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AI-enabled Automated Cardiac Chambers Volumetry (autochamber) In Coronary Calcium Scans Outperforms Charge-AF For Prediction Of Atrial Fibrillation: The Multi-Ethnic Study Of Atherosclerosis

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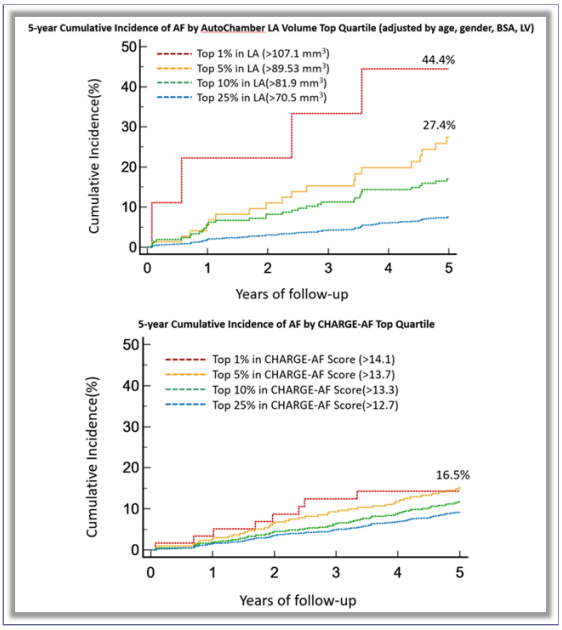
Abstract:
Introduction: Coronary artery calcium (CAC) scan has more useful information than is currently reported. We developed an AI-enabled automated cardiac chambers volumetry technique that works on non-contrast and contrast-enhanced cardiac scans, and reports the volume of cardiac chambers. Unlike in coronary artery disease where we have strong predictive tools such as CAC and CT angiography, for predicting atrial fibrillation (AF), we are limited to CHARGE-AF which is an epidemiological risk calculator. In this report, we compare the predictive value of AutoChamber measured left atrial (LA) volume with CHARGE-AF for prediction of AF in Multi-Ethnic Study of Atherosclerosis (MESA), the largest ongoing multi-ethnic research on the underlying causes of cardiovascular diseases (CVD) in the US.
Methods: 6814 participants (age 45-84 years) free of clinical CVD at baseline were enrolled between 2000 and 2002. In the 6814 participants (52.4% women; age, 62 ± 10.1 years) followed over 15 years for CVD events, 1263 had incident AF. AutoChamber was run on the CAC scans and reported LA volume in 6739 cases. CAC scans in 75 cases could not be used due to missing slices from old EBCT (Electron Beam Computed Tomography) scans. CHARGE-AF score was calculated using the risk model study by Alonso et al. MESA committee approval was obtained for this study.
Results: AutoChamber LA volume was 55.8±14.1 and 67.1±16.1 mm^3 for females and males, respectively ($p<0.0001$). Cumulative incidence of AF was compared between the top 1% (N=64) and 5% (N=316) of both LA volumetry and CHARGE-AF score in 6398 cases. At 5 years the cumulative incidence of AF was 44.5% vs. 16.5% (P=0.0007) for the top 1% and 28% vs 16% (P=0.0002) for the top 5%, in AutoChamber vs CHARGE-AF respectively. Likewise, at 10 years the top 1% showed 70.4% vs. 30.9% (P=0.0001) and top 5% showed 40.6% vs. 30.7% (P=0.002) incidence. At 15 years the cumulative incidence was 85.7% vs. 72.7% (P=0.05) and 62% vs. 52.5% (P=0.01).
Conclusions: In MESA, AutoChamber LA volumetry detected a larger number of high-risk pre-AF patients than CHARGE-AF. To our knowledge this is the first AI-enabled study to measure LA volume in non-contrast chest CT scans that demonstrated its utility for AF prediction. Since AutoChamber is an opportunistic AI-enabled tool that can automatically report cardiac chambers volume, its clinical utility as an added value to CAC scans is promising and warrants investigations in other cohorts.



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