

Survival differences after stroke in a multiethnic population: follow-up study with the south London stroke register

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Abstract

Objectives To identify ethnic differences in survival after stroke and examine the factors that influence survival.

Design Population based stroke register with follow-up.

Settings South London stroke register.

Participants 2321 patients with first stroke registered between January 1995 and December 2002.

Main outcome measures Sociodemographic factors, risk factors for stroke and their management, severity of stroke, and acute service provision factors. Survival analysis with Kaplan-Meier curves, log rank test, and Cox's proportional hazard model with stratification.

Results In univariable analyses of survival, outcome was better for black people than white people (median 33.7 *v* 20.0 months). After stratification by socioeconomic status, type of stroke, and Glasgow coma score, and adjustment for other potential confounders, being black was generally associated with better survival, taking into account the interaction between ethnicity and age, and ethnicity and prior Barthel score. Of the risk factors for stroke considered, current smoking (hazard ratio 1.21, 95% confidence interval 1.01 to 1.45, $P=0.044$), untreated atrial fibrillation (1.36, 1.08 to 1.72, $P=0.009$), untreated diabetes (1.53, 1.05 to 2.22, $P=0.027$), and treated diabetes (1.61, 1.27 to 2.03, $P<0.001$) were associated with reduced survival.

Conclusion In general, black patients in a south London population with first ever stroke are more likely to survive than white patients, the exceptions being in those aged <65 and those with a prior Barthel score <15 . Some pre-stroke risk factors that have the potential to be modified, including the appropriate treatment of existing health problems, have a strong impact on survival.

Introduction

Black people have higher incidence and mortality for stroke than white people in the United Kingdom and the United States,¹⁻³ with inconsistent evidence of disadvantage for black people in long term survival. In Britain, Caribbean immigrants have the highest mortality from stroke,⁴ and in black men in the US, up to 46% of the excess risk of death from stroke in men can be explained by socioeconomic class.⁵

The south London stroke register was established to investigate ethnic differences in the natural course of stroke.⁵ We identified sociodemographic factors, pre-stroke risk factors and their management, indicators of stroke severity, and acute treatment factors associated with survival after stroke.

Methods

The population based stroke register recorded first ever strokes between January 1995 and December 2002 in patients of all age groups.^{5,6} Socioeconomic categories were grouped into non-manual, manual, and economically inactive. Ethnic origin was categorised into black (black-Caribbean, black African, and black other) and white. We restricted analysis to these categories only as numbers in other ethnic groups were small.

Classification of the pathological subtype (cerebral infarction, primary intracerebral haemorrhage, and subarachnoid haemorrhage) was based on results from at least one of brain imaging, analysis of cerebrospinal fluid, or necropsy examination. Cases without pathological confirmation of subtype were unclassified. Cerebral infarction was categorised as total anterior cerebral, partial anterior cerebral, posterior cerebral, and lacunar.

Data collected on pre-stroke risk factors included current smoking status, high alcohol intake (≥ 14 units a week for women, ≥ 21 units a week for men), hypertension (blood pressure $>140/90$ mm Hg), atrial fibrillation, diabetes, ischaemic heart disease, and transient ischaemic attack.

Management of risk factors before stroke was analysed by prescription of antihypertensive drugs; atrial fibrillation was subdivided into no treatment, aspirin, other antiplatelets, or warfarin; a history of transient ischaemic attack or ischaemic heart disease by treatment with aspirin; and diabetes by treatment with oral hypoglycaemics or insulin. Case severity variables before stroke included urinary incontinence, living alone before stroke, and prior Barthel index (categorised as 0-14 or 15-20). Case severity variables in the acute phase included urinary incontinence, ability to swallow, Glasgow coma score (categorised as 0-8 or 9-15), pathological and clinical stroke subtype, and admission to a stroke unit, a general medical ward, or remaining in the community.

Statistical methods

Survival time was from date of stroke to date of death. Patients with no record of death were censored at the end of 2003. Univariable analyses examined ethnic differences in sociodemographic factors, risk factors before stroke and their management, case severity, and service provision variables. Survival after the initial stroke was examined with unadjusted Kaplan-Meier survival curves, with comparisons between black and white groups.

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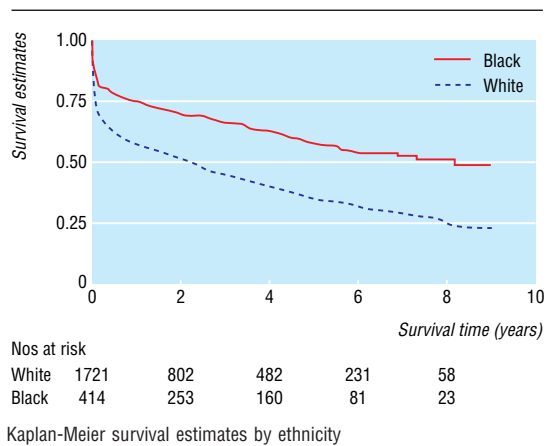
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Kaplan-Meier curves for black and white patients by age are on bmj.com



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We used Cox proportional hazards survival analysis to investigate ethnic associations, adjusting for potential confounding factors (see bmj.com for further details).

Results

The south London stroke register registered 2321 patients. Of these, 1721 (74.1%) were white, 414 (17.8%) black, and 186 (8.0%) other groups or missing ethnicity. See table on bmj.com for sociodemographic factors, risk factors and their management, case severity, and acute service provision variables.

Regarding modifiable behavioural risk factors, a lower proportion of black people had a high alcohol intake and fewer were current smokers. High blood pressure and diabetes were more commonly observed in black people, with the reverse for ischaemic heart disease, atrial fibrillation, and transient ischaemic attack. Of those people with previously diagnosed medical conditions, a record of treatment for high blood pressure was more common for black people (180/286 (62.9%) *v* 551/964 (57.2%) white people). The same was true for ischaemic heart disease (24/50 (48.0%) *v* 148/371 (39.9%)). Treatment for transient ischaemic attack, however, was more common in white people than in black people (98/234 (41.9%) *v* 13/44 (29.6%)).

Black patients were more likely to be admitted to the stroke unit, and similar proportions in both groups were managed in the community during the acute phase.

Survival analysis

The 2321 patients represented 6081 person years of time after stroke; 4253 person years for the 1721 white people and 1358 for the 414 black people, with the remainder of other ethnic groups not analysed here. There were 1303 deaths (1097 and 166, respectively). Mean (median) survival was 31.2 (20.0) months for white people and 39.3 (33.7) months for black people. Case fatality was 275 (16.0%) and 40 (9.7%) at seven days and 567 (32.9%) and 80 (19.3%) at three months.

The survival curve showed a clear difference between the two groups (figure), with white people having poorer survival (log rank test $P < 0.001$). After adjustment for age and stratification for socioeconomic status and stroke subtype, this trend remained (hazard ratio 0.72, 95% confidence interval 0.61 to 0.87, $P < 0.001$). See bmj.com for models using different variables and extra figures.

In the final proportional hazards survival model, ethnicity was highly significant (hazard ratio 24.80, 95% confidence interval 4.70 to 130.87), but when we adjusted for the interaction between ethnicity and age (0.97, 0.95 to 0.99) and prior Barthel score (0.17, 0.08 to 0.36), black people aged ≥ 65 and with a prior Barthel score of at least 15 had a substantial survival advantage over white people.

Current smoking was an indication of poorer survival (1.21, 1.01 to 1.45). Patients with atrial fibrillation treated with warfarin alone fared worse (1.83, 1.09 to 3.07) as did similar patients who were untreated (1.36, 1.08 to 1.72). Diabetes, treated (1.61, 1.27 to 2.03) or untreated (1.53, 1.05 to 2.22), was also an indicator of worse survival.

Initial continence was linked to better survival (0.55, 0.45 to 0.67), and failing the swallow test was associated with worse survival (1.49, 1.23 to 1.79). Patients who were not admitted fared better (0.59, 0.45 to 0.78), and admission to a stroke unit had no impact on survival.

Discussion

In this study of ethnic differences in survival and the effect of sociodemographics, case severity, and clinical management factors on outcome in stroke we found that black patients are more likely to survive than white patients, even after we controlled for various factors.

The use of race and ethnicity in research has been debated hotly.^{7, 8} We used the UK census self definition of ethnicity, although the self reporting of ethnicity may change over time.⁷ The census definition is also used to categorise the local population estimates in this study. We amalgamated African Caribbean and African groups, yet biologically or culturally there may be no sense in such a grouping (to perform the analyses separately will require a larger cohort). Despite an increased risk of disease, our analyses show a survival advantage in black people.

Comparison with other studies

No two studies use the same methods for determining the classification of ethnic or racial differences. The main reports on survival in "black" groups are in the US where studies of black Americans and Hispanics have been detailed but with more superficial adjustment for confounding factors. The findings are equivocal but suggest a survival disadvantage in black people.^{3, 9} The Northern Manhattan population based stroke study found a non-significant five year survival advantage in Caribbean Hispanics (67%) and black Americans (61%) compared with white people (46%).¹⁰ Our study showed a clear advantage for black people, with five year survival being 57% for black people and 36% for white people.

The modifiable risk factors that increase the risk of stroke and recurrent stroke have been shown in population based stroke studies in the US and south London.^{11, 12} In the Manhattan studies hypertension, diabetes, and physical inactivity had high aetiological fractions in American black people and Caribbean Hispanics, which mirrors the prevalence of these risk factors in the south London population. Our analyses indicate improved use of appropriate medications for control of risk factors in black people after we controlled for age, although we did not assess dose and

compliance. Improved management may reflect heightened awareness by black people and healthcare professionals to the risks of stroke.

Possible confounding and bias

One confounding factor may be the differences in case mix between groups. We adjusted for previous activity of daily living, Glasgow coma score, acute urinary incontinence, and swallowing deficits. There is still the potential for residual confounding.

A possible cause of bias could have been if the register had missed either the more mild strokes in white people or the more severe strokes in black people (or both). When we allowed for differences in case ascertainment, the differences in three month mortality remained; thus we can be reasonably sure that the black mortality advantage seen here is not due to ascertainment bias (see bmj.com).

The south London register has observed an increased risk of stroke but improved survival for most groups within the black population. After controlling for sociodemographic, case severity, and healthcare interventions we found a residual unexplained overall survival advantage in the black group. This requires more detailed description of case mix and stroke subtype, including aetiological subtype, investigation of a healthy migrant population, and care after stroke.

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Ethical approval: Ethical approval was from the ethics committees of Guy's and St Thomas' Hospital Trust, King's College Hospital, Queen Square, and Westminster Hospital.

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What is already known on this topic

The risk of stroke and mortality from stroke are higher in black ethnic groups compared with white groups

Analysis of survival after stroke between ethnic groups has rarely controlled for differences in socioeconomic status, management of pre-morbid risk factors, case mix, or acute management

What this study adds

Black people with good mobility before a stroke and older black people have a substantial survival advantage over similar white people

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Systematic review of publication bias in studies on publication bias

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Publication bias is a well known phenomenon in clinical literature,^{1,2} in which positive results have a better chance of being published, are published earlier, and are published in journals with higher impact factors. Conclusions exclusively based on published studies, therefore, can be misleading.³ Selective under-reporting of research might be more widespread and more likely to have adverse consequences for patients than publication of deliberately falsified data.¹ We investigated whether there is preferential publication of positive papers on publication bias.

Methods and results

We identified studies that assessed the impact of publication bias in Medline (January 1993 to October 2003)

using the search terms "publication bias", "citation bias", "language bias", "location bias", "reference bias", or "multiple publication bias". We also searched the references of a Cochrane review on publication bias.⁴ We restricted the search to publications that primarily investigated publication bias and whose acceptance therefore might have depended on whether they had found publication bias or not. We retrieved 265 references. Of these, we chose 148 for full examination. Their bibliographies yielded 26 additional papers. We

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References for the 26 studies are on bmj.com

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