RSNA Radiological Society of North America
RADIOLOGICAL SOCIETY OF NORTH AMERICA
820 JORIE BLVD, OAK BROOK, IL 60523
TEL 1-630-571-2670 FAX 1-630-571-7837
RSNA.ORG
NEWS

MRI-DERIVED BODY COMPOSITION AND METABOLIC PHENOTYPES ARE ASSOCIATED WITH EARLY BRAIN AMYLOID AND TAU BURDEN IN MIDLIFE INDEPENDENT OF SMALL VESSEL DISEASE

PURPOSE

Midlife obesity, body composition, and metabolic dysfunction are increasingly recognized as key contributors to Alzheimer's disease risk. In this study, we investigated how amyloid and tau PET measures differ across phenotypes derived from anthropometric, metabolic, and MRI-based body composition features in cognitively normal midlife individuals.

METHODS AND MATERIALS

Abdominal and thigh MRI data from 92 participants were semi-automatically segmented to quantify abdominal subcutaneous and visceral adipose tissue (SAT, and VAT), thigh muscle, and thigh fat volumes. These measures, along with BMI, insulin resistance (HOMA-IR), HDL, and LDL levels, were used to derive phenotypes using an unsupervised Gaussian mixture model applied to standardized features. Data from 30-60 minutes post-injection window of 11C-PiB and 80-100 minutes post-injection window of 18F-AV1451 were used for analysis. Amyloid and tau PET images were co registered to FreeSurfer regions of interest. Amyloid and tau burden were quantified using Centiloid and mean SUVR within a meta-ROI, respectively, with cerebellum as the reference region. Associations between phenotype and amyloid and tau burden were evaluated using multivariable linear regression models adjusted for age and sex. Additional models were further adjusted for race, education, Fazekas score (small vessel disease), diabetes, and hypertension.

RESULTS

Four distinct phenotypes were identified. Phenotype 1 (n=31) was characterized by higher VAT, SAT, and adverse metabolic profile. Phenotype 4 (n=12) demonstrated higher thigh muscle and moderately high VAT with lower SAT and a more favorable metabolic profile. Phenotypes 2 (n=32) and 3 (n=17) represented leaner individuals with low adiposity and muscle, differentiated by higher versus lower HDL levels. Amyloid burden (Centiloid) was significantly lower in phenotype 2 compared to all other phenotypes in age- and sex adjusted models. After additional adjustment for small vessel disease, the difference remained significant only between phenotypes 2 and 1 ($p=0.01$). Tau meta-ROI SUVR was significantly lower in phenotype 3 compared to all other phenotypes, and these differences were more prominent after full adjustment ($p<0.001$ compared to phenotypes 1, 4, and $p=0.002$ compared to phenotype 2).

CONCLUSIONS

Cognitively normal midlife individuals with lean phenotypes derived from integrated MRI-based body composition and metabolic measures have lower amyloid, and tau burden compared to individuals with high adiposity and even higher muscle, independent of vascular risk factors and small vessel disease.

CLINICAL RELEVANCE/APPLICATIONS

Integrated metabolic and imaging derived phenotypes may help stratify midlife individuals at risk for Alzheimer's disease and inform personalized prevention strategies.