Veterans Administration Acute Stroke (VASt) Study
Lack of Race/Ethnic-Based Differences in Utilization of Stroke-Related Procedures or Services

Larry B. Goldstein, MD; David B. Matchar, MD; Jennifer Hoff-Lindquist, MS; Gregory P. Samsa, PhD; Ronnie D. Horner, PhD

Background and Purpose—Race/ethnic-based disparities in the utilization of health-related services have been reported. Data collected as part of the Veterans Administration Acute Stroke Study (VASt) were analyzed to determine whether similar differences were present in patients admitted to Veterans Administration (VA) hospitals with acute ischemic stroke.

Methods—VASt prospectively identified stroke patients admitted to 9 geographically separated VA hospitals between April 1995 and March 1997. Demographic characteristics and all inpatient diagnostic tests/procedures were recorded. Frequencies were compared with χ² tests.

Results—Of 1073 enrolled patients, 775 (white, n=520; nonwhite, n=255, including 226 blacks and 28 Hispanic-Americans) with ischemic stroke were admitted from home. Mean ages (71.0±0.6 versus 71.9±0.4 years; P=0.25) and Trial of ORG 10172 in Acute Stroke Treatment (TOAST) stroke types (atherothrombotic, 12.9% versus 13.3%; cardioembolic, 16.5% versus 18.0%; lacunar, 26.4% versus 27.1%; other, 1.4% versus 2.0%; unclassified, 42.9% versus 39.6%; P=0.89) for whites versus nonwhites were similar. There were no race/ethnic-based differences in the utilization of brain CT (91.0% versus 92.2%; P=0.58), MRI (36.2% versus 41.6%; P=0.14), transthoracic (52.5% versus 53.7%; P=0.75) or transesophageal echocardiography (10.2% versus 10.6%; P=0.86), 24-hour ECG (3.3% versus 1.6%; P=0.17), carotid ultrasound (64.0% versus 62.0%; P=0.57), carotid endarterectomy (1.5% versus 0.8%; P=0.38), rehabilitation evaluations (71.0% versus 76.5%; P=0.11), speech therapy (9.6% versus 12.6%; P=0.21), recreational therapy (3.1% versus 2.0%; P=0.37), or occupational therapy (16.0% versus 19.6%; P=0.20) for whites versus nonwhites, respectively. Angiography was performed less frequently (3.1% versus 8.5%; P=0.01) and ECG more frequently (81.6% versus 73.5%; P=0.01) in nonwhites. The proportions of patients discharged functionally independent were also similar (52% of whites and 50% of nonwhites had discharge Rankin Scale scores of 0, 1, or 2; P=0.63).

Conclusions—Aside from cerebral angiography and ECG, there were no race/ethnic-based disparities in the utilization of a variety of stroke-related procedures and services. The difference in the use of angiography is unlikely to be related to a difference in screening for carotid endarterectomy because there was no difference in the frequency of carotid ultrasonography. The reason ECG was obtained more frequently in nonwhites is uncertain. (Stroke. 2003;34:999-1004.)

Key Words: health services ■ racial differences ■ stroke

Studies consistently document race/ethnic and socioeconomic disparities in access to care and in the use of specific treatment modalities in the United States. This difference extends to both cardiovascular and cerebrovascular disease. Although there are a variety of potential causes for this apparent inequality, the reasons for its existence are not fully explained.

The Veterans Affairs Health Administration (VA) in the United States is an equal-access healthcare system open to all qualifying veterans, thereby largely eliminating socioeconomic barriers to care among participants. The Veterans Administration Acute Stroke Study (VASt) prospectively collected data from a cohort of patients hospitalized with acute ischemic stroke. In the present study VASt data were analyzed to determine whether there were race/ethnic differences in patients' evaluations for ischemic stroke or its management.

Received August 21, 2002; final revision received October 16, 2002; accepted October 30, 2002.

From the Durham Veterans Affairs Medical Center, Durham, NC (L.B.G., D.B.M., J.H-L.); Departments of Neurology (L.B.G.) and General Internal Medicine (D.B.M., G.P.S.), Department of Medicine; Stroke Policy Program, Center for Clinical Health Policy Research (L.B.G., D.B.M.); and Center for Cerebrovascular Disease (L.B.G., D.B.M., G.P.S.), Duke University, Durham, NC; and Office of Minority Health and Research, National Institute of Neurological Disorders and Stroke, Bethesda, Md (R.D.H.).

Correspondence to Larry B. Goldstein, MD, Duke Center for Cerebrovascular Disease, Stroke Policy Program, Center for Clinical Health Policy Research, Box 3651, Duke University Medical Center, Durham, NC 27710. E-mail golds004@mc.duke.edu

© 2003 American Heart Association, Inc.

Stroke is available at http://www.strokeaha.org DOI: 10.1161/01.STR.0000063364.88309.27
Subjects and Methods

Study Design
The design of the VASt Study has previously been published. Briefly, VASt was a 9-site nationwide prospective cohort study of 1073 patients with acute stroke hospitalized within the VA Health Administration between April 1, 1995 and March 31, 1997. Because of confidentiality, the individual sites are not identified. Data on acute care practices, the subject of the present analysis, were collected through medical record review with the use of a standardized chart abstraction protocol. The study protocol was approved by each site’s institutional review board.

Patients
A research assistant identified patients with possible stroke within 48 hours of hospital admission by screening admission logs. The diagnosis was then confirmed by review of medical records and discussion with the patient’s attending physician. This method of patient identification was supplemented by review of the hospital’s discharge files for diagnoses of intracerebral hemorrhage (International Classification of Diseases, Ninth Revision, Clinical Modification [ICD-9-CM] code 431) or acute cerebral infarction (ICD-9-CM code 434 or 436). Patients whose stroke was iatrogenic, was due to brain trauma or neoplasm, occurred during hospitalization for other medical conditions, was an extension of previous stroke, or occurred >7 days before admission were excluded. Patients with a prior history of stroke in whom the index stroke was not an extension of a previous stroke were included. Thus, the overall study cohort consisted of patients with ischemic or hemorrhagic stroke within the prior week. The present analysis focused on patients with ischemic stroke admitted from home, thereby eliminating potential confounding due to evaluations that could have been done at another institution and limitations in evaluations in those previously institutionalized.

Demographic Variables, Diagnostic Testing, and Clinical Course
Demographic characteristics included age, sex, and self-reported race/ethnic group (white, black, Hispanic, other). Comorbid conditions were classified with the Charlson Index. Stroke subtype was assigned according to the Trial of ORG 10172 in Acute Stroke Treatment (TOAST) criteria with the aid of a computerized system for diagnoses of intracerebral hemorrhage (International Classification of Diseases, Ninth Revision, Clinical Modification [ICD-9-CM] code 431) or acute cerebral infarction (ICD-9-CM code 434 or 436). Patients whose stroke was iatrogenic, was due to brain trauma or neoplasm, occurred during hospitalization for other medical conditions, was an extension of previous stroke, or occurred >7 days before admission were excluded. Patients with a prior history of stroke in whom the index stroke was not an extension of a previous stroke were included. Thus, the overall study cohort consisted of patients with ischemic or hemorrhagic stroke within the prior week. The present analysis focused on patients with ischemic stroke admitted from home, thereby eliminating potential confounding due to evaluations that could have been done at another institution and limitations in evaluations in those previously institutionalized.

Statistical Analysis
Because of sample size considerations, whites were compared with subjects of other race/ethnic groups (nonwhites) for these analyses. Continuous variables were compared with t tests and frequencies with χ2 tests.

Results
Of 1073 enrolled patients, 775 (nonwhite, n=255, including 226 blacks and 28 Hispanics; white, n=520) with ischemic stroke were admitted from home. The individual sites enrolled 61 to 118 patients each (median, 32% nonwhites; range, 14% to 59%). Because this was a veteran population, only 2% of the patients were women (0.8% of nonwhites and 2.5% of whites; P=0.10). Table 1 compares demographics, other baseline characteristics, initial stroke severity, and TOAST stroke subtype based on race/ethnic group. Higher proportions of whites were college educated and had annual incomes >$10 000. There were no significant race/ethnic differences based on the patients’ mean ages or comorbid conditions (Charlson Index). The proportions with prior functional deficits, initial stroke severities (based on Canadian Neurological Scale ratings), and stroke subtypes (TOAST classification) were similar.

Table 2 compares the use of diagnostic tests and Table 3 the use of various interventions for stroke management. There were no race/ethnic-based differences in the utilization of brain CT, MRI, transthoracic or transesophageal echocardiography, 24-hour ECG, carotid ultrasound, carotid endarterectomy, rehabilitation evaluations, or speech, recreational, or occupational therapy evaluations. The proportions of patients with do not resuscitate (DNR) orders and with a chart note indicating clinical worsening during the first 24 hours of hospitalization, as well as the patients’ functional status at hospital discharge (Rankin Scale score), were recorded.

### Table 1. Demographics and Baseline Characteristics

<table>
<thead>
<tr>
<th>Feature</th>
<th>Whites (n=520)</th>
<th>Nonwhites (n=255)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age±SEM</td>
<td>71.0±0.6</td>
<td>71.9±0.4</td>
<td>0.25</td>
</tr>
<tr>
<td>Charlson Index</td>
<td>0.6±0.1</td>
<td>0.5±0.1</td>
<td>0.47</td>
</tr>
<tr>
<td>Prior functional deficit</td>
<td>19.2%</td>
<td>24.3%</td>
<td>0.10</td>
</tr>
<tr>
<td>College education</td>
<td>31.8%</td>
<td>22.7%</td>
<td>0.02</td>
</tr>
<tr>
<td>Income&gt;$10,000</td>
<td>47.5%</td>
<td>24.2%</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Stroke severity (CNS)</td>
<td>8.8±0.1</td>
<td>8.4±0.2</td>
<td>0.06</td>
</tr>
<tr>
<td>Stroke subtype (TOAST)</td>
<td></td>
<td></td>
<td>0.89</td>
</tr>
<tr>
<td>Atherothrombotic</td>
<td>12.9%</td>
<td>13.3%</td>
<td></td>
</tr>
<tr>
<td>Cardioembolic</td>
<td>16.5%</td>
<td>18.0%</td>
<td></td>
</tr>
<tr>
<td>Lacunar</td>
<td>26.4%</td>
<td>27.1%</td>
<td></td>
</tr>
<tr>
<td>Other defined</td>
<td>1.4%</td>
<td>2.0%</td>
<td></td>
</tr>
<tr>
<td>Unclassified</td>
<td>42.9%</td>
<td>39.6%</td>
<td></td>
</tr>
</tbody>
</table>

CNS indicates Canadian Neurological Scale; TOAST, Trial of ORG 10172 in Acute Stroke Treatment.

### Table 2. Utilization of Diagnostic Tests

<table>
<thead>
<tr>
<th>Test</th>
<th>Whites (n=520), %</th>
<th>Nonwhites (n=255), %</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brain CT</td>
<td>91.0</td>
<td>92.2</td>
<td>0.58</td>
</tr>
<tr>
<td>Brain MRI</td>
<td>36.2</td>
<td>41.6</td>
<td>0.14</td>
</tr>
<tr>
<td>TTE</td>
<td>52.5</td>
<td>53.7</td>
<td>0.75</td>
</tr>
<tr>
<td>TEE</td>
<td>10.2</td>
<td>10.6</td>
<td>0.86</td>
</tr>
<tr>
<td>24-h ECG</td>
<td>3.3</td>
<td>1.6</td>
<td>0.17</td>
</tr>
<tr>
<td>Carotid ultrasound</td>
<td>64.0</td>
<td>62.0</td>
<td>0.57</td>
</tr>
<tr>
<td>Cerebral angiography</td>
<td>8.5</td>
<td>3.1</td>
<td>0.01</td>
</tr>
<tr>
<td>ECG</td>
<td>73.1</td>
<td>81.6</td>
<td>0.01</td>
</tr>
</tbody>
</table>

TTE indicates transthoracic echocardiography; TEE, transesophageal echocardiography.
TABLE 3. Utilization of Interventions

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Whites (n=520), %</th>
<th>Nonwhites (n=255), %</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>tPA</td>
<td>0.6</td>
<td>0.4</td>
<td>0.73</td>
</tr>
<tr>
<td>Antiplatelet drug</td>
<td>93.2</td>
<td>92.1</td>
<td>0.59</td>
</tr>
<tr>
<td>Carotid endarterectomy</td>
<td>1.5</td>
<td>0.8</td>
<td>0.38</td>
</tr>
<tr>
<td>Rehabilitation evaluation</td>
<td>71.0</td>
<td>76.5</td>
<td>0.11</td>
</tr>
<tr>
<td>Physical therapy</td>
<td>70.5</td>
<td>74.9</td>
<td>0.27</td>
</tr>
<tr>
<td>Speech therapy</td>
<td>9.6</td>
<td>12.6</td>
<td>0.21</td>
</tr>
<tr>
<td>Occupational therapy</td>
<td>16.0</td>
<td>19.6</td>
<td>0.20</td>
</tr>
<tr>
<td>Recreational therapy</td>
<td>3.1</td>
<td>2.0</td>
<td>0.37</td>
</tr>
</tbody>
</table>

tPA indicates tissue plasminogen activator.

Similar and high proportions of patients were given platelet antiaggregants. The use of rehabilitation services was also similar between whites and nonwhites.

Similar proportions of whites and nonwhites had written DNR orders in the case of cardiopulmonary arrest (Table 4). There was no race/ethnic difference in the proportions of patients with clinical deterioration during the first 24 hours of hospitalization. The proportions of patients discharged functionally independent were also similar (52% of whites and 50% of nonwhites had discharge Rankin Scale scores of 0, 1, or 2; P=0.63).

Discussion

The main finding of the present analysis is that there were generally no significant race/ethnic-based differences in the utilization of a wide variety of diagnostic studies and treatments in a cohort of patients with acute ischemic stroke admitted from home to VA Health Administration hospitals. We focused on this subgroup of stroke patients to avoid differences in evaluations that could have been related to studies performed in other hospitals or settings in transferred patients. Because the vast majority of nonwhite patients were black (88%), we compared the care of self-described white versus nonwhite patients as a group. However, the results were substantially the same when Hispanics were excluded from the analyses and whites were compared with blacks (data not shown). Because of the relatively small number of patients, it was not appropriate to analyze the care of Hispanic patients separately. Therefore, these data do not address the possibility that care given to Hispanics might differ from care given to whites or blacks. However, there is no reason to believe that this would be the case.

Race/ethnic-based differences in the utilization of certain stroke-related diagnostic tests and procedures have been found in other studies. Some of these differences have been at least partially ascribed to race/ethnic-based differences in stroke subtypes. For example, blacks are one third to one fourth as likely to have carotid endarterectomy performed compared with whites. However, in some studies proportionally more whites have carotid atherosclerosis and proportionally more blacks have intracranial small-vessel type disease. The higher frequency of intracranial small-vessel disease in blacks may be partially attributed to poorer hypertension control among blacks, which could be related in part to socioeconomic and other barriers to preventive care. In the present study the proportions of patients with small-vessel type (ie, TOAST lacunar subtype) stroke were similar between whites and nonwhites (Table 1). Although nonfinancial barriers to care may exist (eg, distance to a VA medical facility), because all of the patients included in this study were cared for within the VA health system, barriers or lack of barriers to preventive services are expected to be similar regardless of the patient’s socioeconomic status. This may partially explain the lack of race/ethnic-based differences in stroke subtypes, a hypothesis that could be tested by directly comparing VA and non-VA hospitals in future studies.

Of the tests performed, race/ethnic-based differences were found only for routine ECG and cerebral angiography. ECG was obtained more frequently in nonwhites than whites (Table 2). Routine ECG should generally be performed in all stroke patients, and the test was not done in 18% of nonwhites and 26% of whites is not clear. This apparent deficiency should be addressed through quality improvement activities.

Cerebral angiography was more commonly performed in whites than nonwhites, although it was used infrequently in either group (Table 2). Cerebral angiography may be used for a variety of reasons, including evaluation for large-vessel intracranial atherosclerosis, diagnosis of unusual causes of stroke such as vasculitis or dissection, and, in many cases, before proceeding with carotid endarterectomy. As indicated below, there were no race/ethnic-based differences in the utilization of carotid ultrasoundography, a screening test generally done before angiography. Therefore, a disparity in physicians’ intent to
evaluate a patient for endarterectomy on the basis of race/ethnic group would not be expected to account for the difference in the use of angiography. However, there may have been race/ethnic-based differences in the results of carotid ultrasonography or other clinical features that affected the decision to proceed with the more invasive test.

Although important, race/ethnic-based differences in clinical presentation do not fully explain differences in service utilization reported in other studies. For example, noninvasive carotid imaging is a critical step in the presurgical evaluation for carotid endarterectomy. Blacks were previously found to less frequently have carotid imaging compared with whites, even after controlling for clinical presentation and other factors. Part of this difference may be due to race/ethnic-based differences in aversion to surgery. If patients indicate to their physicians that they would not consider an operative procedure, it is not surprising that preoperative diagnostic studies would be deferred. Similar aversion to invasive procedures, as well as differences in initial stroke severity, may also explain part of the lower reported use of intravenous tPA among blacks compared with whites. In the present study there were no race/ethnic-based differences in the utilization of noninvasive carotid imaging (ie, carotid ultrasound; Table 2), and although the numbers were quite small, there were no differences in the use of tPA or carotid endarterectomy (Table 3). Therefore, there is no evidence that aversion to surgery or invasive procedures was important in this cohort.

Although a race/ethnic-based difference in initial stroke severity was previously reported for this entire study cohort, the difference between whites and nonwhites in the subgroup of patients with ischemic stroke was small and not statistically significant. In addition, there were no significant imbalances between whites and nonwhites with respect to comorbidity, the proportion with prior functional deficits, or the proportion with DNR orders that might confound the finding of a general lack of race/ethnic-based differences in the process or outcome of these patients’ care.

In summary, we found no major unexplained race/ethnic-based inequalities in the utilization of stroke-related diagnostic procedures or treatments among patients cared for within VA Health Administration hospitals. Although the reasons for differences found in other studies are likely complex and remain only partially explained, the present results suggest that unmeasured barriers to care may be contributing to this discrepancy.

Acknowledgments

This work was supported by a grant from the Department of Veterans Affairs (Health Services Research and Development Service, SDR 93-003). Dr Goldstein was supported in part by a National Institutes of Health Midcareer Development Award in Patient-Oriented Research (K24 NS02165). Dr Horner was supported in part by a grant from the VA Cooperative Studies/Epidemiologic Research and Information Center Programs (CSP/ERIC 602).

References

Goldstein et al  Race/Ethnicity and Stroke Care  1003


Editorial Comment

Diagnostic Disparities: Still Exist?

The VA Stroke (VASt) Study presented here by Goldstein and coworkers attempts to review race/ethnic-based differences in the utilization of stroke-related procedures or services. Inequality in quality health care for minorities have been addressed in several recent articles such as presented by Fiscella and co-authors.1 Oddone and colleagues have presented racial variations in the rates of carotid angiography and endarterectomy in patients with stroke and transient ischemic attack.2 Disparities in health care for minorities reached national attention with the studies of Schullman and associates in examining the practice patterns of physicians in both minorities and women in cardiovascular evaluations.3 Johnston and coworkers have presented evidence of the disparate use of rtPA in blacks.4 Yet, VASt and such studies continue to note the ongoing disparity in the utilization of invasive diagnostic procedures to fully evaluate diseases in minorities.

Goldstein and associates have presented a thorough analysis prospectively of stroke patients admitted to 9 geographically separated VA hospitals. They based their investigation within the Veterans Health Administration in the United States as an equal-access health care system mainly eliminating socioeconomic barriers to health care to all who qualify for such care, in itself a self-selected group that also excludes women from the study, as they note. Of interest was the lack of TOAST ischemic stroke type differences for whites versus nonwhites. Thus the issue is again raised from other studies5–7 suggesting more whites have carotid atherosclerosis and more blacks have intracranial small-vessel-type disease, the latter raising the questionable role of hypertension control in blacks.

Thus the VASt study raises again the question: why the limited use of a basic definitive diagnostic study in minorities? Is the noninvasive ECG as this study would suggest substituting for the more diagnostic invasive cerebral angio-

gram because hypertensive cardiovascular and cerebrovascular small-vessel disease is the anticipated cause of stroke in blacks? The VASt study suggests TOAST ischemic stroke types are the same in whites and nonwhites. Once again evidence is presented here of the disparity in sufficient diagnostic evaluation of diseases in general and via the VASt study for stroke in particular. As this study indicates, larger numbers of patients to include more Hispanics and women must pursue these questions for a clearer understanding of the pathogenesis and appropriate treatment for specific types of stroke in minorities.

Finally, one must continue to examine the attitudes and preconceptions of health care providers in the management of patients with stroke or at risk for stroke. The VASt study suggests there was no evidence that aversion to surgery or invasive procedures was an issue in the cohort studied. Stroke is an equal-opportunity disease and therefore deserves equal access to definitive diagnostic studies. Therefore, the contrary opinion is offered here that the VASt study did indeed find major unexplained race/ethnic-based inequalities in the utilization of stroke-related diagnostic procedures, the disparate use of the definitive cerebral angiogram versus the more inconclusive ECG. Furthermore, the study results suggest in fact measurable barriers to stroke care that maybe contributing to this discrepancy—the attitudes, preconceived notions, and limited understanding of the etiology of stroke in minorities.

Edgar J. Kenton III, MD, Guest Editor Cerebrovascular Diseases Mainline/Jefferson Health System Wynnewood, Pennsylvania

References


Veterans Administration Acute Stroke (VAST) Study: Lack of Race/Ethnic-Based Differences in Utilization of Stroke-Related Procedures or Services
Larry B. Goldstein, David B. Matchar, Jennifer Hoff-Lindquist, Gregory P. Samsa and Ronnie D. Horner

Stroke. 2003;34:999-1004; originally published online March 20, 2003;
doi: 10.1161/01.STR.0000063364.88309.27

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://stroke.ahajournals.org/content/34/4/999

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in Stroke can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to Stroke is online at:
http://stroke.ahajournals.org/subscriptions/