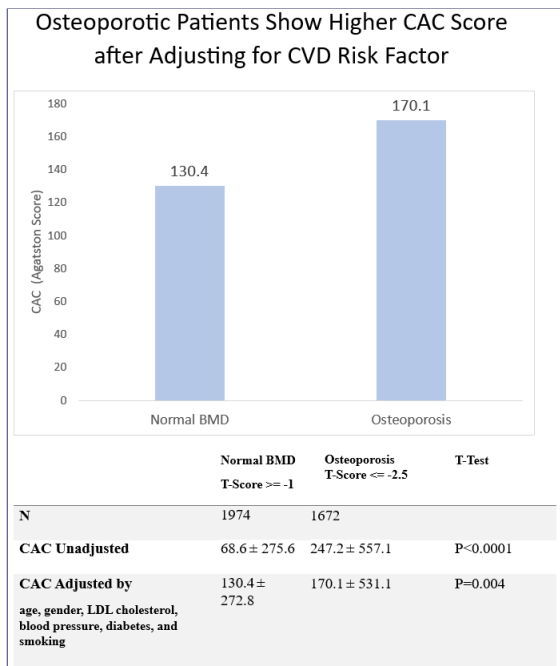
Abstract:
Introduction: The association between low bone mineral density (BMD) and coronary artery calcium (CAC) has been reported before using manual measurement of thoracic BMD. Such manual measurements are time-consuming and subject to operator errors. We therefore used an AI-enabled BMD measurement tool, AutoBMD, to explore the relationship between CAC and BMD independent of traditional risk factors.
Methods: The validation of AutoBMD has been reported previously and received FDA clearance. For this study we applied AutoBMD to 6814 CAC scans from MESA. In 6806 cases both BMD and CAC data were available. Osteoporosis was defined as a T-Score below -2.5. Mean ± SD were calculated for CAC score using Agatston method. P value was calculated using a two-tailed test of significance with α=0.05. BMD was measured in T7-T9 vertebrae.
Results: 6806 cases had both BMD and CAC results with average age 61.9±10.2 years 53.3% female. Average BMD in men and women were 164.4 ± 45.1 and 163.1 ± 50.0 g/cm^3 respectively (P < 0.3467). Average CAC score for men and women were 223.4+544.0 and 76.2 ± 241.3 cm^3 respectively (P < 0.0001). A total of 1672 cases were classified as osteoporotic, which included 986(58.0%) men and 714(42.0%) women. Average CAC (Agatston score) in osteoporotic cases versus normal BMD before adjustment for age and gender were 247.2 ± 557.1 and 68.6 ± 275.6 respectively (P < 0.0001). After adjusting for age, gender and conventional CVD risk factors, average CAC score in osteoporotic cases versus normal BMD were 170.1 ± 531.1 and 130.4+272.8 respectively (P = 0.004) (see graph below).
Conclusions: Low BMD and high CAC are associated independently of age, gender, and traditional risk factors of cardiovascular diseases. Further studies are warranted to evaluate the potential added value of BMD to CAC for prediction of adverse events.

Osteoporotic Patients Show Higher CAC Score after Adjusting for CVD Risk Factor

	Normal BMD T-Score >= -1	Osteoporosis T-Score <= -2.5	T-Test
N	1974	1672	
CAC Unadjusted	68.6 ± 275.6	247.2 ± 557.1	P<0.0001
CAC Adjusted by age, gender, LDL cholesterol, blood pressure, diabetes, and smoking	130.4 ± 272.8	170.1 ± 531.1	P=0.004

Category (Complete): Non contrast cardiac CT: Coronary calcium ; Artificial Intelligence/Machine Learning

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Society of Cardiovascular Computed Tomography (SCCT)
Telephone: 703.766.1706
e-mail: education@scct.org

Helpdesk:
Phone: 217-398-1792
Email: scct@support.ctimeetingtech.com

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