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Clinical Investigation

The Obesity and Heart Failure Epidemics Among African Americans: Insights From the Jackson Heart Study

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ABSTRACT

Background: Higher rates of obesity and heart failure have been observed in African Americans, but associations with mortality are not well-described. We examined intermediate and long-term clinical implications of obesity in African Americans and associations between obesity and all-cause mortality, heart failure, and heart failure hospitalization.

Methods and Results: We conducted a retrospective analysis of a community sample of 5292 African Americans participating in the Jackson Heart Study between September 2000 and January 2013. The main outcomes were associations between body mass index (BMI) and all-cause mortality at 9 years and heart failure hospitalization at 7 years using Cox proportional hazards models and interval development of heart failure (median 8 years' follow-up) using a modified Poisson model. At baseline, 1406 (27%) participants were obese and 1416 (27%) were morbidly obese. With increasing BMI, the cumulative incidence of mortality decreased ($P = .007$), whereas heart failure increased ($P < .001$). Heart failure hospitalization was more common among morbidly obese participants (9.0%; 95% confidence interval [CI] 7.6–11.7) than among normal-weight patients (6.3%; 95% CI 4.7–8.4). After risk adjustment, BMI was not associated with mortality. Each 1-point increase in BMI was associated with a 5% increase in the risk of heart failure (hazard ratio 1.05; 95% CI 1.03–1.06; $P < .001$) and the risk of heart failure hospitalization for BMI greater than 32 kg/m^2 (hazard ratio 1.05; 95% CI 1.03–1.07; $P < .001$).

Conclusions: Obesity and morbid obesity were common in a community sample of African Americans, and both were associated with increased heart failure and heart failure hospitalization. (*J Cardiac Fail 2016;22:589–597*)

Key Words: Health care disparities, heart failure, obesity.

The association of obesity with heart failure (HF) has not been well-described in African Americans (AAs), who have higher rates of both obesity and HF than white populations.[1,2] The relationship between obesity in AAs and mortality also remains unclear. Some studies have suggested a paradoxical lower risk of death in AAs with obesity compared with other populations with obesity.[3–9] To better understand associations between obesity and health outcomes among AAs, we examined relationships between body mass index (BMI) and all-cause mortality, prevalent HF at interval follow-up examinations, and HF hospitalization among >5000 participants in the Jackson Heart Study.[10–14] We hypothesized that obesity would be common in this cohort and that higher BMI would be associated with greater risks of mortality, prevalent HF, and hospitalization for HF.

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Methods

Data Sources

The Jackson Heart Study is a prospective, community-based, observational study that was initiated in 2000 to investigate risk factors for cardiovascular disease in AAs.[10] A strength of the study is that it is the largest cohort to date specifically examining AAs and their risks for cardiovascular disease. All participants provided written informed consent, and study protocols were approved by local institutional review boards. The institutional review board of the Duke University Health System approved our study and the use of study data. Participants completed 3 study visits: examination 1 between September 2000 and March 2004, examination 2 between October 2005 and December 2008, and examination 3 between February 2009 and January 2013. The details of data collected and visit procedures have been described previously.[15] The Jackson Heart Study cohort surveillance system collects follow-up data on all participants, including deaths from 2000 through 2011 and HF hospitalizations from 2005 through 2011.[16]

Study Population

For all outcomes, we included participants who completed examination 1 and had BMI measured. For the analysis of HF hospitalizations, we limited the cohort to participants who survived to January 1, 2005, when HF hospitalization surveillance began. For the assessment of all prevalent HF outcomes, we excluded participants with baseline HF at examination 1. We also required that participants complete examination 2 for the assessment of prevalent HF at examination 2, and we required completion of examination 3 for the assessment of prevalent HF at examination 3 (Supplemental Fig. S1).

Body Mass Index

The study variable of interest was baseline BMI. Height and weight were determined with the participant wearing an examination gown without shoes.[17] We assessed BMI on a continuous scale per 1 point and categorically as follows: normal weight (<25 kg/m^2), overweight (25 to <30 kg/m^2), obese (30 to <35 kg/m^2), and morbidly obese (≥35 kg/m^2).

Outcomes

The primary outcomes were all-cause mortality, prevalent HF at examination 2, prevalent HF at examination 3, and hospital admission for HF. Methods for identification of all-cause mortality in the cohort have been described previously.[16] We assessed all-cause mortality within 9 years after the examination 1 visit date based on a median follow-up time of 9 years and 75th percentile of 10 years. Because HF history was not collected at the 3 clinical examinations, we derived prevalent HF at each examination using the modified Gothenburg criteria developed and validated in the Atherosclerosis Risk In Communities (ARIC) data set and as recently applied to the Jackson Heart Study cohort.[18,19] Among participants without prevalent HF at examination 1, we assessed prevalent HF at examination 2 (median follow-up 4.8 years from examination 1; range 3.4–8.2 years) and prevalent HF at examination 3 (median follow-up 8.0 years from examination 1; range 6.4–12.2 years). We also assessed the cumulative incidence of HF hospitalization between 2005 and 2011 among study participants who survived to January 1, 2005, when HF hospitalization surveillance began. (Median and 75th percentile follow-up was 7 years.) Potential HF hospitalizations in the cohort were identified and adjudicated as described previously.[16]

Covariates

Variables from the baseline clinical examination included demographic characteristics, medical history, physical examination measurements, medications, laboratory test results, and cardiac test results. Medical history was based on either direct clinical examination, self-reported disease history, or health behaviors. For variables with less than 5% missingness, we imputed continuous variables to the overall median value, dichotomous variables to "no," and multichotomous variables to the most frequent categorical value. For variables with >5% missingness (medication variables), we treated the missing values as a separate category.

Statistical Analysis

We describe examination 1 baseline characteristics of the study population by BMI category using frequencies with percentages for categorical variables and medians with interquartile ranges or means with standard deviations for continuous variables. We tested for differences between groups using chi-square tests for categorical variables and Kruskal-Wallis tests for continuous variables.

We calculated the cumulative incidence of all-cause mortality and HF hospitalization by BMI category using Kaplan-Meier estimates, and we tested for differences between groups using log-rank tests. For all survival analyses, we censored data at the time of participant loss to follow-up, or the end of study event surveillance follow-up (December 31, 2011). For HF hospitalization, we also censored data for participants at the time of death. For prevalent HF at examination 2 and prevalent HF at examination 3, we used frequencies with percentages, calculated exact confidence intervals (CIs) for binomial proportions, and tested for differences between groups using Fisher exact tests.

We assessed the unadjusted and adjusted associations between continuous and categorical BMI and outcomes. We used Cox proportional hazards models for mortality and HF hospitalization outcomes. To examine associations with prevalent HF at examination 2, we used a modified Poisson model with an offset parameter to adjust for log of participant time between examinations 1 and 2.[20,21] We explored both linear and nonlinear functional forms for BMI, including polynomials, restricted cubic splines, and linear splines. To explore