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Research Article

Hypertension and alterations in left ventricular structure and geometry in African Americans: the Jackson Heart Study

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Abstract

African Americans (AAs) have an increased risk for hypertension-related cardiovascular outcomes compared with whites, which may be related to abnormal left ventricular (LV) structure. We examined the association of prevalent hypertension with concentric remodeling (CR; normal LV mass index [LVMI] and increased relative wall thickness [RWT]), eccentric hypertrophy (increased LVMI and normal RWT), and concentric hypertrophy (CH; increased LVMI and increased RWT) within the Jackson Heart Study. Among 4721 participants (mean ± SD, age 55.7 ± 12.7 years), 2841 (60.2%) had prevalent hypertension, defined as mean clinic blood pressure ≥140/90 mm Hg or antihypertensive medication use. Prevalent hypertension was associated with a statistically significantly increased odds for having CR (odds ratio [OR] = 1.78, 95% confidence interval [CI] = 1.42–2.24), eccentric hypertrophy (OR = 1.68; 95% CI = 1.15–2.44), and CH (OR = 3.86, 95% CI = 2.28–6.54) after multivariable adjustment. In conclusion, in a population-based sample of AAs, hypertension was associated with increased odds for having abnormal LV structure, particularly CH. J Am Soc Hypertens 2016;10(7):550–558.

Keyword: Echocardiography.

Introduction

African Americans have a higher risk of hypertension and cardiovascular end-organ damage compared to whites.[1–4] Hypertension is associated with alterations in cardiac structure, including an increase in left ventricular (LV) mass (LVM),[5] left ventricular hypertrophy (LVH), and relative wall thickness (RWT), the latter being a measure of LV geometry.[5] Based on categorization by LVM index (LVMI: increased LVMI or normal LVMI) and also geometry (increased RWT or normal RWT), individuals can also be categorized into having one of four LV structural patterns: normal pattern (normal LVMI and normal RWT), concentric remodeling (normal LVMI and increased RWT), eccentric hypertrophy (increased LVMI and normal RWT), and concentric hypertrophy (increased LVMI and increased RWT).[6,7] Each of the three abnormal LV patterns is associated with an increased risk for cardiovascular disease (CVD) events.[8–11] Recently, a classification system has been proposed that further subdivides individuals with

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eccentric hypertrophy and concentric hypertrophy into four categories based on LV chamber size: eccentric nondilated and dilated hypertrophy, and concentric nondilated and dilated hypertrophy.[11–14] Studies have demonstrated that individuals with nondilated LV hypertrophy, particularly those with eccentric nondilated hypertrophy, do not have an increased CVD risk.[13,15,16]

Scarce data are available from epidemiology studies on the prevalence of abnormal LV structural patterns among African Americans.[17–19] The association between prevalent hypertension and each of the abnormal LV structural patterns among African Americans is also understudied.[8,20] Furthermore, little is known about the factors associated with each abnormal LV structural pattern among African Americans with prevalent hypertension. Understanding the factors associated with abnormal LV structural patterns among African Americans with hypertension may help identify potential targets for risk factor modification among this group.

In the present study, we determined the prevalence of concentric remodeling, eccentric hypertrophy, and concentric hypertrophy among participants in the Jackson Heart Study (JHS), a large population-based cohort study comprised exclusively of African Americans. Furthermore, we examined the association of prevalent hypertension with each abnormal LV pattern and assessed factors associated with each abnormal pattern among participants with prevalent hypertension. We also secondarily examined nondilated and dilated subtypes of eccentric hypertrophy and concentric hypertrophy.

Materials and Methods

Sample Population

The JHS is a population-based cohort study of 5301 African-American adults. Details of the study design, recruitment, and data collection have been previously described.[21–26] Briefly, African-American participants were recruited from urban and rural areas of the three counties (Hinds, Madison, and Rankin) that make up the Jackson, MS Metropolitan Statistical Area. Recruitment was restricted to noninstitutionalized adult African Americans aged 21–84 years old.[27] There were 5301 participants who underwent a baseline examination (examination 1) that consisted of interviewer and self-administered questionnaires, clinic blood pressure (CBP) measurements, blood and urine collection, a pill bottle review, and 2D echocardiography. Detailed description of data and specimen collection and specimen processing during examination 1 can be found in the online supplement (Supplemental Methods).

Participants (n = 318) with incomplete CBP or antihypertensive medication data (ie, missing information on self-reported antihypertensive medication use or pill bottle review) or incomplete data on LVM and/or RWT from echocardiography (n = 262) were excluded, leaving a final sample size of 4721 participants at examination 1 for the current analyses. The JHS was approved by the institutional review boards of the participating institutions: the University of Mississippi Medical Center, Jackson State University, and Tougaloo College. All participants provided informed consent. The current analysis was approved by the institutional review boards at the University of Alabama at Birmingham and Columbia University.

Clinic Blood Pressure, Antihypertensive Medication, and Prevalent Hypertension

CBP measurements were taken using a Hawksley random zero sphygmomanometer (Hawksley and Sons Ltd.) and an appropriately sized blood pressure cuff determined by measuring the upper-arm circumference. After a 5-minute silent rest, although participants were seated with their back and arm supported, two BP measurements (1 minute apart) in the right arm were taken.[27] CBP was defined as the average of the two recorded measurements.[27] Antihypertensive medication use was determined by self-report. Participants were also asked to bring any medications taken within 2 weeks before the baseline examination to the clinic visit. Pill bottle review and medication coding were performed by a pharmacist using the Medispan dictionary and classified into categories according to the Therapeutic Classification System.[25] For the current analysis, antihypertensive medication use (yes/no) was defined as self-reporting antihypertensive medication use and having at least one class of antihypertensive medication identified during the pill bottle review. Prevalent hypertension was defined as a mean clinic systolic blood pressure (SBP) $\geq$ 140 mm Hg, mean clinic diastolic blood pressure (DBP) $\geq$ 90 mm Hg, or antihypertensive medication use.

Echocardiography

Certified technicians performed 2D transthoracic echocardiograms (Sonos-4500, Philips Medical Systems) using standardized protocols.[21] Echocardiograms were reviewed for clinical interpretation and analytical measurements by experienced cardiologists on networked image workstations (Vericis, Camtronics Medical Systems).[21] LV dimensions, including LV internal diameter at end diastole (LVEDD, millimeters), interventricular septal thickness in diastole (IVSD, millimeters), and posterior wall thickness in diastole (PWTD, millimeters), were assessed according to the 2D method based on American Society of Echocardiography (ASE) recommendations.[28]

Calculation of Echocardiographic Derived Variables

LVM, LVMI, LVH, and RWT were derived according to ASE recommendations.[28] LVM was calculated using the