Cerebrovascular Risk Factors and Stroke Subtypes: Differences Between Ethnic Groups

Cother Hajat, MRCP; Ruth Dundas, MSc; Judy A. Stewart, MRCP; Enas Lawrence, MRCP; Anthony G. Rudd, FRCP; Robin Howard, FRCP; Charles D.A. Wolfe, FFPHM

Background and Purpose—The excess risk of stroke seen in the black population has not been explained by differences in age, sex, and social class, although differences in the frequency of cerebrovascular risk factors may be partly responsible. Data on risk factor profiles for the UK black stroke population are sparse. Previous studies have contrasted the association of cerebrovascular risk factors between hemorrhagic and ischemic stroke and between etiologic subtypes of infarct. The relationship of cerebrovascular risk factors to clinical classifications of stroke, however, has been little examined. The aim of this study was to establish the frequency of cerebrovascular risk factors in patients with first-ever strokes in the South London, UK, population and to examine the relationship of these risk factors to both ethnicity and Bamford stroke subtype.

Methods—The study included 1254 first-ever stroke patients registered in the South London Community Stroke Register between 1995 and 1998; 995 patients (79.3%) were white, 203 (16.2%) were black, 52 (4.1%) were of other ethnic origin, and 4 (0.3%) were of unknown ethnic origin.

Results—In multivariate analysis, increasing age (P<0.001) and previous cerebrovascular disease (P=0.007) were independently associated with infarct rather than hemorrhage. Atrial fibrillation was associated with all nonlacunar (P=0.02), total anterior circulation (P=0.007), and partial anterior circulation infarcts (P=0.02) compared with the lacunar group. All other risk factors were similar between infarct subtypes. Risk factors for hemorrhage subtypes were similar in multivariate analysis; increasing age was the only factor associated with primary intracerebral hemorrhage over subarachnoid hemorrhage (P<0.001). The black stroke population suffered significantly less atrial fibrillation (P=0.001) and engaged in less alcohol excess (P<0.001) and were less likely to have ever smoked (P<0.001). Hypertension (P<0.001) and diabetes mellitus (P<0.001) were more prevalent in the black population.

Conclusions—Physiological cerebrovascular risk factors for the UK black population are similar to those of the US black population, but behavioral risk factors differ. Risk factors differ between ethnic groups in the United Kingdom, and future measures for secondary prevention should take this into consideration. Bamford clinical subtypes bear little association with cerebrovascular risk factors. Other classification systems, such as those that classify stroke by etiology, may be more useful in explaining the excess risk of stroke and the scope for its prevention. (Stroke. 2001;32:37-42.)

Key Words: cerebrovascular disorders ■ ethnic groups ■ risk factors ■ stroke classification
An understanding of risk factor associations with stroke subtypes for different ethnic groups is required to improve primary and secondary preventive strategies. The aims of this study were to establish the frequency of cerebrovascular risk factors in patients with first-ever strokes in the South London, UK, population and to examine the relationship of these risk factors to both ethnicity and Bamford stroke subtype.

**Subjects and Methods**

Patients registered in the South London Stroke Register between January 1, 1995, and December 31, 1998, were included in the study, totaling 1254 patients. The South London Stroke Register is an ongoing population-based register that enrolls first-ever strokes. Ethical consent was obtained from the Guy’s & St Thomas’s Ethical Committee in accordance with the Helsinki Declaration of 1975, revised in 1983. The detailed methods of notification of patients and data collection have been previously described. Ischemic heart disease was defined as a history of angina or myocardial infarction; cerebrovascular disease was defined as a previous history of transient ischemic attacks. A previous history of atrial fibrillation was noted in addition to a screen for atrial fibrillation by the study physician from an ECG performed either during the patient’s hospital stay or, for community-treated patients, during outpatient clinic attendance. Hypertension was diagnosed by either a blood pressure reading of >160/95 mm Hg (World Health Organization [WHO] classification) from records of the general practitioner or hospital or from patient recall of high blood pressure requiring treatment. Diabetes mellitus was diagnosed from records of the general practitioner or hospital of either diet-controlled, oral hypoglycemic–treated, or insulin-treated disease (WHO classification). The patient or next of kin was questioned about a past history of migraine, alcohol, and other. Strokes were classified into subarachnoid hemorrhage (SAH), primary intracerebral hemorrhage (PICH), or ischemic stroke. Ischemic stroke was further subdivided according to the Bamford classification, according to clinical and radiological features, into the following categories: TACI, PACI, POCI, and LACI.

Data on prestroke cerebrovascular risk factors for each patient were recorded both from the records of the hospital or general practitioner and as self-reported by the patient and included ischemic heart disease, cerebrovascular disease, atrial fibrillation, hypertension, diabetes mellitus, and migraine. Ischemic heart disease was defined as a history of angina or myocardial infarction; cerebrovascular disease was defined as a previous history of transient ischemic attacks. A previous history of atrial fibrillation was noted in addition to a screen for atrial fibrillation by the study physician from an ECG performed either during the patient’s hospital stay or, for community-treated patients, during outpatient clinic attendance. Hypertension was diagnosed by either a blood pressure reading of >160/95 mm Hg (World Health Organization [WHO] classification) from records of the general practitioner or hospital or from patient recall of high blood pressure requiring treatment. Diabetes mellitus was diagnosed from records of the general practitioner or hospital of either diet-controlled, oral hypoglycemic–treated, or insulin-treated disease (WHO classification). The patient or next of kin was questioned about a past history of migraine, alcohol, and other.

**TABLE 1. Patient Characteristics for White and Black Ethnic Groups**

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>White (n=995 [79.3%])</th>
<th>Black (n=203 [16.2%])</th>
<th>Total (n=1198 [95.5%])</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age, y (SD)</td>
<td>73.9 (13.2)</td>
<td>62.7 (15.4)</td>
<td>71.7 (14.2)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Male sex</td>
<td>466 (46.8)</td>
<td>110 (54.2)</td>
<td>576 (48.1)</td>
<td>0.06</td>
</tr>
<tr>
<td>Social class</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nonmanual</td>
<td>246 (25.7)</td>
<td>34 (17.9)</td>
<td>280 (24.4)</td>
<td></td>
</tr>
<tr>
<td>Manual</td>
<td>527 (55.0)</td>
<td>144 (75.8)</td>
<td>671 (58.4)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Economically inactive</td>
<td>186 (19.4)</td>
<td>12 (6.3)</td>
<td>198 (17.2)</td>
<td></td>
</tr>
<tr>
<td>Stroke subtype*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infarct</td>
<td>696 (80.7)</td>
<td>132 (69.1)</td>
<td>828 (78.6)</td>
<td>0.4</td>
</tr>
<tr>
<td>LACI</td>
<td>224 (32.2)</td>
<td>48 (36.4)</td>
<td>272 (32.9)</td>
<td>0.4</td>
</tr>
<tr>
<td>TACI</td>
<td>151 (21.7)</td>
<td>31 (23.5)</td>
<td>182 (22.0)</td>
<td>0.8</td>
</tr>
<tr>
<td>PACI</td>
<td>204 (29.3)</td>
<td>36 (27.3)</td>
<td>240 (29.0)</td>
<td>0.6</td>
</tr>
<tr>
<td>POCI</td>
<td>117 (16.8)</td>
<td>17 (12.9)</td>
<td>134 (16.2)</td>
<td>0.1</td>
</tr>
<tr>
<td>PICH</td>
<td>114 (13.2)</td>
<td>37 (19.4)</td>
<td>151 (14.3)</td>
<td>0.2</td>
</tr>
<tr>
<td>SAH</td>
<td>52 (6.0)</td>
<td>22 (11.5)</td>
<td>74 (7.0)</td>
<td>0.7</td>
</tr>
</tbody>
</table>

Values in parentheses are percentages, unless indicated otherwise.

*P values adjusted for age and sex.

**TABLE 2. Frequency of Risk Factors by Ethnic Group, Adjusted for Differences in Age and Sex**

<table>
<thead>
<tr>
<th>Cerebrovascular Risk Factor</th>
<th>White (n=995 [79.3%])</th>
<th>Black (n=203 [16.2%])</th>
<th>Total (n=1198 [95.5%])</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ischemic heart disease</td>
<td>249 (27.0)</td>
<td>29 (15.5)</td>
<td>278 (25.1)</td>
<td>0.09</td>
</tr>
<tr>
<td>Cerebrovascular disease</td>
<td>160 (17.8)</td>
<td>27 (14.6)</td>
<td>187 (17.2)</td>
<td>0.3</td>
</tr>
<tr>
<td>Atrial fibrillation</td>
<td>234 (25.0)</td>
<td>13 (6.8)</td>
<td>247 (21.9)</td>
<td>0.001</td>
</tr>
<tr>
<td>Hypertension</td>
<td>511 (55.5)</td>
<td>133 (70.7)</td>
<td>644 (58.1)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>126 (13.7)</td>
<td>64 (34.0)</td>
<td>190 (17.1)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Migraine</td>
<td>72 (8.0)</td>
<td>15 (8.2)</td>
<td>87 (8.1)</td>
<td>0.5</td>
</tr>
<tr>
<td>Alcohol</td>
<td>151 (18.0)</td>
<td>18 (10.3)</td>
<td>169 (16.7)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Smoking</td>
<td>617 (74.3)</td>
<td>87 (51.5)</td>
<td>704 (70.4)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Values in parentheses are percentages.
TABLE 3. Frequency of Risk Factors for Infarct vs Hemorrhage, Adjusted for Differences in Age and Sex

<table>
<thead>
<tr>
<th>Cerebrovascular Risk Factor</th>
<th>Infarct (n=681) [80.0%]</th>
<th>Hemorrhage (n=243 [20.0%])</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ischemic heart disease</td>
<td>211 (26.2)</td>
<td>39 (17.7)</td>
<td>0.1</td>
</tr>
<tr>
<td>Cerebrovascular disease</td>
<td>162 (20.3)</td>
<td>18 (8.3)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Atrial fibrillation</td>
<td>186 (22.7)</td>
<td>23 (10.3)</td>
<td>0.02</td>
</tr>
<tr>
<td>Hypertension</td>
<td>483 (60.1)</td>
<td>110 (50.2)</td>
<td>0.04</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>167 (20.7)</td>
<td>25 (11.4)</td>
<td>0.003</td>
</tr>
<tr>
<td>Migraine</td>
<td>68 (8.6)</td>
<td>19 (8.9)</td>
<td>0.7</td>
</tr>
<tr>
<td>Alcohol</td>
<td>125 (16.6)</td>
<td>39 (19.7)</td>
<td>0.9</td>
</tr>
<tr>
<td>Smoking</td>
<td>537 (71.4)</td>
<td>125 (66.1)</td>
<td>0.07</td>
</tr>
</tbody>
</table>

Values in parentheses are percentages.

Results

A total of 1254 patients were included in the study, of whom 995 (79.3%) were white, 203 (16.2%) were black, 52 (4.1%) were of other ethnic origin, and 4 (0.3%) were of unknown ethnic origin. Table 1 shows the patient characteristics and stroke subtypes. Subjects in the black ethnic group were younger, with mean age of 73.9 years (SD=15.4) for black and 62.7 years (SD=15.4) for black (P<0.001) subjects. There was no significant difference in sex between white and black ethnic groups, with 466 men (46.8%) in the white group and 110 men (54.2%) in the black group (P=0.06). Blacks were more likely to be from the lower social classes than whites (P<0.001). Although the proportion of patients with hemorrhage rather than infarct was greater for the black ethnic group, the difference was not significant after adjustment for age and sex (P=0.4). The proportions of Bamford infarct subtypes did not differ between ethnic groups after adjustment for age and sex (P>0.1).

Table 2 shows the univariate analysis of risk factor frequencies for the white compared with the black ethnic group, with adjustment for age and sex. Blacks suffered significantly less atrial fibrillation (P<0.001) and were less likely to engage in heavy alcohol consumption (P<0.001) or to have ever smoked (P<0.001). Hypertension (P<0.001) and diabetes mellitus (P<0.001) were more prevalent in the black population.

Table 3 compares the frequency of risk factors for infarct and hemorrhage. Cerebrovascular disease, atrial fibrillation, hypertension, and diabetes mellitus were all significantly more prevalent in patients with cerebral infarct.

Table 4 shows the frequency of risk factors between subtypes of infarct, comparing lacunar with all nonlacunar infarcts and also comparing lacunar infarcts with individual Bamford subtypes. In a comparison of risk factors between lacunar and nonlacunar infarct subtypes, atrial fibrillation was less prevalent in the lacunar (47 [17.5%]) than the nonlacunar group (139 [25.2%]) (P=0.01), and hypertension was more prevalent in the lacunar (173 [65.5%]) than the nonlacunar group (310 [57.4%]) (P=0.03). Risk factor profiles were similar between individual Bamford subtypes (Table 4). Risk factors were again similar between SAH and PICH with the exception of hypertension, present in 86 (58.1%) of PICH and 24 (33.8%) of SAH (P=0.01).

Table 5 shows the multivariate model of factors associated with infarct versus hemorrhage. Ethnic group, age, sex, and all cerebrovascular risk factors, with the exception of migraine, were included in the model. Migraine was omitted from the model because it would have considerably reduced the patient numbers available for analysis and may have

TABLE 4. Frequency of Risk Factors for Lacunar vs Nonlacunar and Lacunar vs Bamford Subtypes: TACI, PACI, and POCI

<table>
<thead>
<tr>
<th>Cerebrovascular Risk Factor</th>
<th>LACI (n=282) [32.7%]</th>
<th>Non-LACI (n=580 [67.3%])</th>
<th>TACI (n=189) [21.9%]</th>
<th>PACI (n=250) [29.0%]</th>
<th>POCI (n=141) [16.4%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ischemic heart disease</td>
<td>69 (26.2)‡</td>
<td>142 (26.2)</td>
<td>44 (24.0)</td>
<td>69 (30.0)</td>
<td>29 (22.5)</td>
</tr>
<tr>
<td>Cerebrovascular disease</td>
<td>52 (20.0)‡</td>
<td>110 (20.4)</td>
<td>39 (21.4)</td>
<td>48 (21.0)</td>
<td>23 (18.0)</td>
</tr>
<tr>
<td>Atrial fibrillation</td>
<td>47 (17.5)*</td>
<td>139 (25.2)</td>
<td>51 (27.7)</td>
<td>66 (28.2)</td>
<td>22 (16.4)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>173 (65.5)†</td>
<td>310 (57.4)</td>
<td>102 (56.7)</td>
<td>134 (58.3)</td>
<td>77 (56.9)</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>54 (20.5)‡</td>
<td>113 (20.9)</td>
<td>42 (23.0)</td>
<td>47 (20.4)</td>
<td>24 (18.6)</td>
</tr>
<tr>
<td>Migraine</td>
<td>21 (8.0)‡</td>
<td>47 (8.9)</td>
<td>10 (5.7)</td>
<td>22 (9.7)</td>
<td>15 (11.9)</td>
</tr>
<tr>
<td>Alcohol</td>
<td>39 (15.4)‡</td>
<td>86 (17.3)</td>
<td>28 (17.3)</td>
<td>35 (16.1)</td>
<td>23 (19.3)</td>
</tr>
<tr>
<td>Smoking</td>
<td>180 (70.6)‡</td>
<td>357 (71.8)</td>
<td>118 (72.8)</td>
<td>153 (70.8)</td>
<td>86 (72.3)</td>
</tr>
</tbody>
</table>

Values in parentheses are percentages.

*P<0.01, †P<0.03, ‡P>0.6 for nonlacunar vs lacunar infarct, adjusted for age and sex.
affected the reliability of the results. Factors independently associated with infarct included increasing age (\(P<0.001\)) and prior cerebrovascular disease (\(P=0.003\)).

Table 6 shows the multivariate model for nonlacunar versus lacunar infarct and individual Bamford subtypes versus lacunar infarct. Ethnic group, age, sex, and all cerebrovascular risk factors, with the exception of migraine, were included in the model. Atrial fibrillation was independently associated with nonlacunar infarct (odds ratio [OR]=1.64; 95% CI, 1.08 to 2.50; \(P=0.02\)). When we compared individual Bamford subtypes versus lacunar infarct, atrial fibrillation was significantly more prevalent for TACI (OR=2.08; 95% CI, 1.22 to 3.54; \(P=0.007\)) and PACI (OR=1.83; 95% CI, 1.12 to 3.00; \(P=0.02\)) but not for POCI (OR=0.92; 95% CI, 0.48 to 1.74; \(P=0.9\)). Risk factor profiles for hemorrhage subtypes were similar in multivariate analysis; increasing age was the only factor significantly associated with PICH compared with SAH (OR=1.08; 95% CI, 1.05 to 1.12; \(P<0.001\)).

**Discussion**

This study is the first European population-based study to investigate the association of cerebrovascular risk factors with stroke subtype and ethnic groups and, to our knowledge, the first study relating risk factors to Bamford infarct subtypes. It shows that risk factor profiles differ between the UK black and white populations and that Bamford clinical subtypes bear little association with cerebrovascular risk factors.

**Ethnic Differences in Cerebrovascular Risk Factors**

This study in a UK inner city population has shown that hypertension is more prevalent in the black stroke population. This is in agreement with US-based studies in both the stroke and general populations that have shown hypertension to be more frequent and blood pressure levels reportedly higher in blacks than in their white counterparts. UK studies of the general population have shown a higher prevalence of hypertension in black Africans and black Caribbeans, although data on the stroke population are sparse. Other studies, however, have reported no ethnic differences in hypertension. The diagnostic criteria used in this study were designed to account for both treated and undiagnosed hypertension, although problems may exist with using both self-reported diagnoses and single blood pressure readings. For this reason, single borderline blood pressure readings (WHO criteria) were not classified as hypertension. Alternative methods of diagnosis would have included using data on the use of antihypertensive medication or the presence of hypertensive ECG changes. However, rates of both antihypertensive treatment and ECG changes have been shown to be higher in the nonwhite population of South London. There is no clear consensus regarding the reason for the excess prevalence of hypertension, although some evidence for ethnic differences in genetic predisposition to hypertension does exist.

### Table 5: Multivariate Model Showing Factors Independently Associated With Infarct Compared With Hemorrhage

<table>
<thead>
<tr>
<th>Factor</th>
<th>OR (95% CI)</th>
<th>(P)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black ethnicity</td>
<td>0.83 (0.49–1.38)</td>
<td>0.5</td>
</tr>
<tr>
<td>Increasing age</td>
<td>1.03 (1.02–1.05)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Female sex</td>
<td>1.00 (0.67–1.49)</td>
<td>1.0</td>
</tr>
<tr>
<td>Ischemic heart disease</td>
<td>1.42 (0.86–2.33)</td>
<td>0.2</td>
</tr>
<tr>
<td>Cerebrovascular disease</td>
<td>2.38 (1.36–4.18)</td>
<td>0.003</td>
</tr>
<tr>
<td>Atrial fibrillation</td>
<td>1.45 (0.85–2.46)</td>
<td>0.2</td>
</tr>
<tr>
<td>Hypertension</td>
<td>1.39 (0.96–2.02)</td>
<td>0.1</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>1.73 (1.00–3.50)</td>
<td>0.06</td>
</tr>
<tr>
<td>Alcohol</td>
<td>0.95 (0.57–1.57)</td>
<td>0.8</td>
</tr>
<tr>
<td>Smoking</td>
<td>1.43 (0.94–2.17)</td>
<td>0.1</td>
</tr>
</tbody>
</table>

**Discussion**

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### Table 6: Multivariate Model Showing OR for Factors Associated With Nonlacunar vs Lacunar Infarct (Multiple Logistic Regression) and Relative Risk Ratios for Factors Associated With Bamford Subtypes vs Lacunar Infarct (Multinomial Logistic Regression)

<table>
<thead>
<tr>
<th>Factor</th>
<th>Non-LACI OR (95% CI)</th>
<th>TACI RRR (95% CI)</th>
<th>PACI RRR (95% CI)</th>
<th>POCI RRR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black ethnicity</td>
<td>1.00 (0.62–1.61)</td>
<td>1.28 (0.68–2.40)</td>
<td>1.02 (0.58–1.81)</td>
<td>0.66 (0.31–1.41)</td>
</tr>
<tr>
<td>Increasing age</td>
<td>1.00 (0.98–1.01)</td>
<td>1.00 (0.98–1.02)</td>
<td>0.99 (0.98–1.01)</td>
<td>1.00 (0.98–1.02)</td>
</tr>
<tr>
<td>Female gender</td>
<td>0.99 (0.70–1.42)</td>
<td>1.12 (0.69–1.80)</td>
<td>1.00 (0.65–1.54)</td>
<td>0.85 (0.51–1.42)</td>
</tr>
<tr>
<td>Ischemic heart disease</td>
<td>0.99 (0.68–1.44)</td>
<td>0.86 (0.52–1.43)</td>
<td>1.20 (0.77–1.86)</td>
<td>0.81 (0.46–1.43)</td>
</tr>
<tr>
<td>Cerebrovascular disease</td>
<td>1.12 (0.75–1.65)</td>
<td>1.33 (0.80–2.21)</td>
<td>1.02 (0.63–1.64)</td>
<td>1.04 (0.59–1.85)</td>
</tr>
<tr>
<td>Atrial fibrillation</td>
<td>1.64* (1.08–2.50)</td>
<td>2.08† (1.22–3.54)</td>
<td>1.83‡ (1.12–3.00)</td>
<td>0.92 (0.48–1.74)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>0.79§ (0.53–1.06)</td>
<td>0.69 (0.44–1.08)</td>
<td>0.83 (0.55–1.26)</td>
<td>0.70 (0.43–1.13)</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>1.03 (0.66–1.59)</td>
<td>1.16 (0.66–2.05)</td>
<td>1.01 (0.60–1.71)</td>
<td>0.88 (0.45–1.72)</td>
</tr>
<tr>
<td>Alcohol</td>
<td>1.13 (0.69–1.83)</td>
<td>1.32 (0.70–2.49)</td>
<td>1.05 (0.59–1.90)</td>
<td>1.05 (0.52–2.09)</td>
</tr>
<tr>
<td>Smoking</td>
<td>1.10 (0.75–1.62)</td>
<td>1.22 (0.73–2.05)</td>
<td>1.07 (0.67–1.70)</td>
<td>1.01 (0.58–1.76)</td>
</tr>
</tbody>
</table>

**RRR indicates relative risk ratio.**

*\(P=0.02\), †\(P=0.007\), ‡\(P=0.02\), §\(P=0.1\), ‖\(P=0.1\).
This study clearly demonstrates a higher frequency of diabetes among the UK black stroke population, confirming the findings of the National Health and Nutrition Examination Survey. Diabetes has previously been shown to be more prevalent among the general black African population in a population-based survey in South London, but, to our knowledge, our data are the first for the UK black stroke population.

The presence of ischemic heart disease is an important risk factor for stroke. This study shows a nonsignificantly lower frequency of ischemic heart disease in a UK black stroke population. This is in agreement with previous studies in the US black stroke population. Despite this lower recorded prevalence, however, the rates of ischemic change on ECG for these patients were higher, suggesting that the use of ECG findings for black patients may not reflect the presence of coronary artery pathology. ECG findings of ischemia were not used for the diagnosis of ischemic heart disease in this study.

Atrial fibrillation is a major risk factor for stroke, increasing the risk of stroke 3-fold to 5-fold in the Framingham Study. This study shows lower frequency rates of atrial fibrillation in the UK black stroke population, confirming findings from a study of the US black stroke population. A population-based survey of the same South London population found no difference in the prevalence of atrial fibrillation between the UK black and white general populations.

The frequency of prior cerebrovascular disease was lower in this UK black population. This confirms findings of a hospital-based study in the Lehigh Valley, Pennsylvania, and probably reflects the previous observation of lower rates of large-artery atherosclerosis in the US black population.

Migraine is a less frequently reported risk factor for stroke. Nevertheless, a study of the general US population taken from the National Health and Nutrition Examination Survey established that migraine was associated with a risk ratio of 1.5 for stroke. That study found no difference in the prevalence of migraine between the black and white populations. Our study confirms this finding for the UK black stroke population.

Previous data on the behavioral risk factors of smoking and alcohol intake show more variability. Overall, smoking prevalence is reported to be higher in US blacks than in whites, although black smokers smoke fewer cigarettes per day. Our study contradicts this finding, with >20% higher rates of smoking among the white compared with the black population. Population studies looking at cerebrovascular risk factors in the UK general population found a lower prevalence of smoking among UK blacks, in agreement with the findings of this study. Alcohol abuse has been reported to be higher in US black stroke patients and lower in the UK black general population; our study confirmed the latter findings in UK black stroke patients.

The cerebrovascular risk factor profile appears to be similar for the US and UK black populations with regard to physiological risk factors. For behavioral risk factors, however, the UK black population appears to engage less in the risk factors of smoking and alcohol abuse. The degree to which the excess risk factor profiles contribute to the higher stroke incidence in the black population remains unclear. In the National Health and Nutrition Examination Survey, a third of the excess black mortality was explained by known cerebrovascular risk factors, and an additional third of the excess was explained by differences in socioeconomic factors. A third of the excess stroke risk remained unaccounted for, however. The role of risk factors in explaining ethnic differences in stroke needs further clarification.

**Stroke Subtypes and Cerebrovascular Risk Factors**

This study shows that in a UK inner city population, increasing age and a prior history of cerebrovascular disease are the only factors independently associated with cerebral infarct compared with hemorrhage. Similar results were obtained from a study in Switzerland for prior cerebrovascular disease. Those investigators also found an association between infarct and diabetes mellitus in women and with smoking in both sexes. A study from Italy, however, found hypertension to be associated with intracerebral hemorrhage and old age and heart disease to be associated more with ischemic stroke.

Atrial fibrillation was found to be associated with all nonlacunar strokes and with TACI and PACI as well. Hypertension was associated with LACI in univariate analysis; after we accounted for ethnicity, social class, and all other risk factors, however, no significant association remained. There was a trend for a higher frequency of hypertension in the LACI group compared with the subgroup nonlacunar infarct and TACI compared with LACI. These results are similar to those of Landi et al, who found no difference in age, diabetes, smoking, or previous transient ischemic attack between lacunar and nonlacunar infarcts but found a trend for higher frequency of hypertension in lacunar infarcts ($P=0.11$). Other studies comparing lacunar and nonlacunar infarcts have found no association between hypertension and lacunar infarct and less atrial fibrillation in lacunar versus nonlacunar stroke, in agreement with our findings.

Although patients with PICH were older then patients with SAH, there was no difference in their cerebrovascular risk factors. This confirms the findings of a Korean case-control study, except that they found smoking to be more prevalent in PICH patients. A larger American study found differences between the subtypes, with a higher prevalence of hypertension, diabetes mellitus, and alcohol intake for PICH and higher rates of smoking for SAH. Reasons for this difference may be the different numbers of patients studied, differences in the ethnic composition of the population, or differences in the statistical methods of analysis used.

**Conclusion**

This study has confirmed that the frequency of physiological risk factors in the UK black stroke population is similar to that of the US black stroke population. However, the frequency of behavioral risk factors is lower in the UK black stroke population. Risk factors differ between white and black ethnic groups in the United Kingdom; this should be taken into consideration when measures for the secondary prevention of stroke are devised.
Risk factors for the various subtypes of stroke in this population are similar to those found in previous studies, which were primarily based in the United States. Risk factor profiles are similar between Bamford infarct subtypes, with the exception of atrial fibrillation, which is higher in TACI and PACI. Bamford subtypes bear little association with cerebrovascular risk factors. Other classification systems, such as those that classify stroke by etiology, may be more useful in trying to explain the excess risk of stroke and the scope for its prevention.

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References

Cerebrovascular Risk Factors and Stroke Subtypes: Differences Between Ethnic Groups
Cother Hajat, Ruth Dundas, Judy A. Stewart, Enas Lawrence, Anthony G. Rudd, Robin Howard and Charles D. A. Wolfe

*Stroke*. 2001;32:37-42
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