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NEWS

Prediction of Major Cardiovascular Events in a Large Outpatient Adult Cohort Using Fully Automated and Normalized Deep Learning Body Composition Analysis of Routine Abdominal CT

Wednesday, December 2, 8:30 – 9:30 AM CT | SSGI04-06 | Featured Paper

PURPOSE

Manually segmented muscle and fat body composition (BC) metrics from abdominal computed tomography (CT) exams are associated with cardiovascular (CV) risk but are too costly to perform clinically. We hypothesize that fully automated BC analysis can augment traditional CV risk models in a large outpatient cohort.

METHOD AND MATERIALS

33,182 outpatient abdominal CT exams performed in our hospital system in 2012 for 23,126 patients were identified. 12,128 patients were free of major CV or cancer diagnoses at time of imaging and their earliest abdominal CT exam in 2012 was selected and analyzed by a deep learning pipeline to determine BC metrics: skeletal muscle area, visceral fat area (VFA) and subcutaneous fat area (Fig A, B). Reference curves were generated through a modified LMS method and used to calculate normalized z-scores. Cause-specific Cox proportional hazards models corrected for height, weight, BMI, institution, smoking status, diabetes and systolic blood pressure (SBP) were used to predict the risk of future myocardial infarction (MI) and stroke based on BC z-scores.

RESULTS

The cohort (mean age, 52 years; 57% women; 83% White, 9% Black, 3% Asian) was followed for 5 years following each person's index abdominal CT exam. 1560 MI and 938 stroke events occurred. Visceral fat area (VFA) was independently associated with future MI (hazard ratio [HR] with 95%CI: 1.15 [0.95-1.41], 1.05 [0.84-1.31], and 1.31 [1.03-1.67] for quartiles 2, 3, and 4 versus the first quartile, p=0.04), while no evidence of an association was present for weight and height (Fig C). VFA was also independently associated with future stroke (HR: 1.37 [1.05-1.77], 1.49 [1.13-1.97], and 1.46 [1.07-2.00] for quartiles 2, 3, and 4 versus the first quartile, p=0.04), while no evidence of an association was present for weight and height (Fig D). BMI was not independently associated with MI or stroke in a model adjusted for all BC metrics.

CONCLUSION

Fully automated BC analysis of outpatient abdominal CT exams enables prediction of major cardiovascular events better than weight, height and BMI.

CLINICAL RELEVANCE/APPLICATION

Fully automated and normalized CT-based BC analysis potentially provides valuable latent value from routine CT imaging to augment cardiovascular risk prediction in a large outpatient population.