The Role of Diabetes and Components of the Metabolic Syndrome in Stroke and Coronary Heart Disease Mortality in U.K. White and African-Caribbean Populations

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Foreign-born African Americans have low coronary heart disease (CHD) mortality rates, whereas those born in the U.S. have elevated rates compared with the white population (1–3). In U.K. African-Caribbean men (mainly first-generation migrants) the rate is half that of the general population (4). As in the U.S., U.K. African Caribbeans are predisposed to hypertension, diabetes, and insulin resistance, while triglyceride levels are substantially lower than in Europeans (5–8). U.K. African-Caribbean men are also less centrally obese than European men. These latter factors may contribute to the relative protection from CHD in U.K. African Caribbeans. However, confirmatory data from U.K.-specific cohorts are required. Higher risk of stroke in U.K. African Caribbeans may not be explicable by elevated resting blood pressure, as we have previously found that resting systolic blood pressure is only 6 mmHg higher in African-Caribbean men compared with European men (9).

We describe CHD and stroke mortality rates in U.K. African Caribbeans and Europeans and investigate whether ethnic group differences can be explained by differences in diabetes or other conventional cardiovascular risk factors.

RESEARCH DESIGN AND METHODS

— Two West London population-based cohorts were recruited to identical protocols between 1988 and 1991; since then, they have been followed for mortality for an average of 15.8 years. Both studies were previously described in detail (5,10) and approved by local research ethics committees. Participants underwent fasting baseline tests and oral glucose tolerance tests. CHD deaths were identified by the ICD9 codes 410–414.9 and ICD10 codes I200–I259. Stroke deaths were identified by ICD9 codes 430–438.9 and ICD10 codes I600–I699. Poisson regression models provided mortality rate ratios for CHD and stroke deaths. Statistical significance was accepted at the 5% level. Analyses were performed in Stata version 8.

RESULTS

— Participants were aged 40–69 years at baseline and comprised 2,346 white Europeans (mean age 52.9 ± 7.0 years, 76% male) and 729 African Caribbeans (53.6 ± 5.0 years, 56% male). All African Caribbeans were born in the Caribbean Islands and had been a resident in the U.K. for an average of 30 years.

At baseline, compared with Europeans, African Caribbeans were more insulin resistant (age-adjusted geometric mean for homeostasis model assessment [HOMA] 2.27 vs. 1.69, $P < 0.001$) (11), had more diabetes (18 vs. 6%, $P < 0.001$), and had higher blood pressures (age-adjusted median 131 vs. 122 mmHg, $P < 0.001$). In contrast, they had lower total cholesterol (age-adjusted geometric means 5.48 vs. 5.85 mmol/l, $P < 0.001$), lower triglyceride (1.11 vs. 1.39 mmol/l, $P < 0.001$), and higher HDL cholesterol (1.50 vs. 1.32 mmol/l) levels, whereas African-Caribbean women were more centrally obese than European women (waist circumference 89 vs. 80 cm, $P < 0.001$). Baseline CHD, defined by major electrocardiogram changes, was most prevalent in Europeans (2.9 vs. 1.4%, $P = 0.03$). Previous stroke had occurred in 2.2% of African Caribbeans and in 1.0% of Europeans. Europeans were more likely to have smoked previously (67 vs. 33%, $P < 0.001$), and African Caribbeans were more likely to have manual occupations (75 vs. 61%, $P < 0.001$).

In each ethnic group, 85% of stroke deaths and 70% of CHD deaths occurred in the hospital. Thirteen African Caribbeans and 106 Europeans died from CHD (unadjusted mortality rates 1.24/1,000 vs. 3.02/1,000 person-years, $P = 0.003$). There were no significant interactions between ethnicity and sex or between ethnicity and single risk factors. Stratified analyses confirmed that relationships between individual risk factors and CHD mortality were as anticipated within each ethnic group.

In univariate and multivariate models adjusted for the conventional cardiovascular risk factors, ethnic group differences in CHD mortality were barely altered (Table 1). Exclusion of subjects with baseline CHD did not alter the ethnic group differentials.

Sixteen African Caribbeans and 27 Europeans died from stroke (unadjusted mortality rates 1.52/1,000 vs. 0.77/1,000 person-years, $P = 0.030$). There was no significant interaction between ethnicity and sex ($P = 0.13$).

Stroke mortality was associated with a marked interaction between ethnicity and diabetes. Nine of 16 African Caribbeans who died from stroke had diabetes at baseline compared with only 2 of 27 Europeans (P value for interaction term = 0.057). All but one of those with diabetes who died of stroke were in the top quartile of HOMA insulin resistance. Stratified analyses indicated that in people without

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Abbreviations: CHD, coronary heart disease; HOMA, homeostasis model assessment.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

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Table 1—*CHD and stroke mortality from baseline (1989–1992) to 14 February 2006: African Caribbeans versus Europeans*

	CHD mortality (119 deaths)*		Cerebrovascular disease mortality in people without diabetes (32 deaths)†		Cerebrovascular disease mortality in people with diabetes (11 deaths)†	
Mortality rate ratios adjusted for:	African Caribbeans vs. Europeans	*P*	African Caribbeans vs. Europeans	*P*	African Caribbeans vs. Europeans	*P*
Age	0.39 (0.22–0.69)	0.001	1.04 (0.45–2.40)	0.92	5.54 (1.19–25.74)	0.029
Age and sex	0.44 (0.25–0.79)	0.006	1.01 (0.43–2.35)	0.99	5.10 (1.04–24.91)	0.044
Age and baseline CHD/previous stroke‡	0.41 (0.23–0.74)	0.003	1.20 (0.51–2.79)	0.70	4.71 (1.01–22.00)	0.049
Age and smoking (current/ex/never)	0.48 (0.27–0.87)	0.015	1.03 (0.44–2.39)	0.95	7.87 (1.61–38.40)	0.011
Age and occupational status (manual/nonmanual)	0.38 (0.21–0.69)	0.001	0.92 (0.39–2.11)	0.82	4.98 (1.05–23.69)	0.044
Age and glucose tolerance category§	0.35 (0.20–0.63)	<0.001	1.05 (0.45–2.44)	0.91	—	—
Age and HOMA insulin resistance	0.33 (0.18–0.62)	<0.001	1.16 (0.50–2.70)	0.73	—	—
Age and fasting triglycerides	0.46 (0.26–0.82)	0.009	1.08 (0.46–2.55)	0.85	7.63 (1.51–38.49)	0.014
Age and waist circumference	0.39 (0.22–0.70)	0.001	1.04 (0.45–2.40)	0.93	5.47 (1.17–25.60)	0.031
Age and SBP‖	0.33 (0.18–0.58)	<0.001	0.79 (0.34–1.85)	0.59	5.02 (1.08–23.32)	0.040
Age, sex, smoking, total cholesterol, and SBP‖	0.49 (0.27–0.88)	0.018	0.84 (0.35–2.03)	0.70	6.71 (1.38–32.50)¶	0.018
Age, sex, HOMA, fasting triglycerides, and waist circumference	0.45 (0.24–0.85)	0.015	1.16 (0.48–2.82)	0.74	¶	

Data are mortality rate ratios (95% CI). The reference group was European. *Europeans: 106 deaths, including 10 with known diabetes and 2 with undetected diabetes. African Caribbeans: 13 deaths, including 3 with known diabetes and 1 with undetected diabetes. †Europeans with diabetes: 2 deaths, including 1 with known diabetes and 1 with undetected diabetes at baseline. African Caribbeans with diabetes: 9 deaths, including 6 with known diabetes and 3 with undetected diabetes at baseline. ‡CHD mortality adjusted for baseline CHD (major Q waves on electrocardiogram); stroke mortality adjusted for baseline previous stroke. §Impaired fasting glucose, impaired glucose tolerance, and diabetes. ‖Quartiles of systolic blood pressure (SBP; treated hypertension ranked in top quartile). ¶Adjusted for systolic blood pressure and smoking only; further multivariate analyses not undertaken due to the small numbers of events.

diabetes ($n = 2,769$) there were no significant ethnic group differences in stroke mortality. However, African Caribbeans with diabetes ($n = 141$) had stroke mortality rates 5.54 times ($P = 0.029$) higher than Europeans with diabetes ($n = 151$). Systolic and diastolic blood pressures strongly predicted stroke mortality in both ethnic and age-groups. However, univariate adjustments, including systolic blood pressure, did not alter the excess mortality seen in African Caribbeans with diabetes (Table 1).

CONCLUSIONS — Ethnic group differences in baseline stroke and CHD prevalence were reflected in mortality rates. Although total numbers of deaths were small, substantially lower CHD mortality rates were observed in U.K. African Caribbeans when compared with Europeans. This ethnic difference in CHD mortality was not explained by conventional cardiovascular disease risk factors, including triglyceride levels. Favorable lipid patterns extend beyond triglycerides in African Caribbeans, suggesting that further study of lipid metabolism in association with insulin resistance and in response to other stimuli is needed in people of African-Caribbean descent living in the U.K. in order to explain their reduced risk of CHD.

We, for the first time, identify the importance of diabetes in determining ethnic group differences in stroke mortality in the U.K. U.K. African Caribbeans with diabetes were over five times more likely to die of stroke than Europeans with diabetes, regardless of blood pressure. The close correlation with HOMA insulin resistance in these diabetes stroke deaths suggests that regulation of cerebral blood vessels (12,13) may be more adversely affected by insulin resistance in African Caribbeans and that glucose regulation may be as important as blood pressure in the development of cerebrovascular disease in African Caribbeans and in accounting for between ethnic group differences.

This hypothesis requires confirmation in future studies, for example, assessing ethnic group differences in autoregulation of the cerebral circulation in association with differing degrees of glucose tolerance.

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