Infrequency of Blacks Among Patients Having Carotid Endarterectomy

J. Gary Maxwell, MD, FACS, Edmund J. Rutherford, MD, Deborah Covington, MS, Thomas V. Clancy, MD, A. Darrell Tackett, MD, FACS, Norman Robinson, MD, and George Johnson Jr., MD, FACS

We reviewed demographic data on patients having 2,256 carotid endarterectomies in eight large hospitals in North Carolina to determine the frequency of blacks among these patients. Blacks comprised only 4.6% of the patients having carotid endarterectomy even though they comprised 26% of all patients discharged and 22% of the general population of the state. Data from the National Inpatient Profile of the Commission on Professional and Hospital Activities, which represents patients discharged from short-term, nonfederal hospitals throughout the United States, show that nationwide, blacks comprise only 2.7% of the patients having carotid endarterectomy, whereas they comprise 12.0% of all patients discharged, 12.1% of the general population, and 10.7% of patients discharged following Class I surgical procedures. Blacks have only 67 carotid endarterectomies per 100,000 patients discharged; this rate is five or more times higher in whites. Among black patients having carotid endarterectomy, women predominate, whereas men predominate among white patients having carotid endarterectomy (p=0.006). The underrepresentation of blacks among patients having carotid endarterectomy lends support to the concept that carotid vascular disease in blacks is distributed intracranially rather than extracranially as opposed to the extracranial rather than intracranial distribution in whites. (Stroke 1989;20:22-26)

Blacks experience morbidity and mortality from stroke at rates far above those for whites.1 Though extracranial carotid vascular disease is an acknowledged cause for stroke, several authors have observed that blacks tend to have intracranial rather than extracranial vascular disease.2-4 In addition to differences in the prevalence of hypertension and diabetes, other studies have suggested that differences in the susceptibility of certain anatomic sites to atherosclerosis may explain observed racial differences in the distribution of cerebrovascular disease.7,8 To resolve this question, additional data on patterns of vascular disease involvement or sparing in blacks are needed.9

Information about differences in the incidence of carotid endarterectomy among races would lend support to the concept of racial differences in the intracranial–extracranial distribution of carotid vascular disease. Only one study has examined the rate of carotid endarterectomy among black patients; that study reported that the rate in blacks was only 40% of that in whites.10

The purpose of our article is to document the racial distribution of carotid endarterectomy in several patient populations.

Subjects and Methods

New Hanover Memorial Hospital is a 520-bed general hospital located in southeastern, coastal North Carolina. The hospital draws from an estimated population of 375,000 people in seven surrounding counties. It is a teaching hospital affiliated with the University of North Carolina at Chapel Hill but functions primarily as a community hospital.

To survey all carotid endarterectomies performed on patients living in the surrounding area, we queried the six satellite hospitals close to New Hanover Memorial Hospital. In five of these six hospitals, which range in size from 40- to 166-bed facilities, no carotid surgery is performed. In the remaining hospital (with 110 beds) only 33 carotid endarterectomies were performed during 1984–1986; all procedures were in white patients. Thus, in the seven-county region, 340 of 373 (>90%) of all carotid
endarterectomies are performed at New Hanover Memorial Hospital.

To obtain comparison data from other major referral hospitals in North Carolina, we asked 10 of 16 large hospitals in the state to participate in our study. Of the 10 hospitals selected because of their wide geographic distribution throughout the state, seven agreed to contribute data. All seven hospitals are referral centers, and five have residency programs integral to their function; two are private community hospitals. For none of the seven hospitals is information available regarding the number of carotid endarterectomies performed in their satellite hospitals.

The study populations consist of patients discharged from the eight hospitals with the primary or secondary International Classification of Diseases, Ninth Revision Clinical Modification (ICD-9-CM) procedure code for carotid endarterectomy (38.12). Because of the unavailability of data, the study period varied somewhat among the eight hospitals, but it spans the period 1982–1986. We collected information on the age, sex, race, and payment status of the patients having carotid endarterectomy. Patients were classified as self-pay if they were not covered by insurance, Medicare, or Medicaid; self-pay includes patients who are unable to pay for health care. For comparison, we examined demographic data for all patients discharged over similar time periods and for the general population in each hospital's surrounding counties. Population estimates were taken from the 1980 United States Bureau of Census report.

To compare our results with those for a larger population, we used demographic data from a national sample of patients, the National Inpatient Profile (NIP) compiled by the Commission on Professional and Hospital Activities (CPHA) in Ann Arbor, Michigan. Approximately 1,200 short-term, nonfederal hospitals throughout the United States submit data from individual patient discharge records to CPHA. These data represent approximately 25% of all discharges from similar US hospitals. From these records, CPHA draws a sample of two million patients and uses stratification and estimation techniques to project this sample to represent all patients discharged from the universe of short-term, nonfederal hospitals in the United States. This nationally representative sample comprises the NIP. From these data, we examined all discharges for 1985–1986 with primary or secondary ICD-9-CM procedure codes 38.12.

By agreement, no hospital in North Carolina other than New Hanover Memorial Hospital is identified by name. No hospital identification is included in the NIP data.

We examined differences in proportions using the $\chi^2$ test and differences in means using the $t$ test.

**Results**

The demographic description of all 544,507 patients discharged from the eight hospitals is summarized in Table 1; the percentage of all patients discharged who were black varied from 8% to 44%. Information regarding racial makeup of the self-pay patients was not available. US census data indicate that 22% of the population of North Carolina is black. Comparably, 26% of all patients discharged from the eight hospitals were black.

A total of 2,256 carotid endarterectomies were performed in the eight hospitals (Table 2); 103 (4.6%) were in black patients. The percentage of blacks among the patients having carotid endarterectomy in each hospital varied from 0.8% to 8.8%. Because individual patient identification numbers were not available in seven of the eight hospitals, it was not possible to identify the patients who comprise 1,916 of these carotid endarterectomies. This limitation does not allow identification of opposite side or reoperation in the same patient.

At New Hanover Memorial Hospital 340 carotid endarterectomies were performed in 327 patients during 1984–1986. Only 21 (6.4%) of the 327 patients were black. Opposite side or reoperations were

### Table 1. Hospital Characteristics and Demographic Description of All Patients Discharged From Eight North Carolina Hospitals

<table>
<thead>
<tr>
<th>Hospital</th>
<th>No. beds</th>
<th>Teaching hospital</th>
<th>Period</th>
<th>No.</th>
<th>% black</th>
<th>% male</th>
<th>% self-pay</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>520</td>
<td>Yes</td>
<td>1984–Sept '86</td>
<td>58,138</td>
<td>27</td>
<td>42</td>
<td>13</td>
</tr>
<tr>
<td>B</td>
<td>777</td>
<td>Yes</td>
<td>1984–Sept '86</td>
<td>89,424</td>
<td>34</td>
<td>44</td>
<td>5*</td>
</tr>
<tr>
<td>C</td>
<td>560</td>
<td>Yes</td>
<td>1984–1986</td>
<td>57,712</td>
<td>38</td>
<td>43</td>
<td>17</td>
</tr>
<tr>
<td>D</td>
<td>513</td>
<td>Yes</td>
<td>1984–1986</td>
<td>70,020</td>
<td>35</td>
<td>42</td>
<td>11</td>
</tr>
<tr>
<td>E</td>
<td>282</td>
<td>No</td>
<td>1986 only</td>
<td>35,279†</td>
<td>44*</td>
<td>40*</td>
<td>9*</td>
</tr>
<tr>
<td>F</td>
<td>695</td>
<td>No</td>
<td>1984–1986</td>
<td>104,143</td>
<td>19</td>
<td>37</td>
<td>13</td>
</tr>
<tr>
<td>G</td>
<td>468</td>
<td>Yes</td>
<td>1984–1986</td>
<td>66,395</td>
<td>26</td>
<td>41</td>
<td>12</td>
</tr>
<tr>
<td>H</td>
<td>392</td>
<td>Yes</td>
<td>1984–1986</td>
<td>63,396</td>
<td>8</td>
<td>42</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>524†</td>
<td></td>
<td></td>
<td>544,507</td>
<td>26</td>
<td>39</td>
<td>11</td>
</tr>
</tbody>
</table>

Hospital A, New Hanover Memorial Hospital, other hospitals are not identified by agreement; white includes other races. *1986 only; data not available for 1984 or 1985. †1984–September 1986. ‡Mean.
performed in 13 patients; 12 of the 13 were white and 12 of the 13 were male. Review of 500 consecutive carotid/cerebral angiograms done at New Hanover Memorial Hospital during 1984–1986 showed that 15% were in black patients.

For each hospital, the percentage of blacks among patients having carotid endarterectomy was strikingly smaller than the percentage of blacks among all patients discharged, whereas the percentage of blacks among all patients discharged equals or exceeds the median percentage of blacks among the general population in that hospital’s five-county catchment area (Figure 1).

The majority of white patients having carotid endarterectomy were male, whereas the majority of black patients having carotid endarterectomy were female (Table 2). Due to the few black patients having carotid endarterectomy in each hospital, the data were aggregated to compute statistical tests. Using the aggregate total for all eight hospitals, the relation between race and sex was significant (p = 0.006).

Due to the few black patients having carotid endarterectomy in each hospital, the data on age were also aggregated. The age range for the aggregate total was 30–99 years. The mean age of white patients having carotid endarterectomy was 66 years, whereas that of blacks was 64 years.

For the eight hospitals, 11% of all patients discharged were classified as self-pay, compared with 8% nationally (Table 3). Among the patients having carotid endarterectomy in the eight hospitals, 2% were classified as self-pay, compared with 1.0% nationally. Among black patients having carotid endarterectomy in the eight hospitals, 9% were classified as self-pay. The difference between blacks and whites in pay status among patients having carotid endarterectomy is significant (p = 0.0001). No description of pay status is available for black patients having carotid endarterectomy in the NIP data from the CPHA.

Nationwide, 105,000 carotid endarterectomies were performed in 1985 and 83,000 in 1986; 2.7% of the patients having carotid endarterectomy in 1985–1986 were black (Table 4). Concurrently, blacks represented 10.7% of the population of patients having Class I surgical procedures and 12% of the population of all patients discharged from US hospitals. US census data for 1985 indicate that 12.1% of the general population is black.11

The difference between blacks and whites in the prevalence of carotid endarterectomies per 100,000 patients discharged per year is striking (Table 5). The prevalence of carotid endarterectomy appears to be higher for the eight North Carolina hospitals in our study than for the nation. There is a known increased rate of stroke in the South Atlantic states, and some geographic areas of North Carolina are known to have higher stroke mortality than the state as a whole.1213 However, our North Carolina data cannot be compared with the national data because our sample of eight hospitals is not representative of all 130 general, acute-care North Carolina hospitals. If carotid endarterectomies are not performed in the majority of satellite hospitals, as is the case with the satellite hospitals...
TABLE 3. Pay Status for Patients Discharged From Hospitals

<table>
<thead>
<tr>
<th>Pay status</th>
<th>Eight North Carolina hospitals</th>
<th>US hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All patients</td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Insurance, Medicare, Medicaid,</td>
<td>484,611</td>
<td>89</td>
</tr>
<tr>
<td>other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-pay</td>
<td>59,896</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>544,507</td>
<td>100</td>
</tr>
</tbody>
</table>

*Hospital E excluded because data on pay status not available. Seven other cases excluded due to unknown pay status.
†National Inpatient Profile, Commission on Professional and Hospital Activities, 1985 and 1986 data.

Discussion

Extracranial carotid vascular disease is an acknowledged risk factor for stroke, and blacks are known to experience higher rates of stroke than whites. If factors contributing to atheromatous change, such as hypertension, smoking, and diabetes, affected all vascular beds equally, blacks would be expected to be at least proportionally represented, if not overrepresented, in any population of patients having carotid endarterectomy. We show, however, that blacks are underrepresented among patients having carotid endarterectomy. This finding supports the concept that the distribution of carotid atheromatous disease is a racial or genetic feature of this vascular area. Caplan and Cooper described significant differences in the distribution of vascular patterns of disease between racial groups. Using cerebral angiography, a study of 502 stroke patients entered into the Michael Reese Hospital Stroke Registry found that white patients had more lesions, more symptomatic lesions, and more high-grade stenotic lesions along the extracranial carotid artery than did blacks; black patients had predominantly intracranial lesions. Caplan and Cooper speculated that atherosclerosis of the intima of the extracranial vessels in whites may be different than the process of arteriosclerosis affecting the media and the internal elastic membrane of the intracranial vessels in blacks. Whereas blacks seem to be strikingly underrepresented in the population of patients having carotid endarterectomy, intracranial versus extracranial disease distribution may not be the only explanation for this observation. An alternative explanation could be that, whatever their incidence of extracranial carotid disease, blacks, for reasons such as lack of proximity, different referral patterns, or economics, do not find access to the surgical care system. Although we do not have sufficient data to exclude this explanation, the national data show that the percentage of blacks among all patients discharged from hospitals is comparable to the percentage of blacks in the general population (12.0% vs. 12.1%). The national data also show that blacks are only slightly under-represented among all surgical patients discharged (10.7% vs. 12.1%). Gillum, in his study of data from the National Hospital Discharge Survey, found that in 1981 the age-adjusted rate of cerebral angiography was equal in blacks and whites aged 35–74 years, an observation suggesting that blacks have access to diagnostic procedures appropriate for the evaluation of carotid vascular disease.

In all eight North Carolina hospitals, the percentage of blacks among all patients discharged was equal to or greater than the percentage of blacks in the hospital watershed's general population; lack of insurance, Medicare, or Medicaid coverage was more common in black than in white patients having carotid endarterectomy. These two observations, taken together, do not suggest that pay status specifically limited access of blacks to carotid endarterectomy. Blacks were underrepresented in the 500 consecutive angiograms done at New Hanover Memorial Hospital, again raising the possibility that diagnostic procedures for neurologic symptoms in blacks may not be performed proportionately.

Almost all studies describing carotid endarterectomy outcomes indicate male predominance among the patients having this procedure. We have noted that women predominate among our black patients having carotid endarterectomy. This finding agrees with the angiographic results cited by Caplan.

TABLE 4. Frequency of Blacks Among Various National Patient Populations

<table>
<thead>
<tr>
<th>No.</th>
<th>% black</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total hospital discharge†</td>
<td>75,561,004</td>
</tr>
<tr>
<td>Total surgical procedures‡</td>
<td>31,740,448</td>
</tr>
<tr>
<td>Total carotid endarterectomies</td>
<td>188,907</td>
</tr>
</tbody>
</table>

*National Inpatient Profile, Commission on Professional and Hospital Activities; 1985 and 1986 data aggregated.
†Patients with principal diagnosis.
‡Class I procedures only.
et al, Heyman et al, and Gorelick et al, who found that among blacks extracranial disease was more common in women than in men. Since black women have higher rates of stroke than black men, it is interesting to note the correlation suggested in a study of stroke in North Carolina by Becker et al, who found that hypertension and diabetes were more frequent in nonwhite women.

While we show that blacks are underrepresented among patients having carotid endarterectomy and have suggested that this finding strengthens the concept that carotid vascular disease in blacks is distributed differently than in whites, several caveats seem warranted. First, the data we present represent crude rates of carotid endarterectomy and are not adjusted for age; our comparisons may be biased by racial differences in survivorship. Second, our data are strictly demographic; we have no data on indications for surgery or other factors contributing to the performance of carotid endarterectomy with which to compare blacks and whites. Third, measurements of the surgical treatment of a disease (carotid endarterectomy) may not be directly related to the prevalence of that disease (carotid atherosclerosis). Only prospective studies that begin with the entire black population at risk could eliminate these biases and provide more confidence in our association between race, carotid vascular disease, and its surgical treatment.

Acknowledgments

The assistance of Ms. Joan Peterson Lanier, RRA, medical records librarian, and Ms. Anne Watson, RRA, MSA, Director of Quality Review, New Hanover Memorial Hospital, in obtaining access to the information described in this report is gratefully acknowledged. The authors also express appreciation to the medical records librarians at the other seven North Carolina hospitals that also provided information for this report; by agreement these hospitals are not identified. The assistance of Ms. Barbara Walters, RN, MS, CCRN, Client Development Specialist at CPHA, Ann Arbor, Michigan, is also gratefully acknowledged.

References


TABLE 5. Carotid Endarterectomies per 100,000 Patients Discharged per Year

<table>
<thead>
<tr>
<th></th>
<th>United States*</th>
<th>North Carolina†</th>
<th>New Hanover Memorial Hospital‡</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>274</td>
<td>502</td>
<td>694</td>
</tr>
<tr>
<td>Blacks</td>
<td>67</td>
<td>72</td>
<td>127</td>
</tr>
<tr>
<td>Whites</td>
<td>313</td>
<td>690</td>
<td>904</td>
</tr>
<tr>
<td>Ratio (black: white)</td>
<td>1:5</td>
<td>1:9</td>
<td>1:7</td>
</tr>
</tbody>
</table>

*Based on sample of only seven of 130 general, acute-care hospitals in North Carolina, figured for only 1 year (1985) for which data were consistently available.
†Based only on 1985 data.
‡Based on 130 general hospitals in North Carolina, figured for only 1 year (1985) for which data were consistently available.

KEY WORDS • blacks • endarterectomy • epidemiology • carotid artery diseases
Infrequency of blacks among patients having carotid endarterectomy.
J G Maxwell, E J Rutherford, D Covington, T V Clancy, A D Tackett, N Robinson and G Johnson, Jr

Stroke. 1989;20:22-26
doi: 10.1161/01.STR.20.1.22

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/20/1/22

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/