Race-ethnic differences in subclinical left ventricular systolic dysfunction by global longitudinal strain: A community-based cohort study

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Background Race-ethnic differences exist in the epidemiology of heart failure, with blacks experiencing higher incidence and worse prognosis. Left ventricular (LV) systolic dysfunction (LVSD) detected by speckle-tracking global longitudinal strain (GLS) is a predictor of cardiovascular events including heart failure. It is not known whether race-ethnic differences in GLS-LVSD exist in subjects without overt LV dysfunction.

Methods Participants from a triethnic community-based study underwent 2-dimensional echocardiography with assessment of LV ejection fraction (LVEF) and GLS by speckle-tracking. Participants with LVEF <50% were excluded. Left ventricular systolic dysfunction by GLS was defined as GLS >95% percentile in a healthy sample (–14.7%).

Results Of the 678 study participants (mean age 71 ± 9 years, 61% women), 114 were blacks; 464, Hispanics; and 100, whites. Global longitudinal strain was significantly lower in blacks (–16.5% ± 3.5%) than in whites (–17.5% ± 3.0%) and Hispanics (–17.3% ± 2.9%) in both univariate (P = .015) and multivariate analyses (P = .011), whereas LVEF was not significantly different between the 3 groups (64.3% ± 4.6%, 63.4% ± 4.9%, 64.7% ± 4.9%, respectively, univariate P = .064, multivariate P = .291). Left ventricular systolic dysfunction by GLS was more frequent in blacks (27.2%) than in whites (19.0%) and Hispanics (14.9%, P = .008). In multivariate analysis adjusted for confounders and cardiovascular risk factors, blacks were significantly more likely to have GLS-LVSD (adjusted odds ratio 2.6, 95% CIs 1.4-4.7, P = .002) compared to the other groups.

Conclusions Among participants from a triethnic community cohort, black race was associated with greater degree of subclinical LVSD by GLS than other race-ethnic groups. This difference was independent of confounders and cardiovascular risk factors. (Am Heart J 2015;169:721-6.)

Heart failure (HF) is a leading cause of morbidity and mortality in the United States, affects an estimated 5.1 million adult Americans, and is projected to undergo a 25% increase in prevalence by 2030.[1] Several studies showed that race-ethnic differences exist in HF epidemiology.[2-5] Data from population studies have shown that the incidence and prevalence of HF are greater in the black population. Once the diagnosis is made, HF progression is more rapid in black than in white patients, with associated higher risk of hospitalizations.[6-8] This imbalance between races possibly reflects the higher prevalence in black subjects of cardiovascular risk factors such as hypertension and diabetes mellitus and their worse profile of cardiovascular health metrics.[9-12] Left ventricular (LV) systolic dysfunction (LVSD), a predictor of cardiovascular events and incident HF, has been documented in 2% to 14% of the general population, even without a prior diagnosis of myocardial infarction or HF.[13-16] Despite the higher incidence of HF in blacks, it is not clear whether LVSD is more frequent in blacks, especially after accounting for their worse cardiovascular risk profile.[17-19] In previous studies, LVSD was assessed by LV ejection fraction (LVEF); however, LV global longitudinal strain (GLS) measured by echocardiographic speckle-tracking imaging is emerging as a more sensitive measure of LV function, able to detect subclinical LVSD in a significant number of subjects with normal LVEF.[20] Furthermore, because GLS is a powerful predictor of cardiovascular outcome, independent of and

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Grant support: This work was supported by the National Institute of Neurological Disorders and Stroke (grant nos. R01 NS36286 to M.D.T. and R37 NS29993 to R.L.S./M.S.E.).
Conflicts of interest: None.
Submitted November 3, 2014; accepted February 1, 2015.

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0002-8703

http://dx.doi.org/10.1016/j.ahj.2015.02.011

additive to LVEF,[20-22] its assessment might be of help in the early identification of subjects at high risk for future cardiovascular events, especially in race-ethnic groups that more frequently experience overt HF. Accordingly, we investigated race-ethnic differences in subclinical LVSD measured by echocardiographic speckle-tracking GLS in a triethnic sample from a community-based cohort study.

Methods

Study population

The Cardiovascular Abnormalities and Brain Lesions (CABL) study is a community-based epidemiologic study designed to investigate the cardiovascular predictors of silent brain disease in the community. The CABL study based its recruitment on the Northern Manhattan Study (NOMAS), a population-based prospective study investigating the epidemiology and risk factors for stroke and cardiovascular disease. The study design and recruitment details of NOMAS have been described previously.[23] The CABL inclusion criteria were as follows: (1) age >50 years, (2) no contraindications to magnetic resonance imaging, and (3) no prior stroke. Of the 1,004 participants enrolled between 2005 and 2010, 276 had no raw digital echocardiographic data or had suboptimal image quality for speckle-tracking analysis and were, therefore, excluded from the present analysis. Additional exclusions were LVEF <50% and race-ethnicities other than black, white, or Hispanic. Written informed consent was obtained from all study participants.

Risk factor assessment

Cardiovascular risk factors were ascertained through direct examination and interview by trained research assistants. *Hypertension* was defined as systolic blood pressure (SBP) ≥140 mm Hg or diastolic blood pressure (DBP) ≥90 mm Hg or self-reported history of hypertension or use of antihypertensive medication. *Diabetes mellitus* was defined as fasting blood glucose ≥126 mg/dL or self-reported history of diabetes or use of diabetes medications. *Hypercholesterolemia* was defined as total serum cholesterol >240 mg/dL, self-report of hypercholesterolemia, or use of lipid-lowering treatment. Cigarette smoking, either at the time of the interview or in the past, was recorded. *Coronary artery disease* was defined as a history of myocardial infarction, coronary artery bypass grafting, or percutaneous coronary intervention. The race-ethnicity classification was based on self-identification and modeled after the US Census. Self-reported race-ethnicity was categorized as non-Hispanic white (white), non-Hispanic black (black), and Hispanic. Participants of other race-ethnicities (n = 22) were excluded.

Echocardiographic assessment

Two-dimensional echocardiography. Transthoracic echocardiography was performed using a commercially available system (iE 33; Philips, Andover, MA) by a trained, registered cardiac sonographer according to a standardized protocol. Left ventricular wall thickness and diameters and left atrial anteroposterior diameter were measured from a parasternal long-axis view according to current guidelines.[24] Left ventricular end-diastolic diameter (LVEDi) and left atrial diameter were indexed by body surface area. Left ventricular ejection fraction was calculated using the biplane modified Simpson's rule. Left ventricular mass was calculated with a validated method[25] and indexed by body surface area (LV mass index). Left ventricular relative wall thickness was calculated as 2 × posterior wall thickness/LV end-diastolic diameter. Left ventricular diastolic function was assessed as previously described by transmitral Doppler and mitral annulus tissue Doppler.[26] Peak early (E) and late velocity (A) of mitral inflow were measured, and the E/A ratio was calculated. Peak early diastolic velocity (e′) of the lateral and septal mitral annulus were measured and averaged.

Speckle-tracking strain imaging

Speckle-tracking analysis was performed off-line using commercially available software (QLAB Advanced Quantification Software version 8.1; Philips), as previously described.[27] Briefly, speckle-tracking analysis of LV myocardial deformation over the longitudinal axis was performed from 2-dimensional gray-scale loops recorded at a frame rate ≥45 fps. Global longitudinal strain was calculated averaging the negative peak of longitudinal strain from 12 ventricular segments from the apical 4-chamber and 2-chamber views. *Abnormal GLS* was defined as GLS greater than −14.7%, corresponding to the value separating the lowest 5% of the distribution in a healthy subgroup from the same cohort.[20]

Statistical analysis

Data are presented as mean ± SD for continuous variables and as percentage for categorical variables. One-way analysis of variance and χ^2 tests were used to assess differences between race-ethnic groups. Linear and logistic models were used to assess differences in systolic function between groups, and odds ratios (ORs) and 95% CIs were calculated. Covariates were selected based on their univariate association with race-ethnicity with $P < .1$. For all statistical analyses, a 2-tailed $P < .05$ was considered significant. Statistical analyses were performed using SAS software version 9.3 (SAS Institute, Inc, Cary, NC).

The study protocol was approved by the institutional review boards of Columbia University Medical Center and the University of Miami. This study was supported by grants from the National Institute of Neurological Disorders and Stroke (grant nos. R01 NS36286 to M.D.T. and R37 NS29993 to R.L.S./M.S.E.). The authors are solely responsible for the design and conduct of this study, all study analyses, the drafting and editing of the manuscript and its final contents.

Results

Characteristics of the study population by race-ethnicity

Study sample included 678 participants, of whom 464 were Hispanics (68.4%), 114 blacks (16.8%), and 100