Prevalence and determinants of electrocardiographic abnormalities in African Americans with type 2 diabetes

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Abstract *Background:* Electrocardiographic (ECG) abnormalities are independently associated with poor outcomes in the general population. Their prevalence and determinants were assessed in the understudied African American population with type 2 diabetes.
  Methods: Standard 12-lead ECGs were digitally recorded in 635 unrelated African American-Diabetes Heart Study (AA-DHS) participants, automatically processed at a central lab, read, and coded using standard Minnesota ECG Classification. Age- and sex-specific prevalence rates of ECG abnormalities were calculated and logistic regression models were fitted to examine cross-sectional associations between participant characteristics and ECG abnormalities.
  Results: Participants were 56% women with a mean age of 56 years; 60% had at least one minor or major ECG abnormality [23% $\geqslant$1 major (or major plus minor), and 37% $\geqslant$1 minor (with no major)]. Men had a higher prevalence of $\geqslant$1 minor or major ECG abnormality (66.1% men vs. 55.6% women, $p = 0.0089$). In univariate

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analysis, age, past history of cardiovascular disease, diabetes duration, systolic blood pressure, sex and statin use were associated with the presence of any (major or minor) ECG abnormalities. In a multivariate model including variables, female sex (OR [95% CI] 0.79 [0.67, 0.93]), statin use (0.79 [0.67, 0.93]) and diabetes duration (1.03 [1.0, 1.05]) remained statistically significant.

Conclusions: Nearly three out of five African Americans with diabetes had at least one ECG abnormality. Female sex and statin use were significantly associated with lower odds of any ECG abnormality and diabetes duration was significantly associated with higher odds of any ECG abnormality in the multivariable model.

1. Introduction

Associations between minor and major electrocardiographic (ECG) abnormalities and incident cardiovascular disease (CVD) are widely observed [1–6]. These associations persist after adjustment for traditional CVD risk factors suggesting they are independent. A higher prevalence of ECG abnormalities has been reported in African Americans (AAs) relative to European Americans [7,8] — a finding in accordance with higher CVD rates in the general AA population. Patients with diabetes are at a significantly increased risk of CVD events, and diabetes is widely accepted as a coronary artery disease risk equivalent [9–11].

Few studies have assessed the prevalence and determinants of ECG abnormalities in AAs with type 2 diabetes (T2D). It is currently recommended by the American Heart Association/American College of Cardiology Foundation (AHA/ACCF) guidelines to obtain ECGs for those with diabetes [12]. However, it remains unclear how best to use the results of the ECG to improve patient care. Information regarding the prevalence of ECG abnormalities in the high risk AA population with T2D could help guide efforts to develop risk stratification tools to identify those who may benefit from closer follow-up and aggressive risk factor management. There are potential subsets of patients with diabetes with high risk features that may be further elucidated by the ECG, a non-invasive and low-cost screening modality. The prevalence and associations of ECG abnormalities were examined in AAs with T2D enrolled in the African American-Diabetes Heart Study (AA-DHS), one of the most extensively phenotyped African ancestry cohorts for CVD and related risk factors in populations with diabetes.

2. Methods

2.1. Study population

The study sample included 635 consecutive unrelated, self-reported AAs with T2D recruited in the parent Diabetes Heart Study (DHS) and subsequent AA-DHS. In the DHS, siblings concordant for T2D were recruited from internal medicine clinics and community advertising [4]. One member of each AA sib-pair was included and T2D was diagnosed after the age of 34 years in the absence of historical evidence of ketoacidosis. An additional 555 unrelated AAs were subsequently enrolled in the AA-DHS using the same diagnostic criteria, except that T2D was diagnosed after the age of 30 years. Inclusion criteria in both studies allowed individuals with prior myocardial infarction, angina, congestive heart failure, transient ischemic attack, and stroke, but excluded those with previously diagnosed advanced nephropathy (estimated glomerular filtration rate <60 ml/min/1.73 m^2 or end-stage renal disease). Although not excluding participants with prevalent cardiovascular disease may lead to overestimation of ECG abnormalities, it is well established that the diabetic population are at high risk of CVD and excluding those with CVD will risk the representative nature of this sample. Identical examinations were conducted in the Clinical Research Unit of the Wake Forest School of Medicine in DHS and AA-DHS, including interviews for medical history, current medications and health behaviors, measurements of body size, resting blood pressure, 12-lead ECG, fasting blood draw, and spot urine collection. These studies were approved by the Institutional Review Board at the Wake Forest University School of Medicine, and all participants provided written informed consent.